



Comparative Study of Academic Library Websites Using Web Content Management Systems

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Abstract

This study aimed to investigate and compare the features and functionality of academic library websites built on Web Content Management Systems (CMS) at four universities in Africa. The specific objectives included examining design and layout, identifying content types and resources, assessing interactivity and engagement, evaluating accessibility and usability, and reviewing performance and maintenance. Analysis of the four websites revealed that the University of Cape Town Libraries stood out for its excellent quality in design, layout, content availability, interactivity, accessibility, usability, and performance. In contrast, the Makerere University Libraries showed areas needing improvement, particularly in design, content accessibility, interactivity, and usability. The University of Pretoria Libraries exhibited high-quality performance across all categories, ensuring a positive user experience. Meanwhile, the University of Nairobi Libraries demonstrated potential for enhancement in design, interactivity, and accessibility, while maintaining strong performance and security. Based on these findings, several recommendations were made to enhance the websites' quality and user experience. For Makerere University Libraries, suggestions included improving design and layout, addressing content gaps, implementing accessible forums, and enhancing responsiveness. For the University of Nairobi Libraries, recommendations focused on improving design, providing accessible resources, incorporating online chat or forums, and enhancing overall accessibility and usability.

Keywords: Comparative Study, Academic Library Websites, Web Content Management Systems

1. Introduction

Academic libraries are increasingly evolving to meet the digital needs of students, transitioning from traditional physical collections to innovative online services. Library websites have become essential platforms for disseminating information and resources,

playing a crucial role in facilitating access to services such as online catalogs and electronic databases. Consequently, usability has become a critical factor in their design, as a well-structured library website significantly enhances user experience and effectively supports the academic community.

The advent of Content Management Systems (CMS) has transformed how libraries manage their digital content, enabling librarians to update and maintain websites without requiring extensive technical skills. This ensures that users can easily access current and relevant information. However, despite the growing importance of these systems, research on their effectiveness within African academic libraries remains limited. The effectiveness of academic library websites is vital for users, including students and faculty, as the design and functionality of these sites must be evaluated in light of the increasing provision of online resources. This study aims to provide insights into the state of some academic library websites in Africa, highlighting areas for improvement that will be valuable for librarians and web developers. It will contribute to the existing body of knowledge regarding academic library websites in an African context, serving as a reference for future studies. The primary objective of this research is to explore and compare the features and functionality of academic library websites designed using CMS across four African universities, with specific goals that include investigating design and layout features, identifying available content and resources, assessing interactivity and engagement, evaluating accessibility and usability, and analyzing performance and maintenance.

2. Related Work

This section provides a review of relevant literature on the Features and Functionality of Academic Library Websites Designed in WEB Content Management System, with a specific focus on academic library websites, including Design and Layout, Content and Resources, Interactivity and Engagement, Accessibility and Usability, and Performance and Maintenance. The literature reviewed includes previous research studies and other credible materials.

2.1. Design and Layout of Academic Library Websites

The design and layout of websites are critical components of web development, structured through stages like wireframing and visual design. Wireframing is the initial step that organizes the content structure and flow of a webpage without focusing on aesthetic details, aiming for a quick and minimal setup (Kim, 2020). In contrast, visual design addresses the aesthetics of the website, including layout, color, typography, and spacing. This stage involves selecting appropriate visual elements to create an appealing design, with tools like Figma often used to detail elements such as logos and navigation items (Kim, 2020).

Effective design and layout are essential for a visually appealing and user-friendly experience (Kumaran & Subangi, 2017). Their case study on library website design emphasizes the importance of user-friendliness and accessibility, advocating for simple designs that facilitate easy resource access through organized menus and links.

Sundt and Eastman (2019) discussed the redesign of the Utah State University Libraries website, which aimed to address usability issues by creating a more user-centered design. This included a simplified main menu with categorized links for resources, services, and help, informed by user feedback and card sorting exercises. The redesign was successful in enhancing user-friendliness, despite some concerns about the participatory design process.

2.2. Content and Resources of Academic Library Websites

The content and resources available on library websites are crucial for users seeking effective access to information and services. A study by Rahman and Sadik Batcha (2020) highlighted the significance of having accurate, current, and user-friendly content, along with features such as social networking tools, feedback options, regular updates, question papers, news articles, user manuals, and streamlined search functions to improve the user experience. Mandrekar and Rodrigues (2021) addressed the need for well-structured online services, particularly during the pandemic, pointing out that many library websites were inadequately organized to meet users' needs. They recommend creating dedicated library websites with organized content and essential e-resources, including open-access journals and e-books. Furthermore, they stress the importance of libraries generating individual user IDs for database access and incorporating interactive knowledge modules. The study also emphasized the necessity of having an OPAC system for efficient material retrieval, noting that only a few libraries currently offer this service.

Shukla (2017) conducted an analysis of the library websites of central universities in North East India, concentrating on their content and accessibility. The study employed a checklist to evaluate different factors, with the goal of assisting developers in improving the informational quality and user-friendliness of these websites. In a similar vein, S Kumar (2017) compared the content and usability of library websites across central universities in India, discovering that all central libraries offer access to e-resources, such as e-books and e-journals.

2.3. Interactivity and Engagement of Academic Library Websites

The role of social media in enhancing user engagement with libraries has been explored in various studies, highlighting the importance of perceived interactivity and strategic management.

Shafawi and Hassan (2018) found that perceived interactivity significantly drives user engagement with library social media sites. Users are more likely to interact if they feel they can engage with the content. The study advocated for libraries to leverage social media strategically, with clear goals and proper management, proposing a framework for evaluating social media engagement to identify the most effective platforms.

Zou et al. (2020) discussed the concept of a participatory library, emphasizing user involvement in core library functions through social media. They presented strategies for

engaging users, tailored to their preferences based on data analysis, thereby fostering participatory services.

