Libraries for Tomorrow: The Use of ICT and Space Transformation in Some Academic Libraries in Ghana

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Abstract

The aim of this study was to examine transformations in academic library spaces in Ghana. A quantitative approach was adopted for this study. Data was collected using Google Forms. A total of 98 librarians from five academic libraries in Ghana, which represents less than 10% of all librarians in academic libraries in Ghana, participated in the study. The data collected was analysed using R4.0 programming software and is presented using charts and tables. Eighty-one per cent (81%) of the participants agreed that their libraries were moving from "book-centred" to "technology-supported and learning-centred" libraries engineered by emerging technologies and the changing demand of academic library users. It was found that the librarians in the study had moderate to low skills in providing advanced technological support to users in creating, capturing, editing, and sharing multimedia (video, audio, text, images) content for their research, teaching, and learning purposes. The results from the multinomial regression analysis with *p* values shows that the availability of information technology (IT) facilities, their usability and the skills of librarians were significant, revealing that they have effects on the levels of library space transformation. The capabilities of librarians should be improved from undertaking basic computing tasks to providing advanced support to their users. Stakeholders and academic library management should encourage their young librarians to further their education and engage in continuous professional development programmes. Libraries should develop strategies to secure the

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necessary funding to integrate IT facilities. The study used quantitative methods to study transformations in academic library spaces, a grey research area in Ghana.

Keywords: information technologies; learning commons; digitisation; e-resources; academic libraries; Ghana

Introduction

Emerging technologies and their use in the library and information field have revolutionised the work of librarians and the environment in which they work. The changing needs of the user have transformed the library from its traditional function of arranging and housing books and other artefacts to spaces equipped with information and communication technologies, books, and other audio-visual materials. Evolving technologies, expanding frontiers of knowledge and the changing demands of users drive change in libraries (Appiah et al. 2016). Change is an asset to libraries since they do not exist in a vacuum. Libraries must change and adapt to the changes in their environment to survive. Academic libraries most especially need to constantly change and adapt to evolving technologies, expanding frontiers of knowledge, growing interdisciplinarity as well as the changing demands of their user communities. Academic libraries are the heart of their parent institutions, and they are mandated to satisfy the information needs of their parent institutions to meet their teaching, learning and research needs. To achieve this mandate, academic libraries build their collection consistently and constantly improve their technologies.

Over the years, traditional libraries that users used to visit to access books have changed into hybrid and digital libraries where users can access books and electronic resources remotely (Acheampong and Agyemang 2021). The routine work of librarians who work in academic libraries has also changed to include the provision of online services. The environment of the academic library, which used to house huge maps, old books and materials, has also changed to include electronic resources such as computers, Online Public Access Catalogues (OPACs), electronic books, institutional repositories, and journals, among others.

He and Knee (1995) asserted that the influx of technology into librarianship calls for the development of new skills and competencies among librarians if they want to navigate the provision of electronic services to their users. More than two decades down the line, the major roles of academic libraries have now become evident in the need to provide accessible information resources—both print and electronic—and technical support to staff and students, and the need to provide reading and discussion spaces for students and "commons"—technologically enabled areas for their academic community (Oak 2016). Spaces within academic libraries have undergone major transformations. The huge card catalogues that used to be mounted in most reference service points have now been replaced with computer terminals on which users access the online catalogue. New spaces have been dedicated to the creation of computer labs and research commons

equipped with state-of-the-art technologies to enhance the teaching, learning and research of their users (Acheampong and Agyemang 2021; He and Knee 1995).

Problem Statement

As users in recent times increasingly rely on digital platforms rather than print resources, libraries need to respond to this paradigm shift to remain relevant. Academic libraries need to engage their users with information resources—both print and electronic—and maximise the use of library spaces to attract their users. Librarians must be skilled to be able to provide electronic services to their users. After about two decades of the application of information and communications technology (ICT) in academic libraries in Ghana, it has become critical to know the status and position of academic libraries in adapting to the changes brought forth by emerging technologies in the provision of library services, space transformation and the advancement of the skills of librarians.

Study Objectives

The study objectives were:

1. To investigate space transformations in academic library spaces in Ghana;
2. To assess the availability of ICTs in academic libraries in Ghana;
3. To assess the usability of ICTs in academic library services provision in Ghana; and
4. To assess the influence of the availability of ICT facilities, the usability of ICT facilities by librarians and the ICT skills of librarians on library space transformation.

