

Design effectiveness of academic library web sites

A comparison of university, polytechnic, and college sites in Nigeria

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Abstract

Purpose – Academic library websites need evaluation to determine whether users can derive useful experiences while visiting them to perform tasks. This is more so because visiting an academic library website is by voluntary action rather than compulsion as is the case with university, polytechnic and college sites where students must conduct academic transactions that cannot be reasonably avoided. The result of such an evaluation provides signposts for improvement so that academic library websites can continue to be useful to their users. Therefore, the purpose of this paper is to assess the structural effectiveness of academic library websites in Nigeria.

Design/methodology/approach – The case study, research strategy and survey research approach were adopted for the study. Through a Web search, 14 universities, one polytechnic and one college of education were identified while three academic library websites were selected for the study. The evaluation of the websites was un-moderated and conducted remotely by user participants who were recruited across the three tertiary institutions under study. A five-point scale questionnaire served as the research instrument while data were presented in tables and analyzed using the median score. The Kruskal–Wallis test by ranks was used to test the null hypothesis at a five per cent level of significance.

Findings – Out of the 20 items presented for assessment, Group 1 and 2 disagreed to 11 (55 per cent) while agreeing on the remaining 9 (45 per cent) on Lib 1 and Lib 2 websites. Group 3 agreed to 11 (55 per cent) while disagreeing on 9 (45 per cent) on the Lib 3 website. The null hypothesis proposed for the study was rejected as the p -value of 0.04 was significant at $p < 0.05$. This indicated that most of the critical issues pertaining to design effectiveness were perceived to be ineffective.

Originality/value – The findings from this study call for a review of the design of academic library websites in Nigeria so that users can identify which websites are easier to use.

Keywords User studies, Nigeria, User perceptions, Academic libraries, Websites, Website usability, Academic library websites, Design effectiveness

Paper type Research paper

Introduction

The internet has revolutionized the way information is collected, processed, stored, disseminated and accessed in various domains. Web presence, therefore, assumes a very high priority for organizations that desire to be reached easily, readily, instantly and unrestrainedly. These days, clients take interest in verifying the existence of an organization through its Web presence as well as its physical geographical location. Education institutions have reacted to this new user requirement by building expensive and all-embracing websites to publish their course offerings and activities.



Consequently, academic library websites have recently gained prominence. In addition to being locatable on the Web, thereby showing their presence, academic libraries through their sites are also taking advantage of the opportunities provided by information technology to collect digital content, make them available, market their services and provide access to collections outside their immediate vicinity. They can also be reached from any location and at any time thereby providing seamless services.

Users are the *raison d'être* for the existence of libraries and academic library websites must be locatable, available, accessible, effective and easy to use. An effective and easy to use academic library site attracts users to it and sustains their trust. Consequently, academic library sites, just like every other site, must be professionally handled for effectiveness and useful experience to attract traffic.

To determine effectiveness, Preece (2001) opined that a website must undergo a process of evaluation that is capable of providing suggestions for its improvement. Academic library sites, therefore, need evaluation to determine whether users can derive useful experience while visiting them to perform one task or the other. This is more so because visiting an academic library site is by voluntary action rather than compulsion as is the case with university, polytechnic, and college sites where students must register courses, check their results and do one or more things that cannot be reasonably avoided. Academic libraries, whether established in universities, polytechnics or colleges, serve the same purpose of supporting teaching, learning and research functions of these tertiary institutions. Effective library sites are common and tangential to the accomplishment of the academic objectives of their parent institutions such that evaluating them becomes a necessity. The result of such an evaluation provides sign posts for improvement so that academic library sites can continue to be useful to their users.

The aim of the study is to evaluate the design effectiveness of representative academic library websites in Nigeria against user-centered design principles and proffer suggestions for their improvement. However, the specific objectives of the study are as follows:

- determine the design effectiveness of representative academic library websites in Nigeria;
- compare the design effectiveness of representative academic library websites in Nigeria;
- identify design effectiveness deficits in representative academic library websites in Nigeria; and
- advance suggestions for improving design effectiveness of representative academic library websites in Nigeria.

The following research questions guide the study:

- Q1. What design elements are effective on representative academic library websites in Nigeria?
- Q2. What design elements are ineffective on representative academic library websites in Nigeria?
- Q3. What are the deficits in design effectiveness on representative academic library websites in Nigeria?
- Q4. How can design effectiveness be improved on representative academic library websites in Nigeria?

The following null and alternate hypotheses are proposed for the study:

- H₀*. There is no significant difference in the design effectiveness of representative academic library websites in Nigeria.
- H_a*. There is a significant difference in the design effectiveness of representative academic library websites in Nigeria.

Review of related literature

The term *usability* is generally used to denote the ease with which people can use a particular tool or other objects to achieve a particular goal. It may also be used to mean the method of measuring usability or the study of the principles behind an object's perceived efficiency or elegance. Usability is, therefore, used to describe the quality of user experience across websites, software, products and environments.

