An Assessment of the Effect of the Fourth Industrial Revolution on Library Services: A Case of Academic Libraries in Lusaka Province

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ABSTRACT

Objective: To assess library staff's skills and training requirements in response to the Fourth Industrial Revolution.

Methods: The methodology adopted was a descriptive survey design was employed. The study population consisted of librarians from all academic libraries in both public and private universities in Lusaka Province. The study employed a stratified random sampling technique and data was collected using a standard questionnaire with closed-ended questions and analysed using descriptive statistics.

Results: The study underscored the evolving technological landscape in library management, highlighting varying levels of proficiency and confidence among respondents in using digital tools and advanced technologies. While most respondents demonstrated confidence in digital library systems (85%) and familiarity with data analytics tools (70.7%), gaps persisted in advanced areas such as AI-based systems, cloud services, and VR/AR integration, with significant portions reporting only moderate or limited proficiency. Consistent with previous studies, the findings emphasised the importance of targeted training and professional development to bridge these gaps, particularly in emerging Fourth Industrial Revolution (4IR) technologies. Respondents identified digital literacy, AI, and data analytics as priority training areas, aligning with the demand for enhanced technological competencies. By fostering continuous learning and institutional support, libraries could empower staff to adapt to technological advancements, ensuring innovative and effective service delivery in the digital era.

Conclusion: The study revealed a generally positive trend in confidence and familiarity with digital and emerging technologies among library staff, though varying levels of proficiency highlighted areas for growth. Respondents exhibited strong confidence in using digital library management systems, with the majority feeling confident or very confident. Similarly, familiarity with data analytics tools and AI-based systems showed promise, with many respondents reporting comfort and a reasonable level of understanding.

Keywords: Fourth Industrial Revolution, Academic libraries, Artificial intelligence, Infrastructure, and Institutional repositories

INTRODUCTION

The Fourth Industrial Revolution (4IR) represents a transformative era characterised by the integration of digital, physical, and biological technologies, significantly altering the operational landscape of libraries. Academic libraries, especially in Lusaka Province, must adapt to these changes to remain relevant and efficient. This shift necessitates an assessment of library staff skills and training needs to bridge the gap between traditional library practices and emerging technological demands (Schwab, 2016).

Notably, library staff in Lusaka Province often possess foundational skills in cataloguing, classification, and traditional reference services. However, the advent of 4IR technologies, such as artificial intelligence, machine learning, and big data analytics, has revealed significant skill gaps (Ibegbulam, Olowonubi, and Fatounde, 2023). For instance, many library professionals lack proficiency in data management, digital content curation,

and programming, which are increasingly integral to library operations. Mvula and Nkunika (2022) add that students at the University of Zambia increasingly rely on electronic resources for academic work, yet many face challenges in navigating and utilising these platforms effectively, revealing a parallel need for digital literacy among both users and library personnel in a rapidly evolving technological environment.

The technological advancements of 4IR demand a new skill set among library staff. These include digital literacy, information management, and an understanding of blockchain for record management (Ganesamoorthy and Selvakamal, 2025). Furthermore, proficiency in using digital tools like library automation systems, digital repositories, and metadata standards is critical for supporting the academic community effectively. Ganesamoorthy, and Selvakamal also (2024) postulates that training programs tailored to 4IR competencies are essential for equipping staff with the requisite skills. However, academic libraries in Lusaka Province face constraints such as limited funding, inadequate infrastructure, and resistance to change among staff (Kasonde and Kakana, 2020). These challenges underscore the need for strategic interventions to ensure effective upskilling.

Kuyela (2025) revealed that the 4IR has also brought about a shift in knowledge management, from strategies focused solely on dissemination to those that promote access, knowledge sharing, and creative innovations. Academic libraries are expected to keep pace with changes in technology, which are often in a state of flux, and the constantly changing patterns of user behaviour and demand. In a similar vein, Chigwada and Kamble (2021) noted that user expectations regarding library services have shifted. Patrons now demand seamless access to a wide range of digital resources, interactive learning platforms, and personalised assistance from librarians. Libraries must align their offerings with these changing expectations to attract and retain users in an increasingly competitive information landscape.

For instance, academic libraries in South Africa have successfully implemented programs on digital curation and big data analytics, resulting in enhanced service delivery (Kuyela, 2025). Academic libraries in Lusaka Province can draw lessons from such initiatives to design their training models. The Fourth Industrial Revolution presents both opportunities and challenges for academic libraries. By assessing current skill levels and addressing training needs, libraries can equip their staff with the capabilities required to navigate this transformative era. Strategic investments in training, institutional support, and professional development will ensure that library staff remain relevant and continue to meet the evolving needs of the academic community

LITERATURE REVIEW

Understanding Emerging Technologies

Library staff need to be proficient in understanding emerging technologies such as artificial intelligence, machine learning, blockchain, and augmented reality, as these technologies are increasingly shaping the way information is accessed, organized, and disseminated (Ganesamoorthy and Selvakamal, 2024). Familiarity with these technologies enables librarians to effectively adapt library services and resources to meet the evolving needs of patrons.Koekemoer and Von Solms (2021) noted that the 4IR offers new technological solutions that can address the dilemmas in basic service delivery. However, these solutions might be limited by the access people have to the technology required to acquire the said services.