Hypothesis

H1: The availability of ICT facilities, the usability of ICT facilities by librarians and the ICT skills of librarians have a significant impact on library space transformation.

Review of Related Literature

Transformations of Academic Library Spaces

Modern-day academic libraries have a new role in providing services to users. Libraries no longer represent piles of books. The general library environment has changed from an analogue to a digital format with services through library automation systems. Change in the library is mostly initiated by changes in technology (Appiah et al. 2016). Library spaces have diversified to meet the current needs of users. The proliferation of ICTs and the availability of the internet have made sitting places a common need for academic library users. These users are most often in need of seating spaces and access to internet services. Currently, most spaces where books were shelved and stored have

been rearranged and reorganised into computer-enabled spaces known as information commons or learning commons for users.

Information Commons (IC)

Information commons (IC) or learning commons (LC) are integrative and interactive spaces within academic libraries with information and communication technologies, public access computers, productivity software and access to online research databases to support the learning and research needs of students and faculty (Beagle 2010; Crockett, McDaniel, and Remy 2002; Jager 2004; Nwagwu and Matobako 2021). The inclusion of IC or LC in academic libraries around the world is a major transformation of space in academic libraries, which have offered coordinated and extended study and workspaces with an array of services ranging from traditional individual study to collaborative discussion and conference areas (Beagle 2010). Services provided by IC or LC include the provision of collaborative and individual learning spaces, reference services, virtual instructions, multimedia technologies, and printing services, among others (Beagle 2010; Bickley and Corrall 2011; Jager 2004). Studies show that the inclusion of IC/LC has several benefits for students and faculty. Interviewing student assistants at the University of Cape Town, Beagle (2010) evaluated the impact of the Knowledge Commons on teaching and learning. Findings from the study revealed that faculty were satisfied with the interactive and integrative opportunities the facility provided to their students. Students also mentioned that they benefited from the IC because the staff in the unit were always available and ready to provide them with traditional library and technological assistance. They also indicated that the cost of printing in the IC was approximately half the price of what other computer labs on campus were charging.

IT Facilities in Academic Libraries

Rapid technological progress has afforded libraries the platform to advance and expand the delivery of their services. Using internet platforms and emerging technological tools in the fields of information technology, networks, and telecommunications, libraries have developed new technologies and facilities to integrate information resources and improve their services (Yang and Li 2016) and service delivery (Chow and Bucknall 2012). Appiah et al. (2016) and Sammeta and Madara (2017) believe that growth and diversity in the information studies and library science discipline increase with technology. As users' needs and desires grow and change, libraries continue to explore new methods and systems to meet these changing needs and desires. Although Chow and Bucknall (2012) argue that libraries need not necessarily implement every emerging technology, they ought to compare the requirements of their users and respective organisations with the emerging technologies before investing in them.

Through collaborations with information technology (IT) departments, academic libraries deploy library IT facilities to serve patrons and researchers (Evans 2012). These emerging IT facilities are largely used across libraries in the United States, the

United Kingdom, some countries in Europe, and some academic libraries in Africa (Afrane 2020). The automation of library services is central to the implementation of IT facilities in academic libraries; however, there is a growing interest in the digitisation of resources and the creation of institutional repositories that are championing open access and proper research data management across academic libraries (Nnenna and Ume 2015).

The Usability of IT Facilities and Internet Connectivity in an Academic Library

Several studies have been conducted to assess the adoption and use of IT facilities in libraries. Ntui and Inyang (2015) investigated the use of ICT by 225 librarians from two universities in Nigeria. They attempted to understand the impact of information and communications technology on the delivery of services by the staff of those university libraries. Their findings showed that the use of information and communications technology was significantly and positively related to work efficiency. Similarly, a study by Husain and Nazim (2015) analysed IT tools used in some libraries in India. They found that the support rate for modern IT facilities in Indian academic libraries was very low, and a lot of the libraries still use outmoded technologies in their institutions. Mbagwu, Ozioko and Ogueri (2017), Kumar and Viladar (2010), and Aharony and Shonfeld (2015) also studied the use, impact, and difficulties associated with IT facilities in academic libraries.

Skills/Competencies of Library Staff

Academic libraries acquire IT facilities to enhance the delivery of services to patrons. Therefore, the library hopes that users can make full use of IT facilities by getting help from library staff when necessary. Mahwasane and Mudzielwana (2016) agree that library users and staff need appropriate IT skills to maximise the use of information technology in the library. Many studies have found that a lack of IT skills and competencies is the common challenge that hinders the effective use of IT facilities in libraries (Mahwasane and Mudzielwana 2016; Rathnabahu 2015; Verma 2014).