The major concepts of usability can be gleaned from the definition provided by the International Organization for Standardization (ISO)'s 9241 standard which states: "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use". The three operational terms are effectiveness, efficiency and satisfaction. The ISO standard defined the following terms:

- *Effectiveness*: the completeness and accuracy with which users achieve specific goals;
- *Efficiency*: the speed (with accuracy) in which users can complete the task for which they use the product. Also defined as the total resources expended in the task; and
- *Satisfaction*: how pleasant is it to use the design?

For effectiveness, *task* and *physical* or *structural effectiveness* emerge from searching the literature. All other five elements of usability, i.e. task effectiveness, efficiency, engaging, error tolerance, and learnability, are hardly possible without physical or design effectiveness. For example, visual design is the most important element of engaging, while style of visual presentation, the number of functions and type of graphic images or colors as the use of any multimedia elements can affect a user's reaction. The quality of user assistance built into the interface can have a strong impact on task effectiveness, while navigation design elements such as keyboard shortcuts, menu links and other buttons may have impact on the efficiency.

Microsoft (2019) regards effectiveness as a strategy for catching a user's reaction to the system and incorporating it into various development stages. Effectiveness is one of the attributes of usability that ISO 9241-11 defines as the extent to which a product can be used by specified users to achieve specific goals with effectiveness, efficiency and satisfaction in a specified context of use.

The importance of effectiveness as an attribute of usability is underscored in the various models of usability. From Eason (1983, 1984), Nielsen and Molich (1990), ISO (1998) 9241-11, and ISO (2001) 9126 to Quality in Use Integrated Measurement (QUIM) (Seffah *et al.*, 2006), effectiveness remains a recurring attribute of usability. Web effectiveness refers to a user's experience in reading or interacting with a website (Brophy and Crown, 2007).

Palmer (2002) emphasized web effectiveness when he defined usability as consisting of web consistency, ease of navigation for task performance, clarity of interaction, ease of reading, information organization, speed and layout. Website effectiveness plays a critical role in influencing the visitor's decision making to visit it.

Navigability and website organization explain performance, while an accessible web page format is a strong measure of effectiveness (Floyd and Santiago, 2007). These effectiveness attributes focus primarily on design or physical effectiveness, which implies the availability of the relevant information within the website and the possibility to navigate to the relevant web page to obtain it. This may be through the pre-defined access structures such as menus and links. The navigation must be intuitive and take a very short time to sustain interest.

Review of empirical studies

Library website design, analysis of content and form and usability evaluation received good mentions in the literature. In the first category is the work of Harpel-Burke (2005) who compared library home pages of medium-sized universities with commercial home pages using Nielsen and Tahir's (2002) guidelines. The authors found that commercial home pages were livelier than library home pages. In the second category are studies relating to content and form analysis of library websites. Cohen and Still (1999) compared the content, functionality and form of a research university and a two-year college library website and found that the former had better content, was more functional and had more copious use of forms than the latter. Michalec (2000) analyzed the contents of art library websites in the USA. Abubakar *et al.* (2004) and Gbaje and Kotso (2014) did a content analysis of library websites in Nigeria. Quatab and Mahmood (2009) also analyzed the content of library websites in Pakistan.

The navigation of 41 academic health science library websites studied by Brower (2004) showed similarity in the tools used. Academic library websites in Malaysia were evaluated by Lee (2001). The usability of 50 websites was conducted by Nielsen and Tahir (2002) and the usability of the design of academic library websites was performed by McGillis and Toms (2001). The literature discussing design effectiveness of websites seems to be limited (Cowley *et al.*, 2002). However, studies involving the perception of library web pages (Cowley *et al.*, 2002) and librarians' perceptions of website library services in India (Madhusudhan and Nagabhushaban, 2012) are an emerging topic.

From the review of the empirical literature, there is a need to see evaluations of academic library website as a necessary exercise for improving service delivery. Consequently, this study will focus on evaluating the design effectiveness of academic library websites in Nigeria from the perspective of the users.

Research methodology

The case study research strategy was adopted for the study. Case research enables a researcher to study several cases of the same nature. In conducting the study, the survey research methodology was adopted. To identify academic library websites to include in the study, a list of federal, state and private universities, polytechnics and colleges licensed to operate in Nigeria was obtained from the websites of the National Universities Commission, the National Board for Technical Education and the National Commission for Colleges of Education, respectively. Through Web search, the name of the university, polytechnic and college libraries that have identifiable websites were obtained, their web addresses were recorded and used to browse the sites for the confirmation of their existence and availability. In all, 14 universities, one polytechnic and one college of education were identified. Because of the unevenness in the population of these academic libraries, one university library website was randomly selected, while one polytechnic and one college library were purposively selected to form a representative pool for the study (Table I).

Academic libraries that were linked to their institutional websites were excluded because they did not meet the requirement of having a domain name and being hosted and published on at least one server.

The population for the study consisted of 360 final year students who are registered library users at the Nnamdi Azikiwe Library (University of Nigeria, Nsukka), Federal Polytechnic Ado-Ekiti Digital Library and Prof. Mustafa Abba Library (Federal College of Education, Yola) during the 2018/2019 academic sessions. Notices were sent out via e-mail addresses and pasted on notice boards of the respective libraries requesting library users who are final-year students to volunteer as user participants for evaluating the academic library websites under study. After two weeks, 180 library users across the three institutions indicated interest in participating in the study; hence, they formed a pool of evaluators for each library website.