According to Fatouh (2024) the use of current tools like library management software is revolutionising the way technologies are applied in libraries. With development based on three key pillars digital, biological technology, and physics the information and library business has also entered the fourth industrial revolution (also known as Industrial Revolution 4.0). Specifically, the fundamental components of digital development are things like artificial intelligence (AI), the internet of things (IoT), and big data (big data), all of which have a direct bearing on the information and library sector. This is anticipated to significantly alter how consumers are provided with information (Garoufallou, and Gaitanou, 2021).

Data Literacy

With the growth of data in the digital age, library workers must have good data literacy abilities to successfully traverse and analyse huge databases (Ebiefung, 2023). This involves understanding data sources, data formats, data modification techniques, and data visualization tools, all of which are required to provide data-driven services and aid clients with their research. According to Schwab (2016), change will not wait for us; instead, business leaders, educators, and governments must all take proactive steps to up skill and retrain people so that everyone can profit from the 4IR. As a result, the obligation to develop the models and settings to allow it to occur must be accepted, or else we will consume a generation with a lack of skills for the new demands of the labour market and that turns out to be a huge problem to society. Ayinde (2020) encourages information professionals to build up their skills and knowledge regarding 4IR technologies to survive even though the extent to which these innovations are adopted is likely to differ from one library to another

Tamhane (2016) asserts that the modern information environment necessitates that librarians themselves gain knowledge and proficiency, particularly in the areas of electronic publishing, digital information management, modern information and communication technologies, and knowledge management. Put another way, for librarians in university libraries to stay relevant, they must develop ICT-based skills. According to a study done by the Associations and Institutions (2021), libraries must embrace new technologies to preserve information in all formats, offer reliable and efficient support for political and social engagement, and provide universal access to information and scholarly works.

Digital Preservation

Digital preservation in libraries is an important effort that ensures the long-term accessibility and usage of digital items for scholarly research and education. As the volume of born-digital and digitised content grows fast, libraries must preserve these materials in a variety of formats, such as text documents, photographs, audio-visual recordings, databases, and software programs. The purpose of digital preservation is to reduce the hazards of format obsolescence, medium deterioration, and technological changes that may render digital content inaccessible or unusable over time (Kuyela, 2025).

According to Masenya, and Ngulube (2019), one of the essential ideas that guide digital preservation activities in libraries is the adoption of standards and best practices for digital collection management and care. Standards such as the Open Archival Information System (OAIS) reference model give a conceptual framework for establishing reliable digital archives capable of conserving and giving long-term access to digital content (ISO 14721:2012). Libraries can assure interoperability, sustainability, and authenticity in digital preservation activities by following established standards (Subaveerapandiyan 2023).

Information Privacy and Security

Information privacy and security are critical concerns in libraries, where large volumes of sensitive data, including student records, research findings, and intellectual property, are stored and accessed (Barve, 2019). Libraries serve as custodians of vast repositories of information, making them prime targets for malicious actors seeking to exploit vulnerabilities for various purposes, including identity theft, financial fraud, and corporate espionage (Sahay 2024). Therefore, libraries must implement robust privacy and security measures to safeguard the confidentiality, integrity, and availability of their digital assets.

Furthermore, libraries must strike a balance between protecting patron privacy and implementing data analytics to improve services and resource allocation. While data-driven decision-making can improve user experiences and optimise library operations, it also raises questions regarding user monitoring and profiling (Singh, 2024). To solve this issue, libraries should implement transparent privacy rules, get express agreement for data collection and processing, and anonymise or pseudonymise data whenever possible to safeguard patron identities.

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Digital Literacy Instruction

Digital literacy education in libraries is becoming increasingly important in today's information-driven culture. With the expansion of digital resources and the prominence of online information, students must learn how to access, assess, and successfully use digital information (Sharma, 2029). Libraries should play an important role in promoting this growth by offering digital literacy teaching targeted to the specific needs of their user groups. Allegri (1990) define digital literacy as the ability to locate, analyse, and ethically use digital information, as well as grasp the social and cultural ramifications of technology. Thus, digital literacy instruction in academic libraries attempts to equip students to be critical consumers and creators of digital content, rather than simply teaching technical skills; it aims to empower students to become critical consumers and creators of digital content.

A study conducted at LIUTEBM University revealed that many students lacked adequate digital literacy skills, often struggling to distinguish credible online sources from unreliable ones when conducting academic research. Mvula (2023) emphasized that while students increasingly relied on digital platforms for accessing academic materials, their limited competencies in evaluating and utilizing digital information hindered effective learning.