Tofi (2019) highlighted how social media facilitates two-way communication between libraries and their communities, enhancing interaction and feedback. This engagement not only builds the library's image but also fosters brand loyalty among users.

Mohamed Haneefa and Jiji (2019) analyzed national library websites globally, finding similar patterns in content and interactivity. Most websites utilized interactive applications like Facebook and Twitter, primarily placing links in the upper and lower corners of their homepages, which can inform design standards for library portals.

Yap (2020) examined the social media engagement of academic libraries in Kazakhstan during the COVID-19 pandemic. The study revealed a need for improved post frequency and interactivity to attract a younger audience, indicating that library marketing and promotion via social media are still underdeveloped in the region.

2.4. Accessibility and Usability of Academic Library Websites

Usability and accessibility are critical factors in evaluating library websites, as highlighted in various studies.

Ramanayaka et al. (2018b) emphasized that usability is a key determinant of how easily users can navigate library websites. Their study, conducted in Sri Lanka using **the fuzzy AHP approach**, identifies seven key dimensions of usability, noting that while accessibility is rated as less important by experts, it remains essential for ensuring all users, including those with disabilities, can effectively use the website.

Lopes and Silva (2021) focused on the usability of the Public Domain Digital Library website, using ergonomic inspections to identify interface errors and suggest improvements. However, the paper does not address accessibility concerns specifically.

Poff (2019) examined the Coates Library website post-redevelopment, finding that both laptop and mobile users successfully completed tasks, although they navigated differently. The study identified minor design issues and stresses the need for a mobile-friendly, responsive design, but it does not specifically discuss accessibility.

Zare et al. (2021) analyzed the accessibility of central library websites in Iranian universities, referencing the **WCAG 2.1** guidelines. They argued that low accessibility can hinder access for users with disabilities, urging library managers to address these issues.

Hill (2020) differentiated between technical accessibility (compliance with legislation) and actual usability for individuals with disabilities. An examination of Ontario public libraries reveals some positive practices, such as person-first language, but indicates further improvements are necessary for usability.

Klein et al. (2018) discussed usability testing for a library's new website, identifying key factors like understandable terminology and visible links that enhance user experience. They advocate for usability testing during website renovations to improve both accessibility and usability.

Verma and Shukla (2018) evaluate the usability of websites from Indian Institutes of Management, finding that while they contain useful information, they often lack basic usability features, suggesting the need for improvements to better serve users.

Velasquez and Evans (2018) addressed the accessibility and usability of public library websites, recommending user-centered design and usability testing to better meet community needs.

Lastly, Singh and Kumar (2020) assessed the website of the Department of Library Science at Universitas Islam Negeri Alauddin Makassar, finding that it scores well in usability and information quality, indicating overall accessibility for visitors.

2.5. Performance and Maintenance of Academic Library Websites

Performance and maintenance are crucial for ensuring that library websites remain up-to-date and user-friendly (Bharati & Madhusudhan, 2019).

Bharati and Madhusudhan (2019) evaluated the library websites of Jawaharlal Nehru University (JNU) and Banaras Hindu University (BHU), identifying key features needing improvement, such as multimedia, organization, and usability. JNU's website scored above average, while BHU's was average, providing a benchmark for other libraries.

Udartseva (2020) discussed using webometric research to assess library website performance through key traffic metrics like visit depth and repeat visitors. The study suggests that libraries can enhance their web management by analyzing these metrics. The experience of Russian libraries with webometrics is noted as an area for growth, emphasizing the use of analytics tools like Google Analytics for performance evaluation.

Ramanayaka et al. (2018a) proposed a framework for ranking university library websites in Sri Lanka using webometric techniques based on attributes such as size and visibility. Their findings help library administrators identify strengths and weaknesses in their online presence, enhancing their strategic development.

Burkholder and McGinniss (2020) introduced a maintenance schema for library practices, emphasizing that maintenance is essential for sustaining services rather than relying solely on innovation. This holistic view of maintenance can improve library infrastructure and practices.

Fisher (2018) focused on maintaining the quality of external links on the Leeds Beckett University library website, particularly using tools like Google Tag Manager to ensure

links are functional and relevant. This maintenance is vital for helping users access accurate information.

2.6. Features and Functionality of Academic Library Websites

Mierzecka and Suminas (2018) identified key functions of academic library websites from user surveys at the University of Warsaw and Vilnius University. These functions include access to resources, search capabilities, information about collections and policies, assistance with research, and promotion of events. They concluded that academic library websites act as digital gateways to resources, with varying priorities among different user groups.

Sari and Yani (2020) presented an online library application designed for efficiency, featuring a login system for admins and members, a search engine for books, and a computerized data collection system for managing borrowing and returning books. This system aims to improve service delivery for students and assist librarians in data management.

McConnaughy and Wilson (2018) analyzed academic health sciences library home pages, identifying essential features such as contact information, search tools, and multimedia content. They highlighted the significance of responsive design and up-to-date information in enhancing user accessibility and communication.

Rennick (2019) described a web application called "Services" that aims to improve service discovery on academic library websites. This application organizes library services into categories and locations, facilitating easier access for users through a relational database and clearly defined information sections.

3. Methodology

The research design for this study involves a content analysis of e-library websites created using web content management systems, aimed at identifying key features, functionality, and evaluating overall effectiveness and usability. A qualitative research approach will guide a comprehensive review of the website content, employing a content analysis checklist developed from existing literature and best practices specific to e-library evaluations. This checklist will assess various aspects of website design and functionality, such as Design and Layout, Content and Resources, Interactivity and Engagement, Accessibility and Usability, and Performance and Maintenance, with ratings from 1 (poor) to 5 (excellent). The data collection process will involve selecting a sample of e-library websites based on criteria such as popularity and relevance, followed by evaluations using the checklist, which will be performed by multiple researchers to ensure inter-rater reliability, yielding a kappa value of 0.71. Data analysis will incorporate descriptive statistics, including means and standard deviations, alongside Chi-Square to summarize performance across checklist items, with results presented in tables and charts. Factors will be categorized with assigned weightings: Excellent (E) = 4.20-5.00 points, Good (G) = 3.40-4.19 points, Average (AV) = 2.60-3.39 points, Fair (F) = 1.80-2.59 points, and

Poor (P) = 1.00-1.79 points.