An instrument titled *Perceived Design Effectiveness of Nigerian Academic Library Websites Questionnaire* (PEDEACLWQ) was constructed with inputs principally from Nielsen and Molich's (1990) nine-point heuristics and graphic design principles from published literatures in the field of human computer interaction. The questionnaire had a five-point rating scale (SA = Strongly agree (5), A = Agree (4), D = Disagree (3), SD = Strongly disagree (2) and U = Undecided (1)).

The evaluation was un-moderated and conducted remotely. The participants who indicated their interest to serve as evaluators in each library were contacted through e-mail and provided with relevant instructions pertaining to the evaluation. The URL of the library website to be evaluated and a copy of the constructed instrument were supplied to the participants to enable them record their perceptions of the design effectiveness on each item of the questionnaire. User participants were given the same informational, navigational and transactional tasks to perform and also allowed to design appropriate tasks based on their knowledge, experience and use the outcome to evaluate the library websites.

All user participants were allocated three days for the exercise at their respective locations, using any internet-enabled device and Web browser of choice. The participants were instructed to complete the questionnaire after conducting the tasks and return the completed questionnaire via the researcher's e-mail address. On the third day, all submitted copies of the questionnaire were retrieved and examined for errors. Finally, out of the 60 copies of the questionnaire provided at each location, 57 were found usable for both Nnamdi Azikiwe Nsukka and Federal Polytechnic Ado-Ekiti Digital Library, while 58 were deemed good for Prof. Mustafa Abba Library.

The questionnaire data were presented in tables and analyzed for effectiveness using the median of the performance score (f_x) of the three groups for each evaluated item. The decision criterion is if $f_x \geq \bar{x}$ of 122.5 (Agreed) and if $f_x < \bar{x}$ of 122.5 (Disagreed). The Kruskal-Wallis test by ranks was used to test the null hypothesis at a five per cent level of significance. The decision criterion is if H-statistic $> \chi^2$ critical value, then reject H_0 ; otherwise, retain H_a .

Table I.
Academic library websites selected for the study

Name code	Name of the library	URL
Lib 1	Nnamdi Azikiwe Library, University of Nigeria, Nsukka	www.library.unn.edu.ng
Lib 2	Federal Polytechnic Ado-Ekiti Digital Library	www.library.fedpolyado.edu.ng
Lib 3	Prof. Mustafa Abba Library, Federal College of Education, Yola	www.library.fceyola.edu.ng

Results and discussion

Gender distribution of respondents

Table II presents the gender distribution of respondents. Males comprised 58 per cent of the respondents, females comprised the remaining 42 per cent for Lib 1 and Lib 2 respondents, and 59 per cent were males and 41 per cent were females for Lib 3 respondents.

Computer and internet literacy skills of respondents

Table III shows the computer and internet literacy skills of the respondents. All the respondents are of the opinion that they have very good computer and internet literacy skills.

From Table IV, which was derived from Tables AI, AII, and AIII (see Appendix), it can be seen that items 1 to 6, 19 and 20 were found to be effective on Lib 1, Lib 2 and Lib 3 websites, while item 7 on Lib 3, item 8 on Lib 2 and Lib 3, item 10 on Lib 3 and item 15 on Lib

Table II.
Gender distribution of respondents

Gender	Lib 1	Lib 2	Lib 3
Male	33 (58%)	33 (58%)	34 (59%)
Female	24 (42%)	24 (42%)	24 (41%)
Total	57 (100%)	57 (100%)	58 (100%)

Table III.
Computer and literacy skills of respondents

Literacy skill	Satisfactory			Good			Very good		
	Lib 1	Lib 2	Lib 3	Lib 1	Lib 2	Lib 3	Lib 1	Lib 2	Lib 3
Computer literacy	–	–	–	–	–	–	57	57	58
Internet literacy	–	–	–	–	–	–	57	57	58

Lib code	Name of the library	Respondents	Agreed items ($\bar{x} \geq 122.5$)	(%)	Disagreed items ($\bar{x} < 122.5$)	(%)
Lib 1	Nnamdi Azikiwe Library, University of Nigeria, Nsukka	Group 1	1-6, 15, 19, 20	45	7-14, 16-18	55
Lib 2	Federal Polytechnic Ado-Ekiti Digital Library	Group 2	1-6, 8, 19, 20	45	7, 9-18	55
Lib 3	Prof. Mustafa Abba Library, Federal College of Education, Yola	Group 3	1-8, 15, 19, 20	55	9-14, 16-18	45

Notes: The website supports my level of computer literacy; It is easy for me to navigate the website; I am familiar with screen navigation to the website; Wordings of messages and labels are appropriate for me; I am comfortable with the use of color on the website; The website complies with the contrast rule; The fonts and headings are clear; I easily understand the website with provided default buttons; The screen is not dense with content; Website content is well organized; Website links are well maintained; Website responds as expected to actions I take; I need not wait too long to open a page; Website is user-friendly; Website speedily displays information; I will speedily complete work using the website; Website provides error message that clearly tells a user how to fix a problem; Website enables me to easily and quickly recover from mistakes while using it; Individual images of the website are well defined; Visual layout while using the website is satisfying

Table IV.
Distribution of agreed and disagreed items by library website

1 and Lib 3 websites were effective. Each of these items has an fx score \geq \bar{x} score of 122.5 as can be seen from table.

