

INDICATORS OF LIBRARY SERVICE QUALITY AND SATISFACTION AMONG STUDENTS OF NIGERIAN HIGHER EDUCATION INSTITUTIONS. A PRINCIPAL COMPONENT ANALYSIS APPROACH.

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Abstract

Provision and utilization of relevant library resources and services are fundamental for student satisfaction and institutional achievement. Employing the methodology of systematic review, we placed 41 English empirical articles on this subject into perspective. 21 library resources and service factors were relevant to determining student satisfaction in Nigerian Higher Education Institutions (HEIs). Principal Component Analysis (PCA) is a multivariate technique widely used for data reduction. This study further used the PCA to identify the relevant library resources and services variables with the highest variance. Arrangement of resources in their proper places on the shelves; library provides user education/orientation exercises (periodically); application of expert systems in reference service in: cataloging, classification, indexing, and acquisition; standby generators; and easily accessible resources (physical and electronic), which constituted the library's mode of operation (process), were found to contribute 81.1% of the total variance. This indicates that these five factors were the top predictors of student satisfaction with academic libraries in Nigerian public tertiary institutions. The study can go a long way by providing tertiary institution librarians and libraries with a guide on formulating robust educational library policies. The policies, when formulated, are expected to yield good results since the input of the policies originated from those the policies affect the most. Further studies can replicate this research in other developing countries to affirm or disprove the study results.

Keywords: Student's Satisfaction, Library Resources, Library Services, Higher Education Institutions, Principal component analysis, Systematic review

INTRODUCTION

Libraries are service organizations that provide services to their various consumers without discrimination (Akolade, Tella, Akanbi-Ademolake, & Adisa 2015). An academic library is crucial to the institution's support of teaching, research, and learning. The academic library must adapt all of its services to the demands of its users, both now and in the future (Mathar et al., 2021). According to Ekwelem (2013) and Sharma (2019), the availability of the information that libraries retain and transmit in a variety of formats to all users is a critical requirement. In the words of Zhang, Lo, So, and Chiu (2020), academic libraries are service organizations that fulfill the information needs of their communities and help students develop their information literacy skills. The goal is for students to become lifelong learners who can find, retrieve, evaluate, and apply information to create new knowledge. Libraries are concerned about service quality and its effects on present and future library users of collections and services since they are service organizations. The "heart" of the learning community is the academic library, which gives room for study and knowledge expansion for students, staff, and even members of the host community. (Martzoukou 2020).

The library is divided into a number of sections, each of which serves a specific purpose in terms of offering users access to a variety of materials and services. These sections include reference, cataloguing, serials, automation, and circulation (Tchangalova, Harrington, Ritchie & Over 2019). However, there are some factors that could influence how satisfied users are, such as the availability and prompt access to updated information, meeting users' information needs, responding to their inquiries whenever they arise, the adequacy of the library's resources, staff's polite behaviour, among other things. (Aftanorhan, Awang, Rashid, Foziah, & Ghazali 2019).

The expectations of users, particularly students, in terms of information and knowledge search in Higher Education Institutions (HEIs) have changed as a result of the digitized global learning environment and the Information and Communication Technology (ICT) age (Twum, Adams, Budu, & Budu 2022). In particular, the world of information technology (IT) has caused students' needs for information services to change, which puts pressure on academic libraries, as information hubs, to work toward improving their services in order to face competition in the global higher education industry and meet the information needs of users to warrant satisfaction. (Skudai 2012; Decker 2021). This phenomenon necessitates an institution of higher learning to embark on a constant evaluation of the quality issues related to the academic library services.

According to Kamarudin, Halamy, and Mohsin (2020), users of academic libraries are predominantly students. Hence, Popoola (2008) said that information services and resources offered in academic libraries must be able to assist faculty members and students in their research. According to Wong and Saunders (2020), people may get access to crucial information they need to engage in the changing information society through libraries and librarians. Therefore, libraries and library staff have an ethical obligation to provide information to all categories of users regardless of their gender, age, race, political affiliation, and faith affiliation (Akolade, Tella, Akanbi-Ademolake, & Adisa 2015). The glory of a library is to have the success of satisfying users' needs irrespective of their physical and intellectual condition.