Webber, and Johnston, (2017) stated that one strategy for digital literacy instruction in academic libraries is to incorporate it into information literacy programs. The ability to identify an information need, locate and assess information, and use it successfully serves as the foundation for developing digital literacy skills (Association of College and Research Libraries, 2015). Libraries can ensure that students learn the competencies needed to navigate both the print and digital information landscapes by incorporating digital literacy education into information literacy initiatives. For example, courses on evaluating internet sources or adding multimedia aspects to research projects can help students improve their digital literacy skills within the larger framework of information literacy.

Collaboration and Networking

In today's library environment, networking and collaboration are essential for innovation, resource sharing, and improved services. According to Srivastava (2015), to increase their capacity and satisfy the changing requirements of their patrons, libraries are working more and more cooperatively with other organizations, consortia, and outside partners. These partnerships frequently entail cooperative efforts to establish collections, interlibrary loans, and shared technological infrastructure, which allows libraries to maximize resources while lowering expenses (Prakash, and Janardhana, 2017). Academic libraries can improve their ability to assist teaching, learning, and research within their communities by utilizing their combined knowledge and resources.

Consortia are a significant example of library collaboration, bringing together multiple institutions to pursue common aims and address shared difficulties (Hollister, 2017). Consortia provide resource pooling, cooperative purchasing, and collaborative projects that would be difficult for individual libraries to undertake independently. For example, the Association of Research Libraries (ARL) in the United State is a network of leading research libraries that work together on programs such as scholarly communication, digital preservation, and diversity, equity, and inclusion (Kuyela, 2025). Libraries can leverage consortia alliances to negotiate favourable licensing terms for electronic resources, improve access to specialist collections, and develop innovative services that benefit their unique user population

Continuous Learning and Adaptability

Leckie (2005) found that continuous learning and adaptability are essential for libraries to succeed in the rapidly changing landscape of information dissemination and scholarly communication. As technology innovations transform research methodology and user expectations, libraries must stay adaptable to satisfy their users' different requirements. Vázquez-Martínez et al. (2019) also highlight the importance of continual learning for librarians to keep up with new trends and technologies. This emphasises the critical role of

librarians as information professionals who must constantly upgrade their skills and expertise to effectively serve the academic community.

Furthermore, adaptability is essential for academic libraries in responding to changing user behaviours and preferences. With the rise of digital resources and online learning platforms, libraries must change their services and collections to meet the changing demands of students and staff. Jain (2008).) emphasise the relevance of user-centered approaches in library services, arguing for adaptability and responsiveness to user feedback. This highlights the importance for academic libraries to embrace adaptation as a key principle in order to remain relevant and effective in supporting scholarly activities.

Ethical and Social Implications

In today's academic library landscape, ethical and social consequences have a significant impact on policies, procedures, and services. One important aspect is access to information. Providing equitable access to resources for all users, regardless of socioeconomic status or identity, is a core ethical consideration (Winston and Gibbons, 2019). Libraries must balance offering access to a diverse range of perspectives while ensuring that items are not damaging or discriminatory. This entails carefully selecting and curating collections to encourage diversity and inclusivity while adhering to ethical norms.

Akussah and Asante (2019), stated that privacy and confidentiality are paramount in library services. Users often rely on libraries as safe spaces to explore sensitive topics, conduct research, and access information without fear of surveillance or judgment. Librarians must uphold strict confidentiality policies to safeguard user privacy, particularly in the digital realm where data collection and monitoring are prevalent (Sturges, and Davies, 2003). Adhering to professional ethical codes, such as those outlined by the American Library Association, ensures that users can trust libraries as reliable guardians of their information.

Objectives

This study was conducted to assess library staff's skills and training requirements in response to the Fourth Industrial Revolution: Case of academic libraries in Lusaka Province.

METHODS

To assess library staff's skills and training requirements in response to the Fourth Industrial Revolution, a descriptive survey design was employed. The study population consisted of librarians from all academic libraries in both public and private universities in Lusaka Province that were registered with the Higher Education Authority Act of 2021 (HEA). The study employed a stratified random sampling technique to determine both the sample size and the respondents who would represent the entire population. Data was collected using a standard questionnaire with closed-ended questions and analysed using descriptive statistics.