However, items 7-14 were disagreed with on Lib 1; items 9-14 were disagreed with on Lib 2; items 9, 11-14 were disagreed with on Lib 3 and items 16-18 were disagreed with on Lib 1, Lib 2 and Lib 3. Each of these items had an fx score less than the \bar{x} score of 122.5 as can be verified from the table.

Group 1, Group 2 and Group 3 found the following items to be effective on Lib 1, Lib 2, and Lib 3 websites, respectively: 1 (website support for computer literacy level), 2 (ease of navigation), 3 (familiarity with screen navigation), 4 (appropriateness of wordings of headings and labels), 5 (comfort with the use of color), 6 (compliance with the contrast rule), 19 (definitiveness of individual images) and 20 (satisfying visual layout). Group 3 found item 7 (clarity of fonts and headings) effective on the Lib 3 website. Group 2 and Group 3 found item 8 (easy understanding of website with provided default buttons) effective on the Lib 2 and Lib 3 websites, while Group 1 and Group 2 found item 15 (display speed) effective on the Lib 1 and Lib 2 websites, respectively.

However, Group 1, Group 2 and Group 3 found the following items not effective on the Lib 1, Lib 2, and Lib 3 websites, respectively: 9 (denseness of screen), 10 (organisation of website content), 11 (website maintenance), 12 (website response), 13 (waiting time), 4 (user-friendliness), 16 (speedy completion of work) 17 (provision of error messages) and 18 (recovery from mistakes). Group 1 and Group 2 found item 7 (clarity of fonts and headings) not effective on the Lib 1 and Lib 2 websites, respectively. Group 3 considered item 15 (speedy display of information) not effective on the Lib 3 website.

Group 1, Group 2 and Group 3 found items 1-6, 19 and 20 effective on Lib 1, Lib 2 and Lib 3; however, they found items 9-14 and 16-18 not effective on Lib 1, Lib 2 and Lib 3, respectively. Group 3 found item 7 effective on the Lib 3 website, while Group 1 and Group 2 did not find it effective on the Lib 1 and Lib 2 websites, respectively. Group 1 and Group 2 considered item 15 effective on the Lib 1 and Lib 2 websites, while Group 3 found it not effective on the Lib 3 website.

Group 1 and Group 2 found 9 (45 per cent) of the 20 items presented for evaluation effective on the Lib 1 and Lib 2 websites, respectively, while 11 (55 per cent) were considered not effective. However, Group 3 considered 11 (55 per cent) of the 20 items effective on the Lib 3 website while 9 (45 per cent) were adjudged not effective. The number of items considered effective on the Lib 3 website by Group 3 (11 or 55 per cent) is equal to the number of items considered not effective on the Lib 1 and Lib 2 websites by Group 1 and Group 2 (11 or 55 per cent). Similarly, the number of items considered not effective on Lib 3 by Group 3 and considered effective on the Lib 1 and Lib 2 websites by Group 1 and Group 2, respectively, is the same (9 or 45 per cent).

The result shows that the Lib 3 website had more items considered effective than Lib 1 and Lib 2. The Lib 3 website having more effective items is contrary to the perception that in the tertiary institution system, universities always provide better library services and absorb innovations faster than the polytechnic and college of education libraries. The performance of Lib 3 is echoed in [Abifarin and Imavah \(2018\)](#) where Lib 3 ranked higher than Lib 1 and Lib 2 in the availability index of design elements on academic library websites in Nigeria. Out of the 47 items verified, Lib 1 had 25, Lib 2 had 24 and Lib 3 had 28, giving the availability index of 53.12, 51.06 and 59.57, respectively. The rating on effectiveness by the respective groups in this study may be linked to the availability or otherwise of the design elements presented for evaluation.

Test of hypothesis

Table V shows the fx data points for Lib 1, Lib 2 and Lib 3, respectively.

Following paragraph shows the data sorted for all groups into ascending order in one combined set.

Data sorted into ascending order for all groups

58, 79, 83, 101, 101, 102, 103, 104, 107, 108, 108, 110, 111, 112, 112, 112, 113, 114, 114, 114, 114, 114, 115, 115, 119, 119, 120, 120, 122, 123, 123, 124, 125, 128, 128, 129, 137, 137, 138, 139, 141, 148, 152, 154, 158, 159, 159, 163, 176, 206, 217, 219, 222, 225, 225, 227, 237 and 237

Table VI shows the assigned ranks to the data points.

Table VII presents the addition of the different ranks for each category.