The satisfaction of library users is very important and critical. However, it's important to keep in mind that no single library can satisfy all its users all the time (Hedstrom 1997). Some libraries have very limited resources and clearly are unable to satisfy their patrons, while others are large in size, have significant and high-quality holdings, and can give access to a variety of services. Obviously, those libraries that are able to offer users what they desire will attain higher levels of user satisfaction (Anmol, Khan, & Muhammad, 2021). Therefore, it is vital to emphasize that, notwithstanding the substantial impact that resource accessibility has on user satisfaction, the quality of the resources may be assessed based on how well the library manages access to crucial and precarious services and/or materials when and where it is required. It is this overall perception of a library's resources and services that contributes to user satisfaction (Idiegbeyan-Ose & Esse 2013).

Evaluation of service rendered to customers is crucial for all organizations. Since students are the primary patrons of higher education institutions, assessing their level of satisfaction with the library-related services provided would have provided insight into how well they perceive the institutions' service quality. (Anmol, Khan, & Muhammad, 2021). As a tangible dimension of service quality, the library plays a major role in ensuring satisfaction and retention in the institution (Agboola, Bamigboye, & Owolabi 2019). In today's information phase and civilization, delivering quality service in all lengths is imperative if the education system especially higher education institutions to be relevant and counted within the active higher education marketplace (Tijjani 2019).

The general library's mission and vision statements act as the cornerstone for the majority of activities in the community they serve, which includes all types and levels of students as well as academic and non-academic staff members as well as research fellows both inside and outside the institution. Academic libraries should understand how to provide quality services to their customers in the community since most academic libraries are non-financial units of the institution (Agboola, Bamigboye, & Owolabi 2019). However, due to the introduction of search engines on the internet, which users can easily use without having to visit the library, academic and research libraries are now facing competition. A study by Moruwawon (2020) asserted that in today's digital environment, libraries must improve their physical and non-physical facilities in order to survive in a competitive environment.

The influence of library service quality on user satisfaction has been studied by various authors (e.g. Twum, Adams, Budu & Budu 2022; Alam 2021; Srirahayu, Hartini, Handriana, Layyinah & Firdaus 2020; Udo & Philip 2020; Aftanorhan, Awang, Rashid, Foziah & Ghazali 2019; Xu & Du 2018; Rani 2018; Tan, Chen & Yang 2017; Moses et al., 2016; Mohindra & Kumar 2015; Sriram & Rajev 2014, & Pauline 2011). It is believed that libraries with more quality resources and services will more likely be patronized. In addition, the quality of the library exerts a positive influence on perceived quality and satisfaction. More service quality will lead to higher student satisfaction.

Methodology

The study employed two similar methodologies. In accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines proposed by Moher et al., (2015), a systematic review was first conducted in 5 popular databases. The databases are Emerald Insight, Science Direct (Elsevier), Taylor and Francis Online, Springer Link, and Google Scholar. Through the use of diverse combinations of keywords, "Library Service Quality" AND Students Satisfaction in Nigeria", Academic Library" AND "Students Satisfaction" AND "Tertiary Institutions in Nigeria", "User satisfaction" AND "Academic Library" AND "Higher Education Institutions in Nigeria" Higher Education Students Satisfaction" AND "Library Quality" AND " Nigeria", "Physical and Non-Physical Library Service" AND "Customer Satisfaction" AND Tertiary Institutions in Nigeria" Keywords, article titles, abstracts, and full texts were searched. We searched through the titles, keywords, abstracts, and, in some cases, the entire manuscript to extract the included service quality indicators, as proposed by Linnenluecke, Marrone, and Singh (2020). Additionally, according to the theory put forward by Xiao and Watson (2019), we resolve any disagreement and difference regarding any aspect that appears unclear through consensus. There is no restriction on the studies retrieved. This would allow for the inclusion of any pertinent publications that address at least one service quality element that could have an impact on a library user’s satisfaction in Nigerian HEIs. Further, we only paid attention to elements that came from empirical and double-blind reviewed publications in accordance with Tonhäuser and Bükler's (2016) rigor criteria. Finally, as shown in figure 1 and appendix 1, we identified twenty-one (21) aspects of service quality factors that influence library users’ satisfaction in Nigerian HEIs.