Verma (2014) mentioned that library staff need a reasonable level of expertise to recognise system challenges, provide users with efficient support, and ensure that facility services are often available. In his recommendations on the IT difficulties faced, Rathnabahu (2015) urged the provision of better and periodic IT refresher programmes for librarians. He added that these programmes must be external, internal, and as practical as possible. When it comes to users of the library, Mahwasane and Mudzielwana (2016) suggested that libraries give training on best practices in a literature search to improve users' information retrieval and information search skills. Universities should incorporate basic information literacy and information and communications technology courses into the curriculum to cultivate students' basic computer literacy skills.

Many studies have evaluated the ICT infrastructure of libraries. Moorthy and Karisiddappa (2001) found that most libraries in India use CDS/ISIS as library management software. Kasi Rao and Babu (2000) proposed that Foxpro, dBase, ORACLE, Visual Basic and local software packages are widely used in IT applications in a special library in Chennai. In addition, several studies that assess the ICT skill sets required by librarians in today's fast-changing library environment, notably Ayoku and Okafor (2015), Mathews and Pardue (2009) and Babu, Vinayagamoorthy, and Gopalakrishnan (2007), among others, have further identified IT skill sets for librarians.

Mathews and Pardue (2009) studied IT skills that employers believe are essential for librarians in today's technology-driven library environment, including web development, project management, system development, and system applications. Other listed specific IT skills include the following: knowledge of programming languages (such as Visual Basic, Java, C#, C, Structured Query Language [SQL]), networking (LAN management, network design, network security and network management), project management and web development (IT project management, production supervision and programming personnel), system development and system application (software installation, software update, maintenance, hardware installation and troubleshooting, maintenance system implementation and return).

Methodology

A quantitative research approach was adopted for this study. Using the survey design, an online questionnaire was used in the collection of data. This questionnaire was designed by the researchers and subjected to face and content validity measurements. The questionnaire consisted of five sections made up of open- and closed-ended questions. The convenient sampling technique was used in the selection of respondents for the study. The questionnaire was distributed using the WhatsApp platforms of librarians from four academic libraries in Ghana. Data collected was analysed using the R 4.1.0 software. The required packages were installed, and the data was cleaned before the analysis was conducted. To satisfy the conditions necessary for inferential statistics, the sample size was larger than 30% but less than 10% of the population of librarians in Ghana. Results from the analysis are presented using tables and charts.

Description of Data

There were 98 participants in this study with 52 variables, which represent the number of questions asked.

Biographical Data

Fifty-four (55%) of the respondents were males and 44 (45%) were females. Sixty-seven (68%) of these respondents were from the University of Ghana; 10 (10%) were from Kwame Nkrumah University of Science and Technology, and four (4%) each were from the University for Development Studies, Valley View University and the University of

Education Winneba, Kumasi Campus. Three (3%) respondents each were also from the Central University, the Methodist University College, and the University of Cape Coast.

The ages of the respondents were categorised into young adults (25–40 years) and adults (41–60 years). The bar chart in Figure 1 shows that 81 (83%) of the respondents were young adults while 17 (17%) were adults. Amongst the young adults aged between 25–40 years, 25 (31%) were in the senior staff rank while the remaining 56 (69%) were junior staff. Of the adults aged 41–60 years, 10 (59%) were senior staff and seven (41%) were junior staff, as indicated in Figure 1.

