

Digital pedagogies for librarians in higher education: a systematic review of the literature

Mousin Omar Saib, Mogiveny Rajkoomar and Nalindren Naicker

Department of Information Systems, Durban University of Technology, Durban, South Africa, and

Cecilia Temilola Olugbara

UNESCO Chair on ODL College of Education, University of South Africa, Pretoria, South Africa

Abstract

Purpose – The purpose of this paper is to identify and present a global perspective of digital pedagogies in relation to technology and academic librarians.

Design/methodology/approach – The preferred reporting items for systematic reviews and meta-analyses (PRISMA) methodology was used in this study.

Findings – Based on the data, academic librarians must develop a foundational understanding of 21st century pedagogies and digital skills to teach in an online environment.

Originality/value – This review paper considers the emergent teaching role of the academic librarian within the digital environment. The themes in the findings highlight the importance of digital pedagogical knowledge and digital fluency of academic librarians as a teacher within the digital environment in higher education.

Keywords Academic librarians, Pedagogies, Digital pedagogies, Digital skills, Digital literacy skills, Professional development

Paper type Research paper

Abbreviations

PRISMA = preferred reporting items for systematic reviews and meta-analyses; and

RQ = research question.

1. Introduction

The teaching, learning and research ambits in higher education is continuously adapting to progressive change (Sappington and Bedford, 2017). The reasons for this change is innumerable. There include political, social, financial and technological; however, the internet through various technologies has been central in shifting academia specifically within the context of higher education institutions (Davidson-Shivers *et al.*, 2018). This is mainly because of the growth, development and accessibility of the internet and technology. Higher education institutions have responded to this transition by embracing the internet and technology through multimodal methods of teaching, learning and research.

The importance of the internet and technology also resonates beyond the walls of academic libraries at higher education institutions. Worldwide, academic libraries are emerging as progressive research environments for scholarship in digital humanities, data curation, evolving integrated library systems, learning analytics, open access, research data services, digital pedagogies, machine learning and artificial intelligence within

the digital environment (Uzwysyn, 2018; White, 2017). Lewitzky (2020) posits that with the creation of the internet and rapid growth of technology, academic libraries have shifted from the provision of resources to a more active and integrated role within higher education. Hence, the internet and technology have equally been drivers of innovative change for academic libraries in the digital environment.

Academic libraries at higher education institutions have rapidly evolved in the digital age, particularly in terms of teaching and learning. Corral and Jolly (2019) supports this by stating that academic libraries are making concerted efforts to integrate their services into the broader teaching and learning missions of their universities focusing on the role of the “librarian as teacher.” This includes direct participation in relation to online teaching and learning. Currently, academic librarians are actively engaging as teachers, facilitators and mediators in the online environments.

However, Davies-Hoffman (2013) states that despite criticisms in the literature “for over 30 years” pointing towards academic librarians and their lack of pedagogical knowledge, they continue to teach. Globally, this has been a “grey area,” as

© Mousin Omar Saib, Mogiveny Rajkoomar, Nalindren Naicker and Cecilia Temilola Olugbara. Published by Emerald Publishing Limited. This article is published under the Creative Commons Attribution (CC BY 4.0) licence. Anyone may reproduce, distribute, translate and create derivative works of this article (for both commercial and non-commercial purposes), subject to full attribution to the original publication and authors. The full terms of this licence may be seen at <http://creativecommons.org/licences/by/4.0/legalcode>

The current issue and full text archive of this journal is available on Emerald Insight at: <https://www.emerald.com/insight/2398-6247.htm>



Information Discovery and Delivery
51/1 (2023) 13–25
Emerald Publishing Limited [ISSN 2398-6247]
[DOI 10.1108/IDD-06-2021-0066]

Received 27 June 2021
Revised 2 September 2021
5 October 2021
22 November 2021
Accepted 27 January 2022

research is constantly challenging the academic librarian's foundational and theoretical grounding in education, consequently, raising concerns of their preparedness to teach (Austin and Bhandol, 2013; Bell and Shank, 2004; McGuinness, 2011; Raju, 2017; Walter, 2006; Wheeler and McKinney, 2015). Recently, the literature has further revealed an increasing need for pedagogical and technological skills in the digital environment for academic librarians (Miller, 2007; Walter, 2008; Hall, 2013; Hensley, 2015).

Similarly, Shank and Bell (2011) agrees that the role of academic librarians with both technological and pedagogical skills are critical to a digitised academic library environment characterised by “disruptive innovations.” According to Hall (2013), experts have questioned whether academic librarians have the necessary grounding in the “rudiments of pedagogy” encompassing digital skills to take this role seriously. The inclusion of technology as a prerequisite for online teaching has created an interdependence between digital and pedagogical skills adding a new dimension for academic librarians involved in teaching.