Figure 1. The reported library service quality factors by different studies

The second step sought to collect further knowledge regarding the magnitude of impacts of the identified factors on users' satisfaction. The technique involves sending the electronic survey to students from the selected tertiary institutions in Nigeria. Hence, an online questionnaire using Google form was sent to (115) students. According to Salama, Uzunboylu, and El Muti (2020) and Mondal, Mondal, Ghosal and Mondal, (2018) the platform was reported to be effective in creating online forms tutorials, and questionnaires. The questionnaire was divided into two sections. The first segment focuses on respondents' demographics (gender, age, and area of study). The second section asked the respondents to rank each of the identified library service quality factors based on how they influence student satisfaction. Precisely, the respondents were asked to rank each factor using a 5-rating scale ranging from 1–5. 1=strongly dissatisfied, 2=somewhat dissatisfied, 3=neutral, 4=somewhat satisfied, and 5=strongly satisfied. In furtherance of the analysis, a principal component analysis was performed using the SPSS 20 software. This has allowed for the identification of respondents' level of agreement on the level of effect of each library service quality factor.

Data analysis Technique

In statistics, one of the most popular multivariate approaches is principal component analysis (PCA). In order to evaluate the underlying structure of the data and the covariance/correlation structure of a group of variables, it is frequently used to reduce the dimensionality of the data. Singular value decomposition offers a straightforward method for identifying the principal components (PCs) for classical PCA. However, solutions obtained in this way could lack robustness, smoothness, and sparsity, among other desirable features. PCA is used to explore linear relationships among groups of variables. It highlights the importance and ranking of the variables as well as their sensitivity to variance (Kurita 2019, Granato, Santos, Escher, Ferreira, & Maggio 2018. Todhunter, 2015; Reiris, & Brooks 2015). The PCA analysis was used to explore linear relationships among the library quality service factors identified through the systematic literature review conducted by

this study. Analysis was conducted using SPSS (version 20) on the 21 library service quality factors, employing a direct oblimin rotation option. This was selected because it allows for a parsimonious solution by explaining the variation in the original data set using a few underlying components (Tabachnick & Fidell 2014). Oblique oblimin rotation was chosen because: (1) it works best when the purpose of the factor analysis is to acquire a number of theoretically significant factors; and (2) it makes the assumption that factors are associated more plausible and practical in the social sciences (Hair, Anderson, Tatham, & Black, 1998). Thus the conducted PCA data reduction assisted in identifying a smaller portion of the library service quality factors that explain most of the variance being observed.

Reliabilities

Factorability (Correlation among items): The Factorability Matrix shows the relationships between variables (Williams, Brown, & Onsmann, 2012). One of the most important steps in PCA analysis is the correlation matrix. As recommended by Tabachnick and Fidell (2007), the value of the correlation matrix should be above 0.3. According to Hair et al. (2010), factor loadings of 0.3 should be considered as low, loadings of 0.4 as important, and loadings of 0.5 are regarded as significant. The result suggests the majority of the items had coefficient values above 3.0. Having a significant number of correlations below this threshold could have rendered this analysis inappropriate (Mardia, Wiechers, Eltzner & Huckemann, 2022). Further, the standard deviation scores from the majority of the components look similar, suggesting either covariance or a correlation matrix can be used (Seedorff & Brown, 2021). The paper opted for correlation.

Measures of Sampling Adequacy (MSA): The MSA examines the overall indicators of correlation factors. These consist of Bartlett’s Test of Sphericity (1954) measurement and Kaiser Mayer Olkin (KMO).

Table 1 Results of KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.606
Bartlett's Test of Sphericity	Approx. Chi-Square	3172.146
	Df	210
	Sig.	0.000

If the result from the measurement of Bartlett is below 0.05, then it is significant and vice versa. Ideally, the KMO value should be larger than 0.5 or 0.6 (Zeynivandnezhad, Rashed & Kanooni, 2019).

The KMO Sampling Adequacy for this study was 0.606 as shown in Table 1. Similarly, the Bartlett's test of sphericity is above the 0.5 threshold, with $\chi^2 = 317$, $P < 0,000.$, and examination of the scree plot as well as Monte Carlo PCA for Parallel Analysis (Watkins 2006). This suggests the data suitability for factor analysis (Kamani, Haddadpour, Forsati & Mahdavi, 2022).