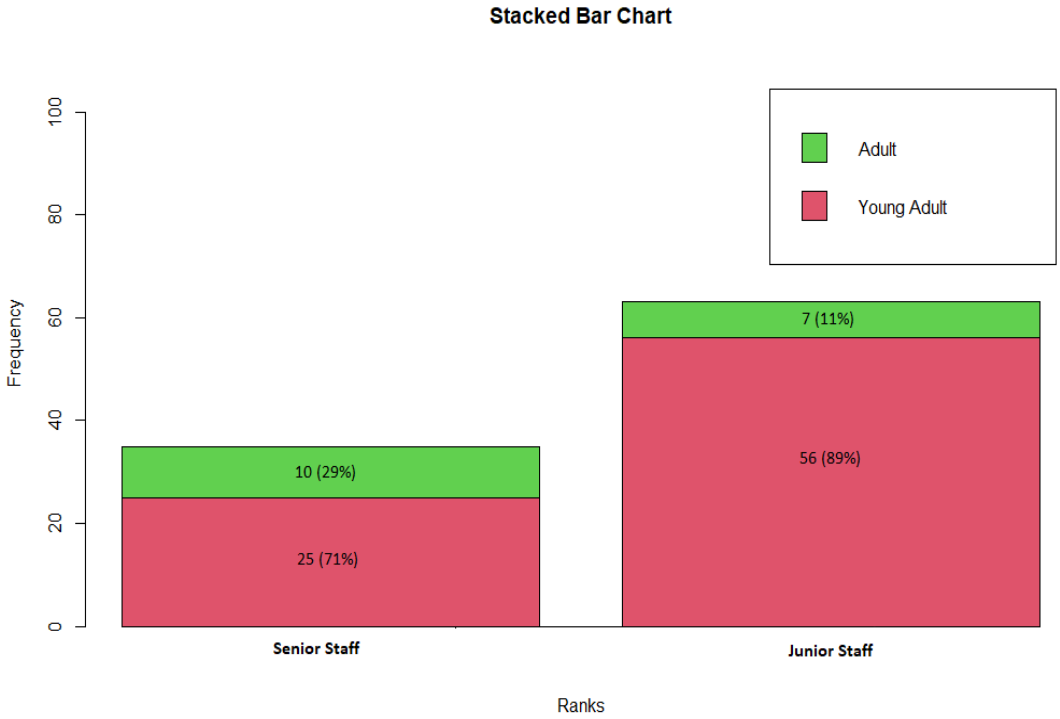

Figure 1: Demographic characteristics of respondents

Relationship between Age and Rank

At a 95% confidence level, the chi square test displayed a *p* value greater than 0.05, which indicates that the respondents' ranks are not dependent on their age. To answer the first objective, the level of transformation of academic library spaces in Ghana was investigated. The researchers asked several questions to which the respondents needed to indicate their agreement on a five-point Likert scale. The responses revealed that 79 (81%) of the staff concurred that libraries are moving from "book-centred" to a "technology-supported" and "learning-centred" paradigm of library space; 92 (94%) agreed that libraries have traditionally been thought of as places for quiet independent study and that there is an increasing demand for social spaces. The responses also

revealed that 94 (96%) of the staff believe that there is high student adoption of information technologies and 84 (86%) believe that most students study in the library because they have all the resources at hand regardless of what they are doing (revising, coursework, research).

Availability and Use of ICT Facilities in Service Delivery

The availability of IT facilities used in academic libraries in Ghana was also assessed. To assess this objective, researchers asked several questions on the availability and use of IT facilities in service delivery to which the respondents were requested to indicate their level of agreement on a five-point Likert scale. The responses revealed that most of the staff agreed that in terms of using IT facilities, users were provided with their needed services. Sixty-six (67%) participants believe their libraries provide circulation services via the internet. Eighty-three (85%) of the respondents agreed that as part of efforts to improve user access to information in their libraries, projects, dissertations and theses were digitised. Sixty-five (66%) also agreed that users' literature searches and access to academic databases/e-journals for scholarly information using mobile devices were automated.

When asked about the possibility of communicating with librarians remotely, 58 (59%) respondents agreed that online reference enquiry services, including live chat with a librarian remotely for assistance, were available. It was also evident from the study that the academic libraries provided online library instructional guides and virtual tours as 62 (63%) respondents agreed with this statement.

Serving as the pivot to the achievement of teaching, learning and research in their parent institutions, respondents were asked if their academic libraries served as a gateway for study, learning and research. Eighty-eight (90%) of the respondents agreed that their libraries served as a gateway for study, learning and research. Eighty-eight (90%) of the respondents agreed that this was achieved by providing access to an adequate number of computers to support study/research in their libraries. Also, 73 (74%) agreed that their libraries subscribed and provided access to an adequate variety of electronic resources.

In assessing the skills of librarians in the usage of IT facilities, the responses showed that 94 (96%) of the staff are skilled in using library tools such as search engines, OPAC, and OCLC FirstSearch; 92 (94%) can adequately formulate search queries; 81 (83%) can easily connect laptops to the library's network and can print to library printers, and 65 (66%) are able to provide desktop support services to all units of the division of libraries faculty and staff. The responses to other statements concerning empowering faculty and scholars in creating, capturing, editing and sharing multimedia (video, audio, text, images) content in support of their research, teaching and learning, managing the libraries' server infrastructure, and managing a fleet of campus and cloud-based servers that provide 24/7 global access to electronic library services showed less than 50% agreement rate.