4. Findings and Discussion

This section delves into the evaluation of websites across different dimensions, such as design and layout, content and resources, interactivity and engagement, accessibility and usability, and performance and maintenance. This also covers General Information of the Websites.

4.1. Characteristics of the Study Websites

4.1.1. University of Cape Town Libraries

UCT Libraries provide state-of-the-art technology, extensive collections of reading and research materials, and specialized services from friendly and efficient staff. The Chancellor Oppenheimer Library is centrally located on Upper Campus, accompanied by eight branch libraries situated near their respective faculties. Together, these libraries house over 1.2 million print volumes. The libraries' website serves as a crucial resource, offering essential information about library hours and services while acting as a portal to various research materials. This includes access to online reference works, bibliographic and full-text databases, 87,350 electronic journals, articles, eBooks, a growing institutional digital repository, and Primo, a discovery and delivery tool for books (UCT Libraries | University of Cape Town, 2020).

4.1.2. Makerere University Libraries

Makerere University Library is an academic unit with programmers, services and functions primarily designed to meet the study, teaching and research information needs of Makerere University community, it also serves as a National Reference Library. In that capacity, it is a Legal Depository for all works published in Uganda including government publications.

The library collection consists of over 600,000 monographs with an annual addition of about 2,500 print books and 100 electronic books excluding donations and exchange, over 12,000 titles of bound Serials/ Periodicals and an annual subscription of about 200 titles of print Serials/ Periodicals and over 27,000 titles of electronic journals. There is a Book Bank System that came into existence in 1990. It comprises basic prescribed text books which are kept and accessed from the academic departments. Currently, the Book Bank collection has over 250,000 copies of books.(About The Library | Jimma University Library, 2015)

4.1.3. University of Pretoria Libraries

The Library provides access to a wide range of information resources, such as books, journals, reports, standards, and special collections. Institutional research output is made available through the UP Space institutional repository while the data that support the research is made available through the Fig share data repository. Institutional open journals are hosted through the Open Journal System (OJS).(About Us - About Us - Subject Guides at University of Pretoria, n.d.)

4.1.4. University of Nairobi Libraries

The University of Nairobi Library System is composed of twelve libraries grouped into

six college libraries plus a central library. The central library known as Jomo Kenyatta Memorial Library (JKML) also houses the administration, central services such as acquisitions, cataloguing coordinating unit, the union catalogues, the bindery and the archives. The system has a total stock of approximately 750,000 volumes, inclusive of books, periodicals and other non-print materials. The stock is divided into general lending materials and specialized research collections. Books in the library system are classified by the Library of Congress Classification Scheme. A union catalogue of library materials held in the system is maintained in the JKML.(*Introduction | Library & Information Services*, n.d.)

4.2. Results of the Study Factors

4.2.1. University of Cape Town Libraries

Table 1 Result of Design and Layout Analysis

Factor	Criteria	Frequency	Percentage
Design and Layout	Visual Appeal	4	30.8
	Ease of Navigation	4	30.8
	Organization of Information	5	38.5
		13	100.1

Based on the table, which displays the frequency and percentage of Design and Layout criteria, the visual appeal and the ease of navigation criterion both accounts for 30.8%, and the organization of information criterion has the highest ranking of 38.5%. Therefore, it can be concluded that the website's Design and Layout is of Excellent quality based on these findings and considerations, for the visual appeal of the website is a clean and organized layout with clear headings, intuitive navigation, and well-structured content. Consistent branding and high-quality imagery can establish a recognizable brand identity and make the website engaging. for the ease of navigation, it's found out that the website has a clear and concise labelling, intuitive organization, and search functionality. It is Navigation menus and links also consistent throughout the website, with an easy-to-use interface and mobile optimization for users accessing the site on smaller screens. For the organization of information of the website is categorized and organized information in a logical and intuitive way, with a hierarchical structure that prioritizes important information. It has also Consistent formatting, clear headings and titles, and search functionality, can also help users find relevant content quickly and easily.

Table 2 Result of Content and Resources Analysis

Factor	Criteria	Frequency	Percentage
Content and Resources	E-books	4	22.2
	Journals	5	27.8
	Databases	5	27.8
	Other Digital Collections	4	22.2
	Total	18	100

Based on the table, which displays the frequency and percentage of Content and Resources criteria, the E-books and Other Digital Collections criterion both accounts for 22.2%, the Journals and Databases criterion Both has the highest ranking of 27.8%. Therefore, it can be concluded that the website's Content and Resources is of Excellent quality based on these findings and considerations, For the e-books of the website is easily accessible to users, compatible with a range of devices and software platforms, and have search functionality and interactivity. for the journals of the website is easily accessible to users with clear instructions for accessing and downloading content. It has also search functionality, be archived for future access, and be indexed and abstracted to help users find relevant content. journals properly licensed and adhere to copyright laws and regulations. For the Databases of the website it has comprehensive content, a user- friendly interface with clear instructions, and a powerful search functionality with advanced options. It's also easily accessible. For the Other Digital Collections of the website it has a variety of media types and have historical, cultural, or educational significance.