Michael and Evangelia (2016) defines digital pedagogies as a pedagogical approach integrating germane technology in online instruction thereby examining in depth the impact of teaching with technology and learning in a digital environment. A recent study by Crawford *et al.* (2020) affirmed that a grounded understanding of critical online pedagogy with effective use of technological pedagogical content knowledge is necessary for an online facilitator and mediator. Thus, a fluid understanding of 21st century pedagogical frameworks, learning theories, student and subject centered curriculum design mixed with the use of appropriate digital educational tools can lead to the desired outcomes for teaching and learning in an online environment.

This paper aims to review the literature, identify, delve and present a global perspective of digital pedagogies in relation to academic librarians. This paper will shed light and open discussions on the emerging teaching role of the academic librarian within the digital environment and the influence of technology on pedagogies. The literature between 2015 and 2020 was scanned, examined and reviewed.

2. Literature review

One of the best-known early studies addressing the rapidly changing role of the academic librarian is by Bell and Shank (2011). Bell and Shank (2011) defined the “blended librarian” as “an academic librarian who combines the traditional skill set of librarianship with the information technologist's hardware/software skills, and the instructional or educational designer's ability to apply technology appropriately in the teaching-learning process.” This led to the concept of “disruptive innovations” leading to Bell and Shanks framework for blended librarianship. This was the yardstick used in many studies probing the dynamic change in the role of academic librarians at higher education institutions *vis-à-vis* “disruptive innovations.” However, this paper using preferred reporting items for systematic reviews and meta-analyses (PRISMA) further aimed to explore the readiness of academic librarians related to an emerging concept in the form of digital pedagogies, worldwide. Therefore, a holistic approach looking through the lens of academic librarians in developed and

developing knowledge economics was important to understand the current role of academic librarians related to digital pedagogies.

The concept of “disruptive innovations” was applied in a baseline study by Raju (2017) in South Africa. The study analysed 108 academic librarian job advertisements in South Africa through content analysis. Furthermore, a baseline list of pedagogic knowledge and skills gleaned from international literature was used as a benchmark to determine the pedagogical and technological competency requirements for academic librarians in South Africa. Raju (2017) examined academic librarian's job advertisements for blended skill sets, finding that the job descriptions did not require skills such as educational technology, online instructional design, developing online resources, digital learning tools and online courseware skills. The findings suggested academic librarians were underprepared in pedagogic competencies for the digital age although their teaching responsibilities have increased at higher education institutions in South Africa. The study further indicated that worldwide and in South Africa, library and information science schools have not prepared academic librarians with the foundational knowledge of pedagogies in preparation for a teaching role at higher education institutions.

Similarly, in Canada, McTavish (2019) probed the intersection of technology and pedagogy in academic librarianship using two research instruments in the methodology of the research. These included an online national survey and an examination of job postings for academic librarians. The similarities in both the South African and the Canadian study are in the lack of foundational pedagogical knowledge of academic librarians while the studies differentiate in the technological skills of the academic librarian in a digital environment. Further, although, in South Africa, job advertisements did not include digital skills, there were signs of digital skills in the job postings and teaching practices in Canada although not conclusive.

Hays and Studebaker (2019) conducted an explanatory sequential mixed methods study in North America to understand academic librarians' involvement and experience in the Scholarship of Teaching and Learning (SoTL) programme. The study explored the development of academic librarians' teacher identities through SoTL. The findings reveal that participation in SoTL significantly influenced academic instruction librarians' teacher identity, instructional practices and professional development. The study also proposed two recommendations. Firstly, higher education libraries would benefit from research on why librarians use technology in their teaching when they are not well versed in the teaching and learning literature. Secondly, academic libraries, the SoTL programme and the tech-savvy communities may benefit from additional research on why academic librarians who teach feel technology is a hindrance in the classroom. These types of research would help understand the hesitancy to teach using technology and address issues pertaining to pedagogies for academic librarians. Ultimately, it may point to professional development needs and the usefulness of programmes such as SOTL.

In England, Wheeler and McKinney (2015) used a phenomenographic approach to investigate the perceptions of academic librarians in their own teaching roles. The study used six librarians as a purposive sample. One of the main themes that emerged from the findings was librarians are less confident

about their teaching and less willing to admit that they are teachers or that they even teach. The findings also encouraged teaching-related professional development events. This included workshops and training to help academic librarians feel informed about good teaching practices and opportunities to develop their ability to speak with authority on library related subject matter within their institutions. Martzoukou (2020) study “Academic libraries in COVID-19: a renewed mission for digital literacy,” in Scotland revealed the position of academic librarians prior to the pandemic. The study unearthed the lack of pedagogical foundational knowledge in academic librarianship intersecting with a lack of digital skills needed for teaching in an online environment. Thus, the study questioned the pedagogical and technological preparedness of academic librarians in the digital age.