Table VIII shows the calculation of the H-statistic.

$$H = \left[\frac{12}{n(n+1)} \sum_{j=1}^c \frac{T_j^2}{n_j} \right] - 3(n-1) \tag{1}$$

$$H = \left[\frac{12}{60(60+1)} \left[\frac{(538.5)^2}{20} + \frac{(594.5)^2}{20} + \frac{(697)^2}{20} \right] - 3(60+1) \right] \tag{2}$$

$$H = \left[\frac{12}{3660} [14499.118 + 17671.513 + 24290.450] - 183 \right] \tag{3}$$

$$H = [0.0032787[56461.081] - 183] \tag{4}$$

$$H = 2.1189446 \tag{5}$$

with a critical chi-square (χ^2) value of 2 degrees of freedom at an alpha level of 0.05 = 5.9915.

Because the H-statistic of 2.1189 is less than the critical χ^2 value of 5.9915, there is enough evidence to retain the null hypothesis. The null hypothesis that there is no significant difference in the design effectiveness between Lib 1 and Lib 2; thus, Lib 3 is hereby retained.

Summary

On the Lib 1 website, Group 1 disagreed to 11 (55 per cent) of the 20 items presented while agreeing on the remaining 9 (45 per cent). On the Lib 2 website, Group 2 agreed on 9 (45 per cent) of the 20 items while disagreeing on the remaining 11 (55 per cent) items. On the Lib 3 website, Group 3 agreed on 11 (55 per cent) of the 20 items while disagreeing on 9 (45 per cent).

Table V.
Fx Data points for
Lib 1, Lib 2 and Lib 3

Lib code	Data points
Lib 1	222, 225, 206, 163, 159, 139, 114, 79, 104, 88, 101, 108, 112, 111, 123, 114, 112, 107, 128, 137
Lib 2	219, 225, 237, 158, 159, 129, 114, 125, 101, 83, 103, 115, 113, 108, 119, 115, 114, 110, 141, 138
Lib 3	217, 227, 237, 152, 176, 137, 154, 124, 102, 123, 58, 120, 117, 114, 128, 122, 120, 119, 158, 148

S/No.	Data point	Rank	Design effectiveness of academic library
1	58	1	
2	79	2	
3	83	3	
4	88	4	
5	101	5.5	
6	101	5.5	
7	102	7	
8	103	8	
9	104	9	
10	107	10	
11	108	11.5	
12	108	11.5	
13	110	13	
14	111	14	
15	112	16	
16	112	16	
17	112	16	
18	113	18	
19	114	21	
20	114	21	
21	114	21	
22	114	21	
23	114	21	
24	115	24.5	
25	115	24.5	
26	119	26.5	
27	119	26.5	
28	120	28.5	
29	120	28.5	
30	122	30	
31	123	31.5	
32	123	31.5	
33	124	33	
34	125	34	
35	128	35.5	
36	128	35.5	
37	129	37	
38	137	38.5	
39	137	38.5	
40	138	40	
41	139	41	
42	141	42	
43	148	43	
44	152	44	
45	154	45	
46	158	46.5	
47	158	46.5	
48	159	48.5	
49	159	48.5	
50	163	50	
51	176	51	
52	206	52	

Table VI.
Assigned ranks to data points

(continued)

EL 37,3	S/No.	Data point	Rank
		53	217
	54	219	54
	55	222	55
586	56	225	56.5
	57	225	56.5
	58	227	58
	59	237	59.5
	60	237	59.5

Table VI.

S/No.	Lib 1		S/No.	Lib 2		S/No.	Lib 3	
	Data point	Rank		Data point	Rank		Data point	Rank
1	79	2	1	83	3	1	58	1
2	88	4	2	101	5.5	2	102	7
3	101	5.5	3	103	8	3	112	16
4	104	9	4	108	11.5	4	114	21
5	107	10	5	110	13	5	119	26.5
6	108	11.5	6	113	18	6	120	28.5
7	111	14	7	114	21	7	120	28.5
8	112	16	8	114	21	8	122	30
9	112	16	9	115	24.5	9	123	31.5
10	114	21	10	115	24.5	10	124	33
11	114	21	11	119	26.5	11	128	35.5
12	123	31.5	12	125	34	12	137	38.5
13	128	35.5	13	129	37	13	148	43
14	137	38.5	14	138	40	14	152	44
15	139	41	15	141	42	15	154	45
16	159	48.5	16	158	46.5	16	158	46.5
17	163	50	17	159	48.5	17	176	51
18	206	52	18	219	54	18	217	53
19	222	55	19	225	56.5	19	227	58
20	225	56.5	20	237	59.5	20	237	59.5
Total		538.5	Total		594.5	Total		697

Table VII.
Addition of different ranks for each category

Calculated H-statistic	Critical χ^2 value	Df	Alpha level	Decision
2.1189	5.9915	2	0.05	Retain H_0

Table VIII.
Result of hypothesis testing

Items 1-6, 19 and 20 were agreed on Lib 1, Lib 2 and Lib 3 while items 9, 11-14 and 16-18 were disagreed. Item 7 was agreed on Lib 3 but disagreed on Lib 1 and Lib 2. Item 8 was agreed on Lib 2 and Lib 3 but disagreed on Lib 1, while item 15 was agreed on Lib 1 and Lib 3 but disagreed on Lib 2.