Finally, the researchers assessed the effects of the availability of IT facilities, their usability by librarians, and the skills of librarians on library space transformation. Using the multinomial regression analysis in R programming resulted in the table below.

Table 1: Summarised multinomial regression model

Dependent variable	**Spacing**
Availability2	$1.101^{**}(0.543)$
Availability3	0.767 (0.487)
Availability4	0.749 (0.480)
Availability5	$1.681^{***}(0.478)$
Skills2	1.472^{***} (0.380)
Skills3	0.374 (0.246)
Skills4	0.357 (0.233)
Skills5	0.216 (0.243)
Observations	784
Log Likelihood	−912.891
Note:	*p<0.1; **p<0.05; ***p<0.01

The results of Table 1 show that there is a significant association between the availability of IT facilities and the skills of librarians. Also, the library space transformation is more likely to receive positive responses when the availability of IT facilities and the skills of librarians receive positive responses. We also saw an accuracy level of 52% of the model in Table 1, which is a fair model to predict library space transformation given the various information technology initiatives (availability and skills).

Results and Discussions

Biographic Data

The study explored the transformation of academic library spaces in Ghana by examining access to and availability of IT facilities and internet connectivity in academic libraries in Ghana, and the usability of IT facilities in academic library services provision in Ghana.

More males than females participated in the study. Of the total number of librarians who participated in the study, University of Ghana (UG) recorded the highest number. This can be attributed to the large number of librarians who work under the University of Ghana Library System. An interesting revelation from the study was the large number of young adult librarians aged between 25–40 years employed in the various libraries that participated in the study. Of this group of young adults, 31% were in the senior staff category, with the remaining 56% in the junior staff category. In establishing a relationship between age and rank, at a 95% confidence level the chi square test displayed a *p* value greater than 0.05, which indicates that the ranks of the respondents are not dependent on their age. As most of these young librarians are in the junior librarian rank, it provides an opportunity for academic libraries to engage their staff in IT training programmes both formally and informally to be able to assist the demand of students in the present technologically charged academic environment, since young people tend to be technologically more competent than their older counterparts.

Level of Transformation of Library Spaces

The study revealed that a majority (81%) of the participants agreed that their libraries are moving from "book-centred" to a "technology-supported" and "learning-centred" environment. This transformation in library space is engineered by emerging technology and the changing demands of academic library users. This finding corroborates findings by Appiah et al. (2016), Beagle (2010), and Nwagwu and Matobako (2021). It was also revealed that there is a high adoption of information technologies by students and their heightened use of libraries is attributable to the availability of resources and facilities. The emergence of the paradigm of the library as "place" (Steiner and Holley 2009), which initiated the information commons and learning commons, has created interactive and integrated spaces within academic libraries, commonly known as one-stop-shops by students (Jager 2004), where users can access all the resources and services needed for their learning and research purposes.

The Availability of ICT in Service Delivery

Assessing the availability and use of IT facilities in delivering services to users, the study revealed that 67% of participants made use of the internet to provide circulation services. This makes it possible for students to access the Online Public Access Catalogue (OPAC) of their libraries to know the holdings of their libraries (IFLA 2017). It was further revealed that increased access to digitised projects, dissertations and

theses is available in academic libraries. This has been made possible through the digitisation and automation of library services and resources (Evans 2012; Sammeta and Madara 2017). Moreover, the automation of users' literature searches and accessing academic databases or e-journals for scholarly information using mobile devices make it possible for librarians to provide readily specific information to meet the individual needs of users through the selective dissemination of information.

The use of online reference enquiry services, a feature that involves the use of the live-chat platforms, makes it possible for users to interact with other users remotely. The study revealed that the use of this service made it possible for the participants' library users to communicate with them without being physically present in the library. It was also revealed that the provision of e-tutorials, online library instructional guides and virtual tours is beneficial to users (Beagle 2010; Bickley and Corrall 2011).

Finally, the study revealed that librarians view academic libraries as a gateway for study, learning and research. This is pivoted on the introduction of technology and the transformation of library spaces to include information commons or learning commons, which are spaces that provide access to an adequate number of computers and other technologies, and a variety of electronic resources to support the study or research of users in their libraries.