RESULTS

Profile of respondents

Gender Distribution

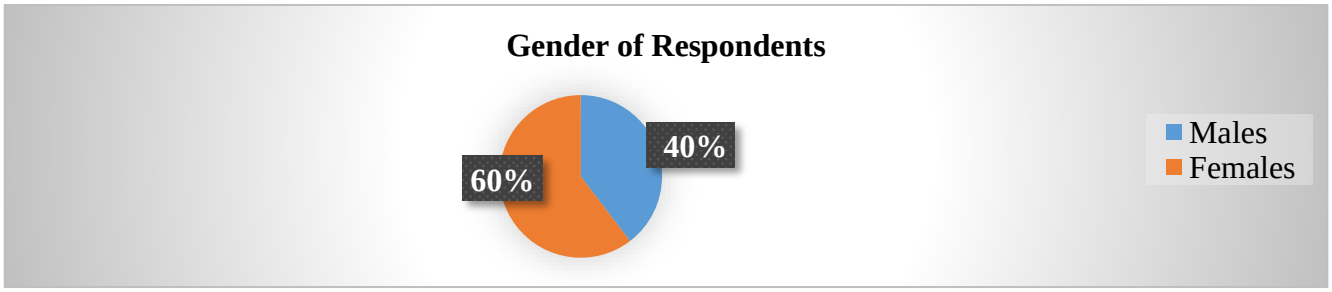

Figure 1: Gender of Respondents

To assess the proportion of male and female academic librarians in selected universities, the frequency of gender was calculated in Figure 1 above. The study revealed that 63 (60%) were female and 43 (40%) were male. These findings highlighted that female librarians were more prevalent in this academic setting.

Working experience

As depicted in Figure 2 below, respondents were asked to indicate their years of work experience. A total of 38 respondents (36%) reported having 9 years or more, 8 (8%) indicated 5–8 years, 37 (35%) reported 1–4 years, and 23 (22%) stated less than 1 year. This distribution suggested a workforce skewed towards experienced professionals, while still accommodating a notable number of less experienced individuals.

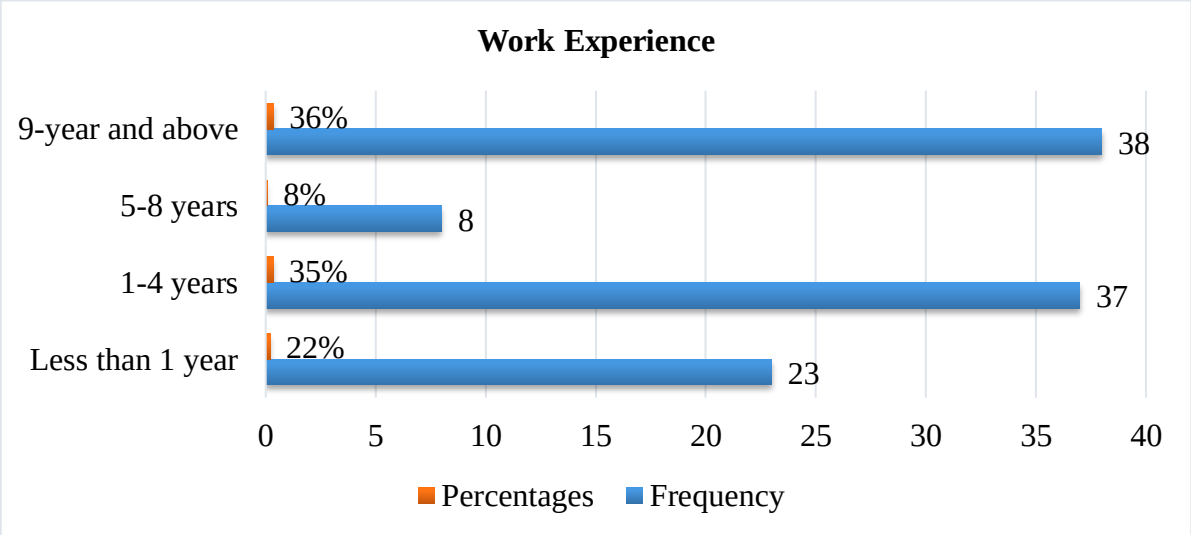

Figure 2: Work experience

Library staff's skills and training requirements in response to the Fourth Industrial Revolution

Confident in using digital library management systems

As demonstrated in Figure 3 below, the study revealed a generally positive outlook among respondents regarding their confidence in using digital library management systems. A total of 46 respondents (43%) expressed confidence, and 44 (42%) indicated they were very confident. Meanwhile, 13 (12%) were somewhat confident, and a small percentage, 3 (3%), were not confident. This distribution indicated that while most users were comfortable with digital library management systems, a minority could have benefited from additional training or support to enhance their proficiency.