Conclusions

Lib 3 was considered more effective than Lib 1 and Lib 2 having scored agreed on 11 (55 per cent) of the 20 items presented for assessment as against 9 (45 per cent) for the latter. Lib 3 was considered not effective on 9 (45 per cent) of the items as against Lib 1 and Lib 2 with 11 (55 per cent) items. Thus, it can be concluded that Lib 3 was more effective than Lib 1 and Lib 2.

Recommendations

Lib 1 and Lib 2 should improve on item 7 by making the fonts and headings on their websites clearer. Lib 1 should make the default buttons provided (item 8) easily understood by respondents. Lib 1, Lib 2 and Lib 3 should make the screen less dense with content (item 9). Lib 1 and Lib 2 should organize their contents better on their websites (item 10). Lib 1, Lib 2 and Lib 3 should endeavor to maintain their links (item 11), make their websites respond to actions taken by users (item 12), reduce the long wait for a web page to open (item 13) and make their website more user-friendly (item 14). Similarly, Lib 1, Lib 2 and Lib 3 should provide assistance to enable users to speedily complete work using the web site (item 16), provide error messages that clearly tell the user how to fix problems (item 17) and help to enable users to easily and quickly recover from a mistake while using the website (item 18). Items that were considered effective can also be upgraded to further improve effectiveness.

References

- Abifarin, F.P. and Imavah, S.A. (2018), "Design evaluation of academic library web sites in Nigeria", *African Journal of Computing and ICT*, Vol. 11 No. 3, pp. 12-32.
- Abubakar, M., Aminu, G. and Hafiz, U. (2004), "University library web sites in Nigeria: analytical of content", *Information and Knowledge Management*, Vol. 4 No. 3, pp. 16-22.
- Brophy, P. and Crown, J. (2007), "Web accessibility", *Library Trends*, Vol. 55 No. 4, pp. 950-972.
- Brower, M.S. (2004), "Academic health science library web sites navigation: analysis of 41 web sites and their navigation tools", *Journal of the Medical Library Association*, Vol. 92 No. 4, pp. 412-420.
- Cohen, L.B. and Still, J.M. (1999), "A comparison of research university and two-year college library web sites: contents, functionality and form", *College and Research Libraries*, Vol. 60 No. 3, pp. 275-289.
- Cowley, H.G., Leffel, R., Ramirez, D., Hart, I.J. and Armstrong, S.T. (2002), "User perception of the library's webpage: a focus group study of Texas A&M university", *Journal of Academic Librarianship*, Vol. 28 No. 4, pp. 205-210.
- Eason, K. (1983), "User centered design for information technology systems", *Physics in Technology*, Vol. 14 No. 1, pp. 210-224.
- Eason, K. (1984), "Towards the experimental study of usability", *Behavior and Information Technology*, Vol. 3 No. 1, pp. 133-144.
- Floyd, K.S. and Santiago, J. (2007), "The state of website accessibility in higher education", *Proceedings of the 2007 Southern Association for Information Systems Conference*, pp. 9-10.
- Gbaje, E.S. and Kotso, J.A. (2014), "Assessing the contents of Nigerian academic library web sites", *Information and Knowledge Management*, Vol. 4 No. 7, pp. 6-11.
- Harpel-Burke, P. (2005), "Library homepage design at medium-sized universities: a comparison to commercial homepages via Nielsen and Tahir", *OCLC Systems and Services: International Digital Library Perspectives*, Vol. 21 No. 13, pp. 193-208.
- International Standard Organisation (ISO) (1998), "ISO 9241: Ergonomics of Human-Computer interaction".

- International Standard Organisation (ISO) (2001), ISO 9126: title?
- Lee, K.H. (2001), "Evaluation of academic library web sites in Malaysia", *Malaysia Journal of Library and Information Science*, No. 2, pp. 95-108.
- McGillis, L. and Toms, G.E. (2001), "Usability of academic library web sites: implication for design", *College and Research Libraries*, Vol. 62 No. 4, pp. 355-367.
- Madhusudhan, M. and Nagabhushaban, V. (2012), "Web-based library services in university libraries in India: an analysis of librarians' perspective", *The Electronic Library*, Vol. 30 No. 5, pp. 569-588.
- Michalec, M. (2000), "A content analysis of art library web sites", *art documentation*, Vol. 25 No. 2, pp. 46-54.
- Nielsen, J. and Molich, R. (1990), "Improving a human-computer dialogue: what designers know about traditional interface design", *Communications of the ACM*, Vol. 33, pp. 338-342, No. March.
- Nielsen, J. and Tahir, M. (2002), *Homepage Usability: 50 Web Sites Deconstructed*, New Riders Publishing, San Francisco.
- Palmer, J. (2002), "Website usability, design, and performance metrics", *Information Systems Research*, Vol. 13 No. 2, pp. 115-225.
- Preece, J. (2001), "Sociability and usability: twenty years of chatting online", *Behavior and Information Technology*, Vol. 20 No. 5, pp. 347-356.
- Quatab, S. and Mahmood, H. (2009), "Library web sites in Pakistan: an analysis of content", *Program Electronic Library and Information Systems*, Vol. 43, pp. 430-445.
- Seffah, A., Donyae, E.E., Kline, R. and Padda, H. (2006), "Usability measurement and metrics: a consolidated model", *Software Quality Journal*, Vol. 14 No. 2, pp. 159-178.