Table 3 Result of Interactivity and Engagement Analysis

Factor	Criteria	Frequency	Percentage
interactivity and engagement	online chat	4	33.3
	forums	3	25.0
	social media integration	5	41.7
	total	12	100

According to the table, which presents the frequency and percentage of Interactivity and Engagement criteria, the online chat criterion accounts for 33.3%, the forums criterion also accounts for 25.0% which is the lowest rank, and the social media integration criterion has the highest ranking of 41.7%. Therefore, it can be concluded that the website's Interactivity and Engagement is of good quality based on these findings and considerations, for the online chat of the website it's easy to access, user-friendly with clear instructions and visual cues. Users' personal information kept confidential, for the forums of the website is accessible to all users, it has search functionality available to users to easily find relevant discussions or posts, can submit questions.

For the social media integration of the website it has social media platforms to increase user engagement, to interact with users and share information. users can access library content and services through their preferred social media channels.

Table 4 Result of Accessibility and Usability Analysis

Factor	Criteria	Frequency	Percentage
Accessibility and Usability	Responsiveness	5	35.7
	Compatibility with Different	4	28.6

	Devices		
	Compliance with Web Accessibility Guidelines	5	35.7
	Total	14	100

According to the table, which presents the frequency and percentage of Accessibility and Usability criteria, the responsiveness and Compliance with Web Accessibility Guidelines criterion both has the highest ranking of 35.7%, the Compatibility with Different Devices criterion also accounts for 28.6%. Therefore, it can be concluded that the website's Accessibility and Usability is of Excellent quality based on these findings and considerations, for the Responsiveness of the website is mobile- friendly, with a design that adapts to different screen sizes and resolutions. For the Compatibility with different devices of the website is cross-platform compatible, providing users with consistent features, functionalities, and content across different devices, including desktops, laptops, tablets, and smartphones. for the compliance with web accessibility guidelines of the website is accessible to all users, including those with disabilities, providing equal access to library resources and services.

Table 5 Result of Performance and Maintenance Analysis

Factor	Criteria	Frequency	Percentage
Performance and maintenance	loading speed	5	35.7
	uptime	4	28.6
	security measures	5	35.7
	total	14	100

Based on the table, which displays the frequency and percentage of Performance and Maintenance criteria, the Loading Speed and Security Measures criterion both has the highest ranking of 35.7%, the Uptime criterion also accounts for 28.6%. Therefore, it can be concluded that the website's Performance and Maintenance is of Excellent quality based on these findings and considerations, for the loading speed of the website is fast, for the uptime of the website is expected to be available and functioning properly for 99.9% of the time it is supposed to be available, users can access the website or service when they need it, without experiencing any interruptions or delays. For the security measures of the website is secure and safe and the information and resources it contains. It also protects against unauthorized access, data breaches, and other security threats.

Table 6 Result of weighting mean intervals of the factors of study

Factor	Criteria	Mean	St. Deviation	Decision
Design and Layout	Visual Appeal	4.3	0.47	Excellent
	Ease of Navigation			
	Organization of In			

	formation			
Content and Resources	E-books	4.5	0.5	Excellent
	Journals			
	Databases			
	Other digital Collections			
Interactivity and Engagement	Online Chat	4	0.82	Good
	Forums			
	Social Media Integration			
Accessibility and Usability	Responsiveness	4.7	0.5	Excellent
	compatibility with different devices			
	compliance with web accessibility guidelines			
Performance and Maintenance	loading speed	4.7	0.5	Excellent
	uptime			
	security measures			
	Grand Mean	4.44	0.558	Excellent

Excellent (E) = 4.20-5.00 points, Good (G) = 3.40-4.19 points, Average (AV) = 2.60-3.39 points, Fair (F) = 1.80-2.59 points, and Poor (P) = 1.00-1.79 points.

The table above shows intervals weighted mean among factors of the study. Design and layout reached mean of (4.3) and St. Deviation of (0.47) this mean indicates Excellent, Content and Resources reached mean of (4.5) and St. Deviation of (0.5) this mean indicates Excellent, Interactivity and Engagement reached mean of (4) and Std. Deviation of (0.82) this mean indicates Good, Accessibility and Usability reached mean of (4.7) and Std. Deviation of (0.5) this mean indicates Excellent, Performance and Maintenance reached mean of (4.7) and Std. Deviation of (0.5) this mean indicates Excellent.

4.2.2. Makerere University Libraries

Table 7 Result of Design and Layout Analysis

Factor	Criteria	Frequency	Percentage
Design and Layout	Visual Appeal	1	16.7
	Ease of Navigation	2	33.3
	Organization of Information	3	50
		6	100

Based on the table, which displays the frequency and percentage of Design and Layout criteria, the visual appeal criterion accounts for 16.7%, the ease of navigation criterion also accounts for 33.3%, and the organization of information criterion has the highest ranking of 50%. Therefore, it can be concluded that the website's Design and Layout is of Fair quality based on these findings and considerations, for the visual appeal of the website appears to be not well-designed, not visually attractive and not user-friendly. for the ease of navigation of the website it's found out that the website has not a

clear and concise labelling, intuitive organization, and search functionality. It is Navigation menus and links also not consistent throughout the website, not an easy-to-use interface and mobile optimization for users accessing the site on smaller screens. For the organization of information of the website is categorized and organized information in a logical and intuitive way. It has also clear headings and titles.

Table 8 Result of Content and Resources Analysis

Factor	Criteria	Frequency	Percentage
Content and Resources	E-books	3	37.5
	Journals	1	12.5
	Databases	3	37.5
	Other Digital Collections	1	12.5
	Total	8	100

According to the table, which presents the frequency and percentage of Content and Resources criteria, the Journals and Other Digital Collections criterion both accounts for 12.5%, the E-books and Databases criterion Both has the highest ranking of 37.5%. Therefore, it can be concluded that the website's Content and Resources is of Fair quality based on these findings and considerations, For the e-books of the website is not easily accessible to users, compatible with a range of devices and software platforms, and have search functionality. for the journals of the website is not easily accessible to users with not clear instructions for accessing and downloading content. For the Databases of the website it has comprehensive content, not user-friendly interface. It's also not easily accessible. For the Other Digital Collections of the website it has not a variety of media types and have not historical, cultural, or educational significance.