Communalities: Thompson (2004) posited that communalities explain the usefulness of the extracted components based on the degree of variance of measurement. Communality is equal to R^2 in the regression equation. To attain sufficient communality, component loadings should be more than 0.5 (Gable & Wolf, 1993). The scores for the 21 components of communalities range from 0.558 to 0.906 (See appendix 2).

Results

The Total Variance Explain (TVE) explains the real components that are extracted. Total Variance Explained shows the variability of each of the components in the PCA analysis. To determine the relevant variables, the eigenvalue greater than 1 is considered (Pallant, 2011). On the other hand, paging 0.8 as the threshold for eigenvalues returned 13 components as shown in appendix 3 table 2. More so, a closer look at the data generated on the table showed that five components (1 -5) contributed 81.1% of the variance, while the remaining components (6 – 21) contributed only 18.9% of the total variance. Further examination of the five residual components indicates little difference among them in terms of variance contribution, with exception of component 1 which contributed 0.81. The average of the communalities score is 0.81 and is above the baseline of 0.70 recommended by Zeynivandnezhad, Rashed, and Kanooni, (2019). Thus, the sum of the percentage explained by the five top components is greater than the 50% recommended by (Dogbegah, Owusu-Manu, and Omoteso 2011).

Table 2 Total Variance Explained (TVE)

Component	Total	Extraction Sums of Squared Loadings	
		% of Variance	Cumulative %
1	10.130	48.238	48.238
2	2.635	12.546	60.784
3	1.880	8.950	69.734
4	1.317	6.270	76.004
5	1.070	5.097	81.101

Pallant (2011) argued that the scree plot is another essential instrument necessary for determining the components to retain when computing the PCA. Figure 2 depicts the scree plot output generated from the SPSS PCA calculations for this study. From the scree plot, an elbow in the shape of the plot is shown. Thus, only components beyond this point are retained.

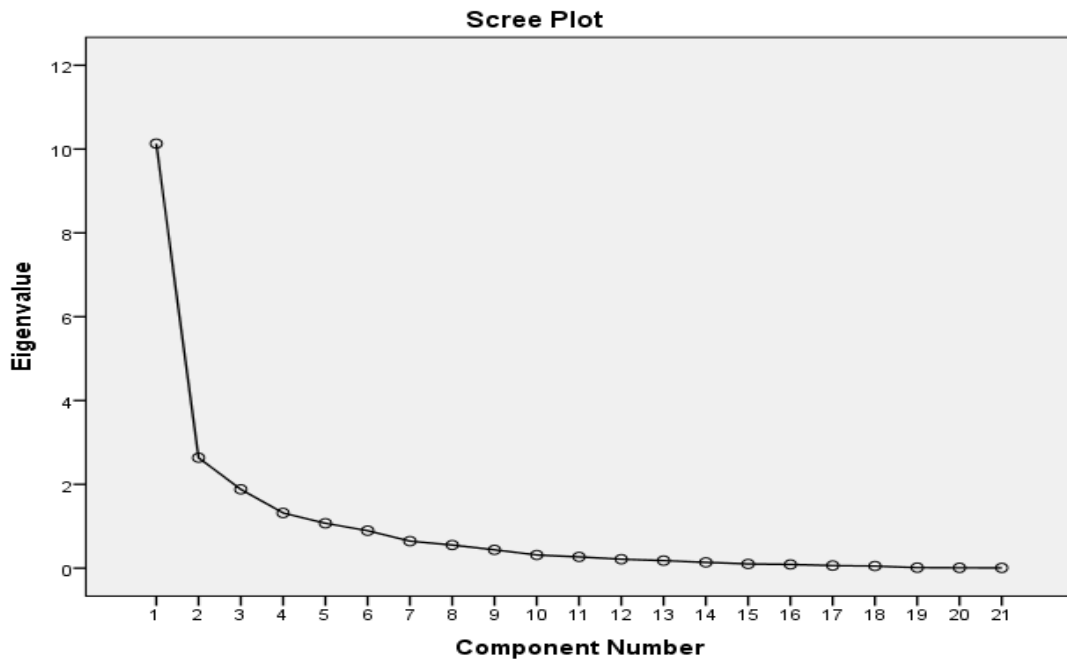


Figure 2: The Scree plot

All these affirm that the five library service quality components can be significantly used to represent the other factors (de Sá et al., 2021).