Appendix

Design effectiveness of Lib1 website

Table AI presents the responses on the design effectiveness of Lib1 (Nnamdi Azikiwe Library, University of Nigeria, Nsukka) website.

S/No.	Items	SA	A	D	SD	UD	Total(fx)	$\bar{x} = 122.5$	Decision
1	The website supports my level of computer literacy	15	31	6	2	3	222	$fx \geq \bar{x}$	Agreed
2	It is easy for me to navigate the website	10	40	2	2	3	225	$fx \geq \bar{x}$	Agreed
3	I am familiar with screen navigation to the website	12	30	3	2	6	206	$fx \geq \bar{x}$	Agreed
4	Wordings of messages and labels are appropriate for me	8	10	20	7	12	163	$fx \geq \bar{x}$	Agreed
5	I am comfortable with the use of color on the website	10	6	34	2	5	159	$fx \geq \bar{x}$	Agreed
6	The website complies with the contrast rule	5	6	28	10	8	139	$fx \geq \bar{x}$	Agreed
7	The fonts and headings are clear	2	4	35	15	1	114	$fx < \bar{x}$	Disagreed
8	I easily understand the site with provided default buttons	0	3	43	6	5	79	$fx < \bar{x}$	Disagreed
9	The screen is not dense with content	1	2	31	20	3	104	$fx < \bar{x}$	Disagreed
10	Website content is well organized	5	6	17	28	1	83	$fx < \bar{x}$	Disagreed
11	Website links are well maintained	3	5	15	33	1	101	$fx < \bar{x}$	Disagreed
12	Website responds as expected to the actions I take	2	3	30	18	1	108	$fx < \bar{x}$	Disagreed
13	I need not wait too long to open a page	1	2	43	10	1	112	$fx < \bar{x}$	Disagreed
14	Website is user friendly	2	5	22	21	2	111	$fx < \bar{x}$	Disagreed
15	Website speedily displays information at the click of a hyperlinked image	2	7	15	22	11	123	$fx \geq \bar{x}$	Agreed
16	I can speedily complete work using the web site	3	8	20	23	3	114	$fx < \bar{x}$	Disagreed
17	Website provides error messages that clearly tell a user how to fix problems	5	1	30	20	1	112	$fx < \bar{x}$	Disagreed
18	Website enables me to easily and quickly recover from mistakes while using it	2	1	39	15	0	107	$fx < \bar{x}$	Disagreed
19	Individual pages of the website are well defined	5	4	15	21	12	128	$fx \geq \bar{x}$	Agreed
20	Visual layout while exploring the website is satisfying	5	7	23	14	8	137	$fx \geq \bar{x}$	Agreed
	Total	99	181	476	287	87	1130		

Notes: SA = Strongly agree; A = Agree; D = Disagree; SD = Strongly disagree; UD = Undecided; Agreed ($fx \geq \bar{x}(122.5) = 9$; Disagreed ($fx < \bar{x}(122.5) = 11$); Going by the decision rule that if $fx \geq \bar{x}$, agreed, if $fx < \bar{x}$, disagreed, 11 (55%) items of the items presented for evaluation were considered not effective while the remaining 9 (45%) were considered effective by Group 2 respondents

Table AI. Design effectiveness of Lib1 website

Table AII presents the responses on the design effectiveness of Lib2 (Federal Polytechnic Ado-Ekiti Digital Library) website. Out of 20 items presented for evaluation, Group 2 respondents agreed on 9 (45 per cent) while disagreeing on 11 (55 per cent) items.