Table 9 Result of Interactivity and Engagement Analysis

Factor	Criteria	Frequency	Percentage
interactivity and engagement	online chat	4	44.4
	forums	1	11.1
	social media integration	4	44.4
	total	9	100

Based on the table, which displays the frequency and percentage of Interactivity and Engagement criteria, the forums criterion accounts for 11.1%, the online chat and the social media integration criterion both has the highest ranking of 44.4%. Therefore, it can be concluded that the website's Interactivity and Engagement is of Average quality based on these findings and considerations, for the online chat of the website it's easy to access, user-friendly. Users' personal information kept confidential, for the forums of the website is not accessible to all users. For the social media integration of the website it has social media platforms to increase user engagement, to interact with users and share information. users can access library content and services through their preferred social media channels.

Table 10 Result of Accessibility and Usability Analysis

Factor	Criteria	Frequency	Percentage
Accessibility and Usability	Responsiveness	3	37.5
	Compatibility with Different Devices	2	25
	Compliance with Web Accessibility Guidelines	3	37.5
	Total	8	100

Based on the table, which displays the frequency and percentage of Accessibility and Usability criteria, the responsiveness and Compliance with Web Accessibility Guidelines criterion both has the highest ranking of 37.5%, the Compatibility with Different Devices criterion also accounts for 25%. Therefore, it can be concluded that the website's Accessibility and Usability is of Average quality based on these findings and considerations, for the Responsiveness of the website is mobile- friendly, with a design that adapts to different screen sizes and resolutions. For the Compatibility with different devices of the website is cross-platform compatible including desktops, laptops, tablets, and smartphones. for the compliance with web accessibility guidelines of the website is accessible to all users.

Table 11 Result of Performance and Maintenance Analysis

Factor	Criteria	Frequency	Percentage
Performance and maintenance	loading speed	3	27.3
	uptime	4	36.4
	security measures	4	36.4
	total	11	100

Based on the table, which displays the frequency and percentage of Performance and Maintenance criteria, the uptime and Security Measures criterion both has the highest ranking of 36.4%, the Loading speed criterion also accounts for 27.3%. Therefore, it can be concluded that the website's Performance and Maintenance is of Good quality based on these findings and considerations, for the loading speed of the website is not fast, for the uptime of the website is expected to be available and functioning properly for 99.9% of the time it is supposed to be available, users can access the website or service when they need it. For the security measures of the website is secure and safe and the information and resources it contains. It also protects against unauthorized access, data breaches, and other security threats.

Table 12 Result of weighting mean intervals of the factors of study

Factor	Criteria	Mean	St. Deviation	Decision
Design and Layout	Visual Appeal	2	0.82	Fair
	Ease of			

	Navigation			
	Organization of Information			
Content and Resources	E-books	2	1	Fair
	Journals			
	Databases			
	Other digital Collections			
Interactivity and Engagement	Online Chat	3	1.4	Average
	Forums			
	Social Media Integration			
Accessibility and Usability	Responsiveness	2.7	0.5	Average
	compatibility with different devices			
	compliance with web accessibility guidelines			
Performance and Maintenance	loading speed	3.7	0.5	Good
	uptime			
	security measures			
	Grand mean	2.68	0.844	Average

Excellent (E) = 4.20-5.00 points, Good (G) = 3.40-4.19 points, Average (AV) = 2.60-3.39 points, Fair (F) = 1.80-2.59 points, and Poor (P) = 1.00-1.79 points.

The table above shows intervals weighted mean among factors of the study. Design and layout reached mean of (2) and St. Deviation of (0.82) this mean indicates Fair, Content and Resources reached mean of (2) and St. Deviation of (1) this mean indicates Fair, Interactivity and Engagement reached mean of (3) and Std. Deviation of (1.4) this mean indicates Average, Accessibility and Usability reached mean of (2.7) and Std. Deviation of (0.5) this mean indicates Average, Performance and Maintenance reached mean of (3.7) and Std. Deviation of (0.5) this mean indicates Good.

4.2.3. University of Pretoria Libraries

Table 13 Result of Design and Layout Analysis

Factor	Criteria	Frequency	Percentage
Design and Layout	Visual Appeal	3	27.3
	Ease of Navigation	4	36.4
	Organization of information	4	36.4
		11	100

According to the table, which presents the frequency and percentage of Design and Layout criteria, the visual appeal criterion accounts for 27.3%, the ease of navigation and the organization of information criterion both has the highest ranking of 36.4%.

Therefore, it can be concluded that the website's Design and Layout is of Good quality based on these findings and considerations, for the visual appeal of the website is a clean and organized layout and not well-structured content. for the ease of navigation, it's found out that the website has a clear and concise labelling, and search functionality. It is Navigation menus and links also consistent throughout the website, with an easy-to-use interface and mobile optimization for users accessing the site on smaller screens. For the organization of information of the website is categorized and organized information in a logical and intuitive way, with a hierarchical structure that prioritizes important information. It has also Consistent formatting, clear headings and titles, and search functionality, can also help users find relevant content quickly and easily.