Discussion

The results of the factor analysis for the Library Service Quality affecting student satisfaction in Nigerian HEIs show that the 21 Library Service Quality (see Table 2), 5 factor components (arrangement of resources in their proper places on the shelves, library provides user education/orientation exercises (periodically), application of Expert Systems in: Reference Service, Cataloguing, Classification, Indexing, and Acquisition, standby generator (s), and easily accessible resources

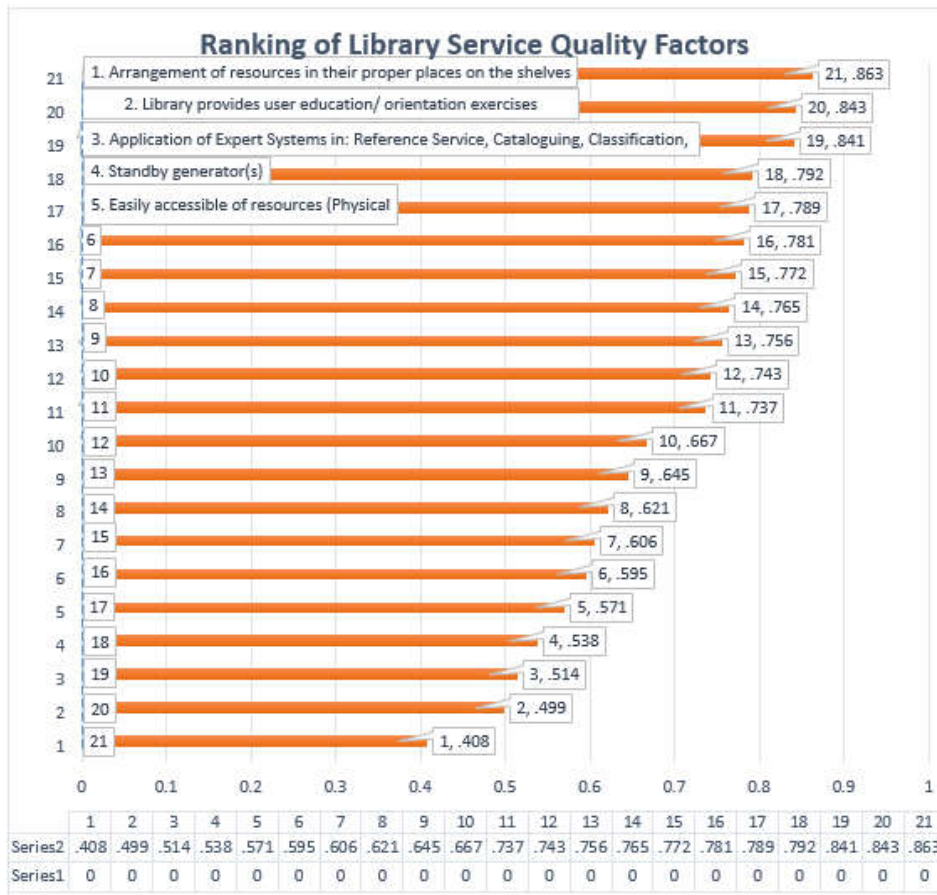


Figure 4: Loading scores for the 21 library service quality factors

Component 1 - Arranging resources on shelves in their proper locations

Resources are organized according to circulation patterns, which include the placement of walls and shelves (Hassanain & Mudhei 2006). The library offers users access to current and pertinent information in the form of books, journals, and electronic resources that are neatly organized on the shelves for simple retrieval (Mugo & Mathu 2021). The first component with the highest variance is arranging resources on shelves in their proper locations as it explained 48.23% of the observed total variance. This is higher than the total explained variance explained by the remaining 20 components. This suggests the critical role of this factor in influencing student satisfaction in Nigerian context. The ability and operation of the library staff to use the facilities available in order to bring these information resources and services to the attention of the users, the attitude of the staff in providing services, and the currency and relevancy of the information resources properly arranged on shelves are some of the requirements necessary for measuring service quality. (Adam 2017).

Component 2 – The library provides user education and orientation exercises (periodically).