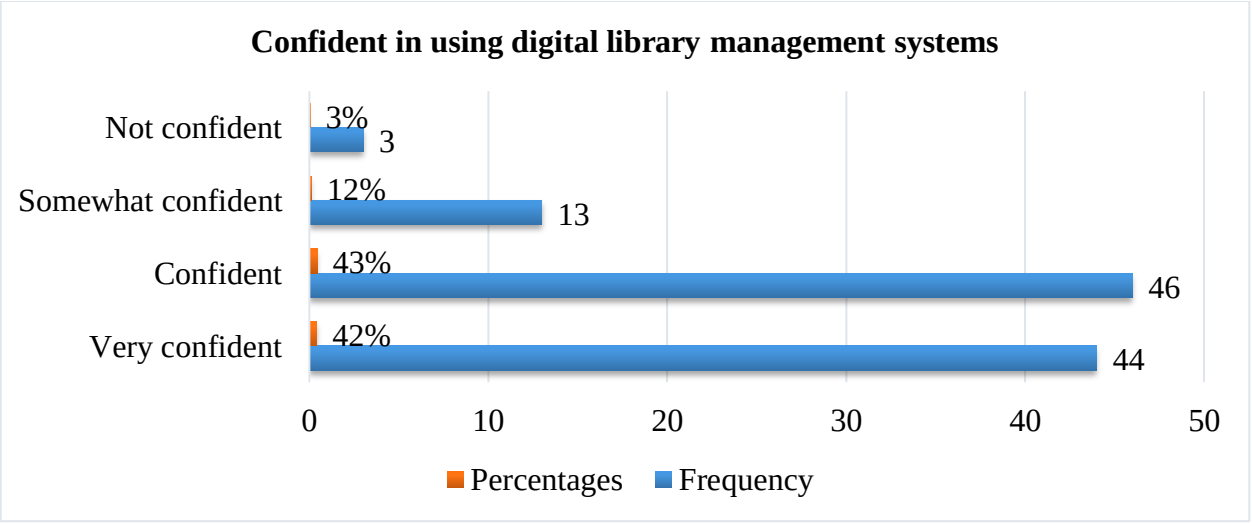

Figure 3: Confident in using digital library management systems

Familiar with data analytics tools for library management

In Table 1 below, the respondents were asked about their familiarity with data analytics tools for library management. The study revealed that 31 respondents (29.2%) had reported being very familiar, 44 (41.5%) were familiar, 19 (17.9%) were somewhat familiar, and 12 (11.3%) were not familiar. This suggested that a significant portion of the respondents had a solid understanding of these tools, which could have been beneficial for library management practices. However, there was still a notable proportion who were either somewhat familiar or not familiar.

Table 1: Familiar with data analytics tools for library management

		Frequency	Percent
Valid	Very familiar	31	29.2
	Familiar	44	41.5
	Somewhat familiar	19	17.9
	Not familiar	12	11.3
	Total	**106**	**100.0%**

Source: Formulated by Author (2024)

Rating the ability to teach patrons how to use new digital resources

According to the results presented in Figure 4 below, respondents were asked to rate their ability to teach patrons how to use new digital resources. The study revealed that the majority, 54 respondents (51%), rated their ability as good, while 32 (30%) rated it as excellent. Fourteen (13%) rated their ability as fair, and three (3%) rated it as poor. This suggested that most respondents possessed satisfactory proficiency in guiding patrons through digital tools, which was crucial in the increasingly technology-driven environment.