Table 14 Result of Content and Resources Analysis

Factor	Criteria	Frequency	Percentage
Content and Resources	E-books	5	33.3
	Journals	4	26.7
	Databases	3	20
	Other Digital Collections	3	20
	Total	15	100

Based on the table, which displays the frequency and percentage of Content and Resources criteria, the journals criterion accounts for 26.7%, the databases and the Other Digital Collections criterion both accounts for 20%, the E-books criterion has the highest ranking of 33.3%. Therefore, it can be concluded that the website's Content and Resources is of Good quality based on these findings and considerations, For the e-books of the website is easily accessible to users, compatible with a range of devices and software platforms, and have search functionality and interactivity, also you can cite every book you want. for the journals of the website is easily accessible to users for accessing and downloading content. It has also search functionality, also you can cite every journal you want. For the Databases of the website it has comprehensive content, a user-friendly interface, and a search functionality. It's also easily accessible. For the Other Digital Collections of the website it has a variety of media types like music and have historical, educational significance.

Table 15 Result of Interactivity and Engagement Analysis

Factor	Criteria	Frequency	Percentage
interactivity and engagement	online chat	5	38.5
	forums	4	30.8
	social media integration	4	30.8
	total	13	100

According to the table, which presents the frequency and percentage of Interactivity and Engagement criteria, the online chat criterion accounts for 38.5%, the forums and the social media integration criterion both has the highest ranking of 30.8%. Therefore, it can be concluded that the website's Interactivity and Engagement is of Excellent quality based on these

findings and considerations, for the online chat of the website it's easy to access, user-friendly with clear instructions and visual cues. Users' personal information kept confidential, for the forums of the website is accessible to all users, it has search functionality available to users to easily find relevant discussions or posts, can submit questions. For the social media integration of the website it has social media platforms to increase user engagement, to interact with users and share information. users can access library content and services through their preferred social media channels.

Table 16 Result of Accessibility and Usability Analysis

Factor	Criteria	Frequency	Percentage
Accessibility and Usability	Responsiveness	5	35.7
	Compatibility with Different Devices	5	35.7
	Compliance with Web Accessibility Guidelines	4	28.6
	Total	14	100

According to the table, which presents the frequency and percentage of Accessibility and Usability criteria, the responsiveness and the Compatibility with Different Devices criterion both has the highest ranking of 35.7%, the compliance with web accessibility guidelines criterion accounts for 28.6%. Therefore, it can be concluded that the website's Accessibility and Usability is of Excellent quality based on these findings and considerations, for the Responsiveness of the website is mobile-friendly, with a design that adapts to different screen sizes and resolutions. For the Compatibility with different devices of the website is cross-platform compatible, providing users with consistent features, functionalities, and content across different devices, including desktops, laptops, tablets, and smartphones. for the compliance with web accessibility guidelines of the website is accessible to all users, including those with disabilities, providing equal access to library resources and services.

Table 17 Result of Performance and Maintenance Analysis

Factor	Criteria	Frequency	Percentage
Performance and maintenance	loading speed	4	28.6
	uptime	4	28.6
	security measures	5	35.7
	total	14	100

Based on the table, which displays the frequency and percentage of Performance and Maintenance criteria, the Loading Speed and the uptime criterion both accounts for 28.6%, the security measures criterion has the highest ranking of 35.7%. Therefore, it can be concluded that the website's Performance and Maintenance is of Excellent quality based on these findings and considerations, for the loading speed of the website is fast, for the uptime of the website is expected to be available and functioning properly for 99.9%

of the time it is supposed to be available, users can access the website or service when they need it, without experiencing any interruptions or delays.

For the security measures of the website is secure and safe and the information and resources it contains. It also protects against unauthorized access, data breaches, and other security threats.

Table 18 Result of weighting mean intervals of the factors of study

Factor	Criteria	Mean	St. Deviation	Decision
Design and Layout	Visual Appeal	3.7	0.5	Good
	Ease of Navigation			
	Organization of Information			
Content and Resources	E-books	3.75	0.83	Good
	Journals			
	Databases			
	Other digital Collections			
Interactivity and Engagement	Online Chat	4.3	0.5	Excellent
	Forums			
	Social Media Integration			
Accessibility and Usability	Responsiveness	4.7	0.5	Excellent
	compatibility with different devices			
	compliance with web accessibility guidelines			
Performance and Maintenance	loading speed	4.3	0.5	Excellent
	uptime			
	security measures			
	Grand Mean	4.15	0.566	Good

Excellent (E) = 4.20-5.00 points, Good (G) = 3.40-4.19 points, Average (AV) = 2.60-3.39 points, Fair (F) = 1.80-2.59 points, and Poor (P) = 1.00-1.79 points.

The table above shows intervals weighted mean among factors of the study. Design and layout reached mean of (3.7) and St. Deviation of (0.5) this mean indicates Good, Content and Resources reached mean of (3.75) and St. Deviation of (0.83) this mean indicates Good, Interactivity and Engagement reached mean of (4.3) and Std. Deviation of (0.5) this mean indicates Excellent, Accessibility and Usability reached mean of (4.7) and Std. Deviation of (0.5) this mean indicates Excellent, Performance and Maintenance reached mean of (4.3) and Std. Deviation of (0.5) this mean indicates Excellent.

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Table 19 Result of Design and Layout Analysis

Factor	Criteria	Frequency	Percentage
Design and Layout	Visual Appeal	2	20
	Ease of Navigation	4	40
	Organization of information	4	40
		10	100

According to the table, which presents the frequency and percentage of Design and Layout criteria, the visual appeal criterion accounts for 20%, the ease of navigation and the organization of information criterion both has the highest ranking of 40%. Therefore, it can be concluded that the website's Design and Layout is of Average quality based on these findings and considerations, for the visual appeal of the website is not good and not well-structured content. For the ease of navigation, it's found out that the website has a clear and concise labelling, and search functionality. It is Navigation menus and links also consistent throughout the website, with an easy-to-use interface and mobile optimization for users accessing the site on smaller screens. For the organization of information of the website is categorized and organized information in a logical and intuitive way, with a hierarchical structure that prioritizes important information. It has a clear headings and titles, and search functionality, can also help users find relevant content quickly and easily.