In order to give users the skills they need to use the library's information resources and services the best, most effectively, and independently, user education refers to a variety of activities aimed at teaching users about information services, infrastructure, organization, collection, and search strategies. (Ogunmodede & Emeahara, 2010; Maduako, 2013). The second component with the higher variance from the PCA analysis is user education and orientation exercises. The factor has the value of 12.545% of the total observed variance explained by the reported factors. Unquestionably, a user education/orientation exercise is a crucial component of an academic library's services since it helps both students and faculty members use the library more effectively by educating and orienting them to its resources. Academic libraries may provide user education in a variety of ways, including orientations, tours, hands-on exercises, database tutorials, subject-specific library courses, etc. (Liu Lo & Itsumura, 2016). In the discipline of librarianship, phrases like "user education," "bibliographic instruction," "library instruction," "library orientation," "reading instruction," and "information literacy" are all used to describe educating library users in the independent use of library resources successfully (Bhatti 2007). User education refers to the various instruction, education, and exploration programs that libraries provide to their users in order to assist them in using the information resources and services that these libraries make available to them in an effective, efficient, and independent manner. There is no end in sight to the process of user education. The patrons are uneducated when it comes to library activities. The collection libraries need some user education on how to access information resources and services because they are so complicated (Suleiman, 2012).

Although many users lack the integrating library (IL) skills required to differentiate between a biased Web page and a refereed journal, library users need the ability to discriminate between good and bad information. Users are made aware of the library's information resources and services, and the staff's demeanor when providing such services is not overemphasized (Emeahara & Ajakaye 2022). Their official academic training includes a significant amount of library user education and orientation since these programs gave them the skills they needed to utilize the accessible library resources to their fullest potential (Liu, Lo & Itsumura 2016).

Component 3—Application of Expert Systems in Reference Service, Cataloguing, Classification, Indexing, and Acquisition:

An expert system is a computer intelligent program system with specialized knowledge and expertise, according to Zhang and Lu (2021). It employs information representation and knowledge reasoning techniques from artificial intelligence to simulate complicated problems that are often addressed by experts by simulating the problem-solving skills of human experts. It can have problem-solving abilities on par with those of an expert. Application of Expert Systems in Reference Service by the HEIs is the third component accounting for 8.950% of the variance explained from the PCA analysis. The extensive usage of expert systems in a large-scale setting has reduced costs and increased industry productivity (Zhang & Chu 2020). Expert systems have quickly advanced, and their applications have yielded enormous advantages. However, as a result of a number of issues, including the challenge of learning from expert systems, artificial intelligence hit its low point (Zhang & Lu, 2021). A knowledge system built on the current expertise of humans is known as an expert system. The first area of Artificial Intelligence (AI) study was the expert system. It is widely utilized in the petrochemical sector, geological surveys, and medical diagnosis, but libraries are now included (Gul & Bano 2019). Various knowledge systems are typically referred to as expert systems (Miotto, Wang, Wang, Jiang & Dudley 2018). Expert systems are clever computer programs built on the knowledge that employ professional information provided by human experts to replicate the thought processes of experts and use knowledge and reasoning to tackle challenging problems that can only be solved by domain experts. The expert system contains a lot of data and reasoning processes in particular units, including classification (Martinez-Mas et al., 2020), indexing (Asemi, Ko & Nowkarizi 2020), automated cataloging (Vijayakumar & Sheshadri 2019), acquisition (Tella & Ajani 2022), and general reference services (Gul & Bano 2019). It can simultaneously store, reason, and judge in addition to having a wealth of professional information and expertise (Tung 2019). The reasoning engine and knowledge base make up the core (Cai, Xu, Xu, Zhang, Guo, Zhang, 2018). The application benefit of the expert system in education is independent of time and space constraints as well as environmental and emotional constraints. Expert systems should be used in education; they are in use on a large scale, and they have well-known benefits for distance learning (Pouyanfar et al., 2018).