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S/No.	Items	SA	A	D	SD	UD	Total (fx)	$\bar{x} = 122.5$	Decision
1	The website supports my level of computer literacy	15	30	6	3	3	219	$fx \geq \bar{x}$	Agreed
2	It is easy for me to navigate the website	10	40	4	1	2	225	$fx \geq \bar{x}$	Agreed
3	I am familiar with screen navigation to the website	11	36	3	3	7	237	$fx \geq \bar{x}$	Agreed
4	Wordings of messages and labels are appropriate for me	8	10	20	8	10	158	$fx \geq \bar{x}$	Agreed
5	I am comfortable with the use of color on the website	10	6	34	2	5	159	$fx \geq \bar{x}$	Agreed
6	The website complies with the contrast rule	5	5	27	12	6	129	$fx \geq \bar{x}$	Agreed
7	The fonts and headings are clear	2	4	35	15	1	114	$fx < \bar{x}$	Disagreed
8	I easily understand the site with provided default buttons	1	4	42	5	5	125	$fx \geq \bar{x}$	Agreed
9	The screen is not dense with content	0	2	30	21	4	101	$fx < \bar{x}$	Disagreed
10	Website content is well organized	5	6	17	28	1	83	$fx < \bar{x}$	Disagreed
11	Website links are well maintained	3	5	15	32	2	103	$fx < \bar{x}$	Disagreed
12	Website responds as expected to the actions I take	3	3	35	15	1	115	$fx < \bar{x}$	Disagreed
13	I need not wait too long to open a page	1	2	42	10	2	113	$fx < \bar{x}$	Disagreed
14	Website is user friendly	2	5	25	22	2	108	$fx < \bar{x}$	Disagreed
15	Website speedily displays information at the click of a hyperlinked image	2	6	12	25	12	119	$fx < \bar{x}$	Disagreed
16	I can speedily complete work using the website	3	6	20	24	4	115	$fx < \bar{x}$	Disagreed
17	Website provides error messages that clearly tell a user how to fix problems	6	1	30	20	0	114	$fx < \bar{x}$	Disagreed
18	Website enables me to easily and quickly recover from mistakes while using it	3	1	38	15	0	110	$fx < \bar{x}$	Disagreed
19	Individual pages of the website are well defined	5	5	16	16	15	141	$fx \geq \bar{x}$	Agreed
20	Visual layout while exploring the website is satisfying	5	8	21	15	8	138	$fx \geq \bar{x}$	Agreed
	<i>Total</i>	<i>101</i>	<i>185</i>	<i>602</i>	<i>282</i>	<i>83</i>	<i>1253</i>		

Table AII.

Design effectiveness of Lib2 website

Notes: SA = Strongly agree, A = Agree; D = Disagree; SD = Strongly disagree; UD = Undecided; agreed ($fx \geq \bar{x}(122.5) = 9$; Disagreed ($fx < \bar{x}(122.5) = 11$)

Table AIII presents the response on the design effectiveness of Lib3 (Prof. Mustafa Abba Library, Federal College of Education, Yola) website. Eleven (55 per cent) of the 20 items presented for evaluation were found to be effective while 9 (45 per cent) were not by Group 3 respondents.

S/No	Items	SA5	A4	D3	SD2	UD1	Total (fx)	$\bar{x}=122.5$	Decision
1	The website supports my level of computer literacy	17	29	6	2	4	217	$fx \geq \bar{x}$	Agreed
2	It is easy for me to navigate the website	10	41	4	2	1	227	$fx \geq \bar{x}$	Agreed
3	I am familiar with screen navigation to the website	18	30	1	1	8	237	$fx \geq \bar{x}$	Agreed
4	Wordings of messages and labels are appropriate for me	7	7	30	5	8	152	$fx \geq \bar{x}$	Agreed
5	I am comfortable with the use of color on the website	13	6	29	1	9	176	$fx \geq \bar{x}$	Agreed
6	The website complies with the contrast rule	6	5	24	15	8	137	$fx \geq \bar{x}$	Agreed
7	The fonts and headings are clear	4	6	36	11	1	154	$fx \geq \bar{x}$	Agreed
8	I easily understand the site with provided default buttons	1	4	44	6	3	124	$fx \geq \bar{x}$	Agreed
9	The screen is not dense with content	1	2	28	24	3	102	$fx < \bar{x}$	Disagreed
10	Website content is well organized	4	8	23	22	1	123	$fx \geq \bar{x}$	Disagreed
11	Website links are well maintained	4	5	12	36	1	58	$fx < \bar{x}$	Disagreed
12	Website responds as expected to the actions I take	4	3	44	8	1	120	$fx < \bar{x}$	Disagreed
13	I need not wait too long to open a page	1	1	45	10	1	112	$fx < \bar{x}$	Disagreed
14	Website is user friendly	3	4	26	23	2	114	$fx < \bar{x}$	Disagreed
15	Website speedily displays information at the click of an hyperlinked image	3	7	13	23	12	128	$fx \geq \bar{x}$	Agreed
16	I can speedily complete work using the website	4	6	20	23	5	122	$fx < \bar{x}$	Disagreed
17	Website provides error messages that clearly tell a user how to fix problems	6	1	33	17	1	120	$fx < \bar{x}$	Disagreed
18	Website enables me to easily and quickly recover from mistakes while using it	3	2	43	10	0	119	$fx < \bar{x}$	Disagreed
19	Individual pages of the website are well defined	7	5	19	8	19	158	$fx \geq \bar{x}$	Agreed
20	Visual layout while exploring the website is satisfying	5	11	22	15	5	148	$fx \geq \bar{x}$	Agreed
	<i>Total</i>	<i>122</i>	<i>178</i>	<i>480</i>	<i>263</i>	<i>91</i>	<i>1253</i>		

Notes: SA= Strongly agree; A = Agree; D = Disagree; SD = Strongly disagree; UD = Undecided; agreed ($fx \geq \bar{x}(122.5) = 11$; Disagreed ($fx < \bar{x}(122.5) = 9$)

Table AIII. Design effectiveness of Lib3 website

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