Table 20 Result of Content and Resources Analysis

Factor	Criteria	Frequency	Percentage
Content and Resources	E-books	4	28.6
	Journals	4	28.6
	Databases	3	21.4
	Other Digital Collections	3	21.4
	Total	14	100

Based on the table, which displays the frequency and percentage of Content and Resources criteria, the databases and the Other Digital Collections criterion both accounts for 21.4%, the E-books and the journals criterion both has the highest ranking of 28.6%. Therefore, it can be concluded that the website's Content and Resources is of Good quality based on these findings and considerations, For the e-books of the website is easily accessible to users, compatible with a range of devices and software platforms, and have search functionality and interactivity, also you can cite every book you want. For the journals of the website is easily accessible to users for accessing and downloading content. It has also search functionality, also you can cite every journal you want. For the Databases of the website it has a user-friendly interface, and a search functionality. It's also easily accessible. For the Other Digital Collections of the website it has a variety of media types and have historical, educational significance.

Table 21 Result of Interactivity and Engagement Analysis

Factor	Criteria	Frequency	Percentage
interactivity and engagement	online chat	1	16.7
	forums	1	16.7
	social media integration	4	66.7
	total	6	100

According to

the table, which presents the frequency and percentage of Interactivity and Engagement criteria, the online chat and the forums criterion both accounts for 16.7%, the social media integration criterion has the highest ranking of 66.7%. Therefore, it can be concluded that the website's Interactivity and Engagement is of Fair quality based on these findings and considerations, for the online chat of the website there is no online chat in this website, for the forums of the website there is no forums in this website. For the social media integration of the website it has social media platforms to increase user engagement, to interact with users and share information. Users can access library content and services through their preferred social media channels.

Table 22 Result of Accessibility and Usability Analysis

Factor	Criteria	Frequency	Percentage
Accessibility and Usability	Responsiveness	4	40
	Compatibility with Different Devices	3	30
	Compliance with Web Accessibility Guidelines	3	30
	Total	10	100

Based on the table, which displays the frequency and percentage of Accessibility and Usability criteria, the Compatibility with Different Devices and the compliance with web accessibility guidelines criterion both accounts for 30%, the responsiveness criterion has the highest ranking of 40%. Therefore, it can be concluded that the website's Accessibility and Usability is of Average quality based on these findings and considerations, for the Responsiveness of the website is mobile-friendly, with a design that adapts to different screen sizes and resolutions. For the Compatibility with different devices of the website is cross-platform compatible, providing users with functionalities, and content across different devices, including desktops, laptops, tablets, and smartphones. For the compliance with web accessibility guidelines of the website is accessible to all users, providing equal access to library resources and services.

Table 23 Result of Performance and Maintenance Analysis

Factor	Criteria	Frequency	Percentage
Performance and maintenance	loading speed	5	35.7
	uptime	4	28.6
	security	5	35.7

	measures		
	total	14	100

According to the table, which presents the frequency and percentage of Performance and Maintenance criteria, the uptime criterion accounts for 28.6%, the Loading Speed and the security measures criterion has the highest ranking of 35.7%. Therefore, it can be concluded that the website's Performance and Maintenance is of Excellent quality based on these findings and considerations, for the loading speed of the website is fast, for the uptime of the website is expected to be available and functioning properly for 99.9% of the time it is supposed to be available, users can access the website or service when they need it. For the security measures of the website is secure and safe and the information and resources it contains. It also protects against unauthorized access, data breaches, and other security threats.

Table 24 Result of weighting mean intervals of the factors of study

Factor	Criteria	Mean	St. Deviation	Decision
Design and Layout	Visual Appeal	3.3	0.94	Average
	Ease of Navigation			
	Organization of Information			
Content and Resources	E-books	3.5	0.5	Good
	Journals			
	Databases			
	Other digital Collections			
Interactivity and Engagement	Online Chat	2	1.41	Fair
	Forums			
	Social Media Integration			
Accessibility and Usability	Responsiveness	3.3	0.5	Average
	compatibility with different devices			
	compliance with web accessibility guidelines			
Performance and Maintenance	loading speed	4.7	0.5	Excellent
	uptime			
	security measures			
	Grand Mean	3.36	0.77	Average

Excellent € = 4.20-5.00 points, *Good (G)* = 3.40-4.19 points, *Average (AV)* = 2.60-3.39 points, *Fair (F)* = 1.80-2.59 points, and *Poor (P)* = 1.00-1.79 points.

The table above shows intervals weighted mean among factors of the study. Design and layout reached mean of (3.3) and St. Deviation of (0.94) this mean indicates Average,

Content and Resources reached mean of (3.5) and St. Deviation of (0.5) this mean indicates Good, Interactivity and Engagement reached mean of (2) and Std. Deviation of (1.41) this mean indicates Fair, Accessibility and Usability reached mean of (3.3) and Std. Deviation of (0.5) this mean indicates Average, Performance and Maintenance reached mean of (4.7) and Std. Deviation of (0.5) this mean indicates Excellent.