Component 4 – Standby generator(s):

Supporting infrastructure for the use of library contributed 6.269% out total variance explained five top factors. To address the issue of network failure as well as to lessen the difficulties encountered when accessing databases in the library, there should be a standby generator (Ivongbe, Abdulsalami & Omorogbe 2021). Due to frequent power outages, libraries in

undeveloped or emerging worlds should have a supporting infrastructure for the use of ICT, such as standby power generators or solar panels (Egbeyemi & Orjime, 2020). A backup power source is a standby generator. It is vital to have a backup power source in the library so that it can operate when the primary power source fails (Ekere & Akor 2019). A modern library is an ICT-based system that requires an appropriate power supply to operate. In order to avoid unpredictable power outages, library administration must have a fully operational standby generator (Ankrah, Agbodza & Atuase 2019). A modern library is an ICT-based system that requires an appropriate power supply to operate. In order to avoid unpredictable power outages, library administration must have a fully operational standby generator (Ankrah, Agbodza & Atuase 2019)

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Component 5: Easily accessible library resources (physical and electronic)

One of the fundamental qualities of a functional structure is that all areas may be accessed with the least amount of effort and disruption (Hassanain & Mudhei 2006). Accessible library resources is the fifth factor or component with high contribution of 5.097% out total variance explained of 81.1% by the top factors To guide patrons and shorten the time it takes for them to find what they're looking for, libraries should have signage that is visible from as many areas as possible. It is advised that signs be red on a white background. The following should be indicated on signs: emergency exits; "You are here" maps; directions to support services such as restrooms, meeting spaces, auditoriums, etc.; directions to stairs and elevators; floor numbers and contents; message boards with instructions, operating hours, and library materials (Beck, 1996). Today, collections are preserved in digital formats and are accessible by computers thanks to the development of digital libraries (Ganaie 2019; Reppen & Simpson-Vlach 2019). Access to both physical and digital libraries should be available to people with physical disabilities (Akolade, Tella, Akanbi-Ademolake, & Adisa 2015; Majinge & Mutula 2018). Additionally, libraries serve as a hub for the pooling and utilization of resources by a sizable portion of society (Igwebuike & Agbo 2015). Making libraries accessible is crucial for society's expansion and advancement (Mandal, Chakrabarti & Maji 2017; Ifijeh & Yusuf 2020).

Conclusion and Recommendations

A report on the systematic analysis discovered 21 library service quality factors influencing tertiary institution library users' satisfaction in a Nigerian context. A factor analysis with principal component analysis via SPSS was equally conducted on the 21 discovered factors. Prior to the PCA analysis, the suitability of the data for PCA analysis was conducted and found suitable. Out of the 21 library service quality factors, five of the most essential were revealed in this study. The library provides user education and orientation exercises on a regular basis; the use of Expert Systems in Reference Service; Cataloguing, Classification, Indexing, and Acquisition; standby generator(s); and easy access to resources (physical and electronic), which almost all fall under the library's modes of operation. The results are in line with previous studies suggesting the significant roles of these variables in predicting student satisfaction in Nigerian tertiary institutions (Mandalia & Parekh, 2017; Loh, Ellis, Paculdar & Wan 2017; Kao 2020; Nofsinger 2021; Adam 2017; Anene, Achebe & Uzoechina 2020; Ebijuwa 2018; Asemi, Ko & Nowkarizi 2020; Yu, Lam & Chiu 2022; Guo, Yang, Yang, Liu, Bielefeld & Tharp 2020; Li, Jiao, Zhang & Xu 2019). This study has shown the urgency of accelerating these five (5) factors by the tertiary institution's management in order for the users of libraries to be contented more. Much emphasis should be given to the factor of arrangement of resources in their proper places on the shelves, as it explains 48.2% of the variable's total variance. Indeed, the lack of a proper and appropriate mode of operation in academic libraries is one of the factors that has been reported by numerous anecdotal and empirical literature to hamper student satisfaction in tertiary institutions (Yu, Lam & Chiu 2022; Saragossi, Stevens, Scheinfeld & Koos 2020; Twum, Adams, Budu & Budu 2022; Xu & Du 2018; Tan, Chen & Yang 2017). Considering the aforementioned findings, it is further recommended that regulatory bodies like the Nigerian Universities Commission (NUC and NCCE) look closely into these service quality factors for the purpose of mandating all public tertiary institutions to pay special attention to them.

Data Availability: The data collected from respondents and SPSS coding are available from the corresponding author upon request.

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Conflicts of Interest: None

Supplementary Materials: A sample questionnaire and other PCA analysis outputs are supplied as supplementary materials herein.

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