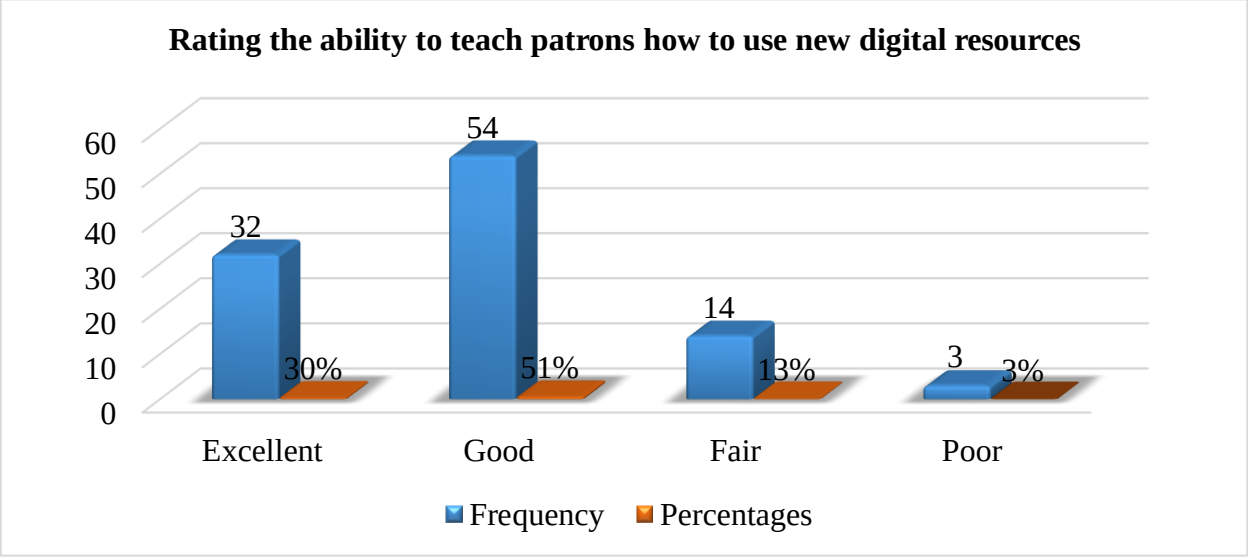

Figure 4: Rating the ability to teach patrons how to use new digital resources

Level of comfort when using artificial intelligence (AI)-based library systems

From the results as presented in Table 2, respondents were asked about their level of comfort with using artificial intelligence (AI)-based library systems. The study found that 29 respondents (27.4%) reported very comfortable, the majority, 55 (51.9%), said comfortable, 18 (17%) indicted somewhat comfortable, and 4 (3.8%) were not comfortable. Overall, the results suggested a promising acceptance of artificial intelligence in library settings but highlighted an opportunity to address minor concerns among less comfortable users.

Table 2: Level of comfort when using AI-based library systems

		Frequency	Percent
Valid	Very comfortable	29	27.4
	Comfortable	55	51.9
	Somewhat comfortable	18	17
	Not comfortable	4	3.8
	Total	**106**	**100.0**

Source: Formulated by Author (2024)

Proficient in using cloud-based library services and integrating virtual reality (VR) or augmented reality (AR) into library services

Table 3: Proficient in cloud-based library services and integrating virtual reality (VR) or augmented reality (AR) into library services

		Frequency	Percent
Valid	Very proficient	12	11.3
	Proficient	28	26.4
	Somewhat proficient	43	40.6
	Not proficient	23	21.7
	Total	**106**	**100.0**

Source: Formulated by Author (2024)

As seen in Table 3 above, the respondents were asked about their proficiency in using cloud-based library services and integrating virtual reality (VR) or augmented reality (AR) into library services. The study revealed that 12 respondents (11.3%) indicated very proficient, 28 (26.4%) were proficient, the majority, 43 (40.6%), had been somewhat proficient, and 23 (21.7%) were not proficient. The findings suggested that while a notable portion of respondents were proficient in using cloud-based library services and integrating VR/AR technologies, the majority still possessed only a moderate level of proficiency.

Types of training most beneficial for library staff in a technologically evolving environment

According to Table 4, respondents were asked about the type of training they considered most beneficial for library staff in a technologically evolving environment. The majority, 43 respondents (40.6%), indicated that digital literacy and technology proficiency were the most beneficial. This was followed by 29 (27.4%) who preferred training in artificial intelligence and machine learning, 21 (19.8%) who chose data management and analytics, and 19 (12.3%) who selected digital content curation and preservation. Overall, these findings suggested that library staff prioritised training that not only kept pace with technological evolution but also positioned them to leverage these tools for improved service delivery.

Table 4: Types of training most beneficial for library staff in a technologically evolving environment

		Frequency	Percent
Valid	Digital literacy and technology proficiency	43	40.6
	Artificial intelligence and machine learning	29	27.4
	Data management and analytics	21	19.8
	Digital content curation and preservation	13	12.3
	Total	**106**	**100.0**

Source: Formulated by Author (2024)

Rating the current skills levels of staff in handling Fourth Industrial Revolution technologies

In Table 5 below, respondents were asked to rate the current skill level of staff in handling Fourth Industrial Revolution technologies. The study revealed that 20 respondents (18.9%) rated them as highly skilled, 57 (53.8%) rated them as moderately skilled, 25 (23.6%) rated them as slightly skilled, and 4 (3.8%) rated them as not skilled at all. This distribution reflected an overall confidence in the staff's ability to engage with emerging technologies.

Table 5: Rating the current skills levels of staff in handling Fourth Industrial Revolution technologies

		Frequency	**Percent**
Valid	Highly skilled	20	18.9
	Moderately skilled	57	53.8
	Slightly skilled	25	23.6
	Not skilled at all	4	3.8
	Total	**106**	**100.0**

Source: Formulated by Author (2024)

Chi-square Test on artificial intelligence and user experience

Table 6: Chi-Square Tests on artificial intelligence and user experience

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	11.376[a]	9	.000
Likelihood Ratio	11.145	9	.000
Linear-by-Linear Association	5.692	1	.000
N of Valid Cases	106		

a. 6 cells (37.5%) have expected count less than 5. The minimum expected count is 1.13.

H_0: The adoption of artificial intelligence in academic libraries does not significantly enhance the user experience

H_1: The adoption of artificial intelligence in academic libraries significantly enhances the user experience

The results in Table 6 showed that $\chi^2 = 11.376$, DF = 9, and the p-value = 0.000. Since the p-value (0.000) was less than the significance level of 0.05, the null hypothesis was rejected, and the alternative hypothesis was accepted. The interpretation is that, there was a relationship between artificial intelligence and user experience in academic libraries. The results also suggested that variations in artificial intelligence implementations were likely to have had a significant impact on user experience outcomes.