4.2.5. Comparison of Weighted Means Among the Websites

Table 25 Comparison of weighted means among the websites

Websites	Design and layout		Content and resources		Interactivity and engagement		Accessibility and usability		Performance and maintenance	
	Mean	St. Deviation	Mean	St. Deviation	Mean	St. Deviation	Mean	St. Deviation	Mean	St. Deviation
University of Cape Town Libraries	4.3	0.47	4.5	0.5	4	0.82	4.7	0.5	4.7	0.5
Makerere University Libraries	2	0.82	2	1	3	1.4	2.7	0.5	3.7	0.5
University of Pretoria Libraries	3.7	0.5	3.75	0.83	4.3	0.5	4.7	0.5	4.3	0.5
University of Nairobi Libraries	3.3	0.94	3.5	0.5	2	1.41	3.3	0.5	4.7	0.5
	3.33		3.47		3.33		3.85		4.35	

Based on the analysis presented in Table 2 and Figure 2, a comparison of weighted means among the websites reveals their performance in the Design and Layout category, Content and Resources category, Interactivity and Engagement category, Accessibility and Usability category, Performance and Maintenance category. For the Design and Layout category, The University of Cape Town Libraries Website achieved the highest rank scoring 4.3 out of 5 indicating excellent design and layout. The University of Pretoria Libraries Website secured the second rank with a score of 3.7 demonstrating good performance in this category. The University of Nairobi Libraries Website obtained the third rank scoring 3.3 reflecting an average performance. However, the Makerere University Libraries Website received the lowest rank with a score of 2 indicating the need for improvement in its design and layout. For the Content and Resources category, The University of Cape Town Libraries Website achieved the highest rank scoring 4.5 out of 5 indicating excellent content and resources. The University of Pretoria Libraries Website secured the second rank with a score of 3.75 demonstrating good performance in this category. The University of Nairobi Libraries Website obtained the third rank scoring 3.5 demonstrating good performance in this category. However, the Makerere University

Libraries Website received the lowest rank with a score of 2 indicating the need for improvement in its content and resources. For the Interactivity and Engagement category, The University of Pretoria Libraries Website achieved the highest rank scoring 4.3 out of 5 indicating excellent Interactivity and Engagement. The University of Cape Town Libraries Website secured the second rank with a score of 4 demonstrating good performance in this category. The Makerere University Libraries Website obtained the third rank scoring 3 reflecting an average performance. However, the University of Nairobi Libraries Website received the lowest rank with a score of 2 indicating the need for improvement in its Interactivity and Engagement. For the Accessibility and Usability category, The University of Cape Town Libraries Website and The University of Pretoria Libraries Website both achieved the highest rank scoring 4.7 indicating excellent Accessibility and Usability. The University of Nairobi Libraries Website obtained the second rank scoring 3.3 reflecting an average performance. The Makerere University Libraries Website received the lowest rank with a score of 2.7 reflecting an average performance. For the Performance and Maintenance category, The University of Cape Town Libraries Website and The University of Nairobi Libraries Website both achieved the highest rank scoring 4.7 indicating excellent Performance and Maintenance. The University of Pretoria Libraries Website secured the second rank with a score of 4.3 demonstrating Excellent performance in this category. The Makerere University Libraries Website received the lowest rank with a score of 3.7 demonstrating good performance in this category.

4.2.6. Comparative of The Grand Means for The Website

Table 26 Comparative of the grand means for the website

Websites	Grand mean	St. Deviation	Decision
University of Cape Town Libraries	4.44	0.558	Excellent
Makerere University Libraries	2.68	0.844	Average
University of Pretoria Libraries	4.15	0.566	Good
University of Nairobi Libraries	3.36	0.77	Average

According to the table, which presents the Grand Mean and St. Deviation of Websites, the University of Cape Town Libraries has Grand Mean of 4.44 which is Excellent Quality. The Makerere University Libraries has Grand Mean of Grand Mean of 2.68 which is Average Quality. The University of Pretoria Libraries has Grand Mean of 4.15 which Good Quality, the University of Nairobi Libraries has Grand Mean of 3.36 which is Average Quality.

5. Conclusion

Based on the evaluations of four university library websites, distinct conclusions can be drawn regarding their quality. The University of Cape Town Libraries website stands out for its exceptional quality across multiple criteria, showcasing an appealing design and well-organized layout that facilitates intuitive navigation. It offers a rich array of resources, including accessible e-books, diverse digital collections, and comprehensive

databases, all complemented by strong interactivity features such as online chat and social media integration. The site prioritizes accessibility and usability, ensuring responsiveness and compatibility across devices while adhering to web accessibility guidelines. Additionally, it maintains excellent performance with fast loading speeds and robust security measures, resulting in a user-friendly and engaging experience.

In contrast, the Makerere University Libraries website presents a mixed assessment. While its Design and Layout category is rated as fair, it suffers from issues related to visual appeal and navigation. The Content and Resources also show fair quality, with limited access to e-books and databases. Interactivity is average, featuring online chat but lacking accessible forums. Accessibility and Usability are similarly average, indicating areas for improvement. Performance and Maintenance are generally good, although loading speed requires attention. The University of Pretoria Libraries website, on the other hand, excels with good quality in design and layout, alongside excellent interactivity and engagement features. It delivers accessible content and demonstrates excellent performance. Finally, the University of Nairobi Libraries website is rated average in design and layout, with good content quality but lacking interactivity elements such as online chat and forums, highlighting areas for potential enhancement to improve the overall user experience.

6. Recommendations

To enhance the overall quality and user experience of the library websites evaluated, several key recommendations can be made. For Makerere University Libraries, it is essential to improve the design and layout by enhancing visual appeal, navigation ease, and information organization. Addressing the current deficiencies in accessing e-books, journals, databases, and other digital collections will create a more comprehensive resource library. Implementing accessible forums could foster user engagement and facilitate community discussions. Additionally, focusing on improving responsiveness, device compatibility, and compliance with web accessibility guidelines will enhance both accessibility and usability. Finally, resolving loading speed issues is crucial for optimizing website performance and ensuring a seamless user experience.

For the University of Nairobi Libraries, recommendations include enhancing visual appeal and content organization to improve the website's overall design and layout. Continuing to provide accessible e-books, journals, databases, and diverse digital collections will ensure a rich resource library. Incorporating online chat or forums can further promote interactivity and user engagement. Efforts should be made to improve responsiveness and device compatibility while adhering to web accessibility guidelines. It is also important to maintain the current high performance and robust security measures while identifying any additional areas for enhancement. These recommendations aim to address identified weaknesses and align the websites with best practices, ultimately leading to an improved user experience.

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