Assessment of Skill Sets in the Use of ICT in Service Delivery

The skill set of librarians should enable them to use available IT facilities in the provision of academic library services in the current technology-driven library environment. The study revealed that 96% of the study participants were good at using library tools such as search engines, OPAC, and OCLC FirstSearch, among others, and were adept at formulating search queries. The study also revealed that most librarians were able to perform basic computing tasks such as connecting laptops to the library's network, providing printing services, and providing desktop support services. The provision of these basic computing tasks is essential for the library users' learning, research and assignment purposes as students currently call the information commons a one-stop-shop (Jager 2004).

However, the study revealed moderate to low skills among librarians in terms of creating, capturing, editing, and sharing multimedia (video, audio, text, images) content in support of the research, teaching and learning of faculty. The skills required for the management of the libraries' server infrastructure and the management of a fleet of campus and cloud-based servers that provide 24/7 global access to electronic library services were low. This lack of advanced technological skills is not surprising when one considers the knowledge and skills acquired by the traditional librarian. The training librarians received until recently did not include advanced knowledge in computing. It is therefore necessary for librarians to acquire professional IT training and collaborate with the IT units of their universities to fill this knowledge and skills gap (Beagle 2010; Jager 2004).

The Effects of the Availability of ICT, Their Usability by Librarians, and the Skills of Librarians on Library Space Transformation

The results from the multinomial regression analysis taking into consideration the *p* values showed that the availability of IT facilities, their usability and the skills of librarians were significant. Thus, they have an effect on the levels of library space transformation. This reveals that the availability of IT facilities, their usability and the skills of librarians influence the levels of library space transformation in academic libraries.

Moreover, there was an accuracy level of 52%, which is an adequate model to predict the level of library space transformation given the various information technology initiatives (usability, skills, and availability). In other words, the respondents' responses to questions on the usability, availability and skills influenced their subsequent responses to the questions on library space. This indicates that once the technologies are available and librarians have the requisite skills to use them, they will readily embrace transformations in their library spaces (Appiah et al. 2016; Beagle 2010; Jager 2004; Nwagwu and Matobako 2021).

Recommendations

The management of academic libraries should ensure that the e-capabilities of librarians in their institutions are improved from undertaking basic computing tasks to providing advanced support to their users. This can be achieved through formal education and informal means such as seminars and workshops and on-the-job training.

The formal education given to librarians in the library school should be revised to include some information technology component to make it easier for librarians to cope with changing technologies. The study revealed that many librarians were aged between 25–40 years and were at the senior and junior ranks in their institutions. This means that these librarians will need to further their education to advance in their organisational ranks. Through continuous profession development, new and improved skills will be acquired to enable them to provide satisfactory services to their users.

Stakeholders, academic libraries and institutions of higher learning should encourage their young librarians to further their education and engage in continuous professional development through avenues such as scholarships and study leave with pay, among other incentives.

The study revealed a lack of advanced technological skills among librarians needed to provide advanced services and assistance to their users in academic libraries. It is recommended that librarians in academic libraries form strong collaborations with staff of their IT departments. The possibility of housing some of these IT staff in the library will make it possible for them to provide prompt services and assistance to the users when necessary.

The successful implementation and use of IT facilities largely depend on the availability of funds to procure and train librarians to effectively utilise them. Libraries need to develop strategies to secure the necessary funding they require to implement IT facilities. They may do so through collaborations and partnerships with appropriate stakeholders; they may write convincing proposals to secure these funds from both international and local agencies. Libraries also need to work hard to convince their institutional management and governments to invest in them to enable them to provide quality services and spaces for effective support to teaching and learning.

Conclusion

In the wake of the exponential advancements in technology and the changing needs of users, space transformation in academic libraries will continue to occur. These changes also provide academic libraries with better and improved ways of making their resources available and accessible to users for their teaching, learning and research purposes. The availability of IT facilities, integrative and interactive learning commons, and the development of the technology skill sets of librarians and their collaborations with the IT departments of their parent institutions will enable them to provide advanced IT support to their users.

Limitations and Future Research

Although this study is important for the provision of satisfactory library services in light of the changing landscape of library services provision and emerging technologies, the use of convenient sampling techniques coupled with the distribution of the questionnaires using a WhatsApp platform makes it difficult to generalise the findings of the study.

A study of the space transformations and the use of ICT facilities in other universities not included in this study will reveal ongoing space transformations in academic libraries in a bid to provide distinctive services in academic libraries.

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