DISCUSSION

Confident in using digital library management systems

The study revealed a generally positive outlook among respondents regarding their confidence in using digital library management systems. A total of 46 respondents (43%) expressed confidence, and 44 (42%) indicated they were very confident. Meanwhile, 13 (12%) were somewhat confident, and a small percentage, 3 (3%), were not confident. This distribution indicated that while most users were comfortable with digital library

management systems, a minority could have benefited from additional training or support to enhance their proficiency.

The findings were also in agreement with Kuyela (2025), who asserted that the advancements in digital technologies had empowered individuals to adapt quickly to new systems, with digital libraries becoming more intuitive and user-friendly over time. Additionally, Joo and Choi (2015) highlighted that positive experiences and frequent interactions with digital library management systems significantly enhanced users' self-efficacy and confidence. These findings suggested that the 85% of respondents in this study who reported being confident or very confident likely reflected this broader trend of growing digital competence among users.

Familiar with data analytics tools for library management

The study revealed that 31 respondents (29.2%) had reported being very familiar, 44 (41.5%) were familiar, 19 (17.9%) were somewhat familiar, and 12 (11.3%) were not familiar. This suggested that a significant portion of the respondents had a solid understanding of these tools, which could have been beneficial for library management practices. However, there was still a notable proportion who were either somewhat familiar or not familiar.

This finding connotes with studied conducted by Siddique and Ahmad (2020), who revealed that data analytics tools were essential for enhancing library operations, including resource allocation, user engagement, and service customization. Their study revealed that while many professionals had a strong understanding of these tools, gaps in familiarity often stemmed from inadequate training opportunities or limited access to technology. This aligned with the findings that a significant proportion of respondents in your study were either somewhat familiar or not familiar with data analytics tools, indicating a need for targeted educational initiatives to bridge the knowledge gap.

Rating the ability to teach patrons how to use new digital resources

The study revealed that the majority, 54 respondents (51%), rated their ability as good, while 32 (30%) rated it as excellent. Fourteen (13%) rated their ability as fair, and three (3%) rated it as poor. This suggested that most respondents possessed satisfactory proficiency in guiding patrons through digital tools, which was crucial in the increasingly technology-driven environment. This finding was similar to Smith et al. (2018), who found that libraries played a vital role in fostering digital competencies, with library staff being instrumental in offering personalized guidance. This support was particularly important in helping patrons navigate new technologies, as library staff with proficient digital skills enhanced the learning experience and empowered users to utilize digital tools effectively (Khan and Bhatti, 2017). This aligned with the finding the study, where a substantial proportion of respondents rated their ability to teach patrons digital resources as good or excellent, suggesting that many staff members had the skills necessary to facilitate digital learning.

As technology continued to evolve, libraries were increasingly seen as spaces for not only accessing digital resources but also for developing digital literacy. According to Jones and Miller (2017), effective instruction in using digital resources was central to improving patrons' ability to navigate the online world. Most respondents in your study rating their ability as good or excellent reflected the trend identified by Packham, Jones, Miller, and Thomas (2004), who emphasized that library professionals trained in digital tools contributed to patrons' confidence and competence in using technology. Libraries were no longer merely information hubs; they were key players in building digital literacy across communities, which underpinned the necessity of proficient library staff.

Level of comfort when using artificial intelligence (AI)-based library systems

The study found that 29 respondents (27.4%) reported very comfortable, the majority, 55 (51.9%), said comfortable, 18 (17%) indicted somewhat comfortable, and 4 (3.8%) were not comfortable. Overall, the results suggested a promising acceptance of artificial intelligence in library settings but highlighted an opportunity to address minor concerns among less comfortable users.

Numerous studies supported the notion that library users generally exhibited positive attitudes toward AI-based systems when they perceived these systems as user-friendly and beneficial. For example, Kuyela (2025) highlighted that AI integration in library systems enhanced the ease of information retrieval and user satisfaction, contributing to higher comfort levels among users. Similarly, Rahmani (2023) argued that the more intuitive and accessible AI-based systems were, the more likely users were to engage positively with them. These findings aligned with the high percentage of respondents in this study who reported feeling "comfortable" or "very comfortable" with AI-based library systems. Such data suggested that well-designed AI systems had the potential to enhance library services and foster user acceptance.

Despite the overall positive reception of AI in library environments, scholars emphasized the need to address concerns among less comfortable users. These findings were similar to Kuyela, (2025), who pointed out that a small but significant group of users often experienced apprehension due to unfamiliarity with AI technologies or fears of data privacy breaches. These concerns may have contributed to the 17% of respondents feeling "somewhat comfortable" and the 3.8% indicating discomfort in this study. To mitigate these issues, Wang et al. (2020) recommended targeted training and awareness programs to demystify AI functionalities and build trust. By addressing these barriers, libraries could ensure more inclusive adoption of AI technologies and further enhance user satisfaction.

Proficient in using cloud-based library services and integrating virtual reality (VR) or augmented reality (AR) into library services

The study revealed that 12 respondents (11.3%) indicated very proficient, 28 (26.4%) were proficient, the majority, 43 (40.6%), had been somewhat proficient, and 23 (21.7%) were not proficient. The findings suggested that while a notable portion of respondents were proficient in using cloud-based library services and integrating VR/AR technologies, the majority still possessed only a moderate level of proficiency. Similarly, Malgard, Asadzandi, Aalaa, and Aghashahi (2022), found that cloud-based services and VR/AR technologies had increasingly become pivotal in delivering innovative library solutions. However, their research showed that most library professionals demonstrated only moderate proficiency in these domains. This aligned with findings indicating a gap between the awareness of advanced library technologies and the ability to effectively integrate them into services.

This finding was similar to Khan, and Bhatti, (2017), who emphasised the disparity in technological skills among library personnel, particularly in emerging tools such as VR and AR. In their study, while a notable portion of respondents rated themselves proficient, a significant number only exhibited basic or moderate skills. The authors attributed this to the uneven availability of resources and support systems across different institutions, which hampered consistent professional development. They further suggested that tailored workshops and hands-on training could bridge this proficiency gap and enhance service delivery.

Types of training most beneficial for library staff in a technologically evolving environment

The majority, 43 respondents (40.6%), indicated that digital literacy and technology proficiency were the most beneficial. This was followed by 29 (27.4%) who preferred training in artificial intelligence and machine learning, 21 (19.8%) who chose data management and analytics, and 19 (12.3%) who selected digital content curation and preservation. Overall, these findings suggested that library staff prioritised training that kept pace with technological evolution and positioned them to leverage these tools for improved service delivery.

Similar findings were recorded by Thangiah and Michael (2024), who emphasised that digital transformation in libraries required staff to have foundational and advanced skills in technology use to enhance service delivery and user experience. Libraries were no longer merely repositories of information but became active facilitators of knowledge dissemination, necessitating staff equipped with the skills to navigate and manage digital tools effectively. These skills enabled libraries to remain relevant in the digital age, aligning with the survey's finding that 40.6% of respondents prioritised this type of training.

Rating the current skills levels of staff in handling Fourth Industrial Revolution technologies

The study revealed that 20 respondents (18.9%) rated them as highly skilled, 57 (53.8%) rated them as moderately skilled, 25 (23.6%) rated them as slightly skilled, and 4 (3.8%) rated them as not skilled at all. The finding was also in line with Yoliadi, Rumba, and Buchory (2023), who indicated that the integration of emerging technologies in libraries demanded a shift from traditional skill sets to more advanced technological competencies. Their study highlighted that while many librarians demonstrated moderate to high proficiency in adopting 4IR tools, there remained a notable segment requiring further training to meet advanced technological demands. This mirrored the findings in this study, where over 70% of respondents rated librarians as moderately or highly skilled, suggesting a general confidence in their capabilities despite room for improvement. The emphasis on adaptability and continuous learning was increasingly seen as pivotal in preparing library staff for the dynamic challenges of the 4IR era. In a related study, Mvula (2023) explored the awareness and usage of reference management software (RMS) among teaching staff at the University of Zambia, revealing a parallel need for ongoing technological upskilling within academic environments. Although many faculty members were aware of RMS tools such as Mendeley, actual usage remained low due to inadequate training and limited understanding of the tools' broader functionalities.

Similarly, Mercy (2023) underscored the importance of technological literacy among librarians as a cornerstone for effective service delivery in the digital age. Their research emphasized that even moderately skilled librarians could significantly contribute to library innovation if they received targeted professional development opportunities. Your findings, which indicated a substantial percentage of librarians as moderately skilled, were consistent with this perspective. By fostering an environment of ongoing education and exposure to 4IR technologies, institutions elevated staff competency levels. This highlighted the critical role of institutional support in addressing the skills gap and ensuring that libraries remained relevant and effective in an increasingly technology-driven landscape.

CONCLUSION

The study revealed a generally positive trend in confidence and familiarity with digital and emerging technologies among library staff, though varying levels of proficiency highlighted areas for growth. Respondents exhibited strong confidence in using digital library management systems, with the majority feeling confident or very confident. Similarly, familiarity with data analytics tools and AI-based systems showed promise, with many respondents reporting comfort and a reasonable level of understanding. However, gaps were noted, particularly in newer technologies like cloud-based services, VR, and AR, where moderate proficiency was most common, and a notable portion of respondents lacked advanced skills. These findings underscored the need for targeted training and resources to address the technological disparities among library staff.

Implications for practice

The following were the implications derived from the findings:

1. Library management should increase the focus on targeted training programs.
2. Academic libraries should prioritize digital literacy in professional development initiatives.
3. Academic libraries should invest in technology and support systems.
4. Library management should encourage collaboration and knowledge sharing across institutions.

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