A reflective case study over a 18-month period using a qualitative approach at the University of South Australia titled “Re-envisioning the role of academic librarians for the digital learning environment: the case of UniSA Online” (Ciccone and Hounslow, 2019) revealed the ever-changing digital environment requires academic librarians to have more than just a basic understanding of online teaching. This study interestingly pointed that key skills have not been addressed by the Australian Library and Information Association’s core competency document nor the American Library Association’s core competencies standard making no explicit reference to digital skills or digital pedagogical understanding needed by the 21st century academic librarian in an online teaching role. The findings revealed a well-defined understanding of learning theories, online curriculum design and pedagogical driven technological knowledge is essential for the 21st century academic librarian to facilitate seamless integration of teaching with technology in a digital environment. Further, it may be time for academic librarians to consider seeking out formal training in curriculum development, online teaching and online learning tools.

Khan’s (2020) findings in Pakistan affirm that academic librarians have a low level of digital skills in information systems, followed by digital services, technology applications and digital tools. Chewe and Zulu (2020) study within the Zambian context discovered that many librarians in Zambia lack advanced digital skills to enable them to navigate complex digital environments. A similar pattern exist in Nigeria (Baro et al., 2019), with academic librarians having moderate to low digital skills within an online environment. Furthermore, a diagnosis study based on library instruction at universities in Chile contested that the progress of digital learning within higher education libraries in the 21st century demands academic librarians updating their digital skills (Marzal and Saurina, 2015).

Thus, the findings in the literature revealed a new reality emerging in academic librarianship at higher education institutions globally. There is clearly a need to focus on the evolving role of the academic librarian in online pedagogic theory and practice, online curriculum design, digital teaching tools, educational technologies and the impact of technology on pedagogy. The understanding of educational theories mixed with pedagogic content knowledge and driven by technology is crucial for academic librarians teaching in a digital environment. This will guide the academic librarian in their evolved roles as online teachers.

PRISMA is a clearly formulated question that uses systematic and explicit methods to identify, select and critically appraise relevant research and to collect and analyse data from the studies that are included in the review (Moher et al., 2010). PRISMA refers to the use of statistical techniques in a systematic review to integrate the results of included studies (Moher et al., 2010). PRISMA statement is a 27-item checklist, ensuring transparency in the reporting of a review (Manriquez et al., 2015).

A systematic literature review implies a study selection criterion intended to identify primary studies that provide direct evidence about the research question reducing the risks of bias and preconceived ideas (Kitchenham, 2004). A systematic review as defined, explained and illustrated by PRISMA was used in identifying, scanning and engaging with the literature delving into scientific publications over the past five years to obtain the necessary data pertaining to the role of academic librarians in the digital environment.

This paper aims to explore the critical pedagogical perspective of academic librarians and their digital skills when using technology at higher education institutions to teach in a digital environment. Academic librarians who teach need to understand different learning theories that support online library instruction, how to select the appropriate technology for different learning outcomes thereby using technology effectively. Therefore, the search strategies and sources selected, reflected the selection criteria relating to the research questions by engaging with the extant literature. This guides the paper without excluding country and author biases in immersing into the literature globally.

3. Research questions

Based on the identified research challenges, the objective of this research paper is to unravel studies focused on the pedagogical and technological skills of academic librarians in the digital environment. Aligned to this research objective, the following research questions are asked:

- RQ1. Are digital pedagogies an emerging theme in academic librarianship in the literature between 2015 and 2020?
- RQ2. What digital skills sets are needed by academic librarians who teach online?

4. Method

The following section outlines the methods undertaken to explore and systematically review existing literature in relation to digital pedagogies and academic librarians. Digital pedagogies can be underpinned epistemologically through a social constructivist approach in higher education with reference to the online environment. Globally, social constructivism theory has laid the foundation for teachers to establish active, cognitive and self-paced learning processes within the online environment in higher education (Alt, 2017). Social constructivism is a standpoint that continuously develops teaching methodologies (Taber, 2017) and informs learning through active engagement. Thus, the use of new technologies adds value to innovative methods of teaching within a digital environment and improves the teacher’s

toolbox. These innovative methods of teaching in a digital environment using technology such as digital tools include problem based learning activities, debates and group exercises.

Digital pedagogies align itself to social constructivism theory, as it enables teachers to facilitate online teaching and learning whilst engaging students in the use of interactive digital tools focusing on the pedagogy to guide the learning outcomes. Therefore, digital tools are an important support mechanism guided by a principled pedagogic approach within the digital environment and not an object on its own.

Thus, this paper explored the emerging role of the academic librarian as a teacher in the digital environment influenced by the impact of technology on pedagogy. This paper is an emerging theme as discussed in a baseline study “to teach or not to teach? The question of the academic librarian and pedagogical competencies in the digital age,” in South Africa (Raju, 2017). The purpose of this paper was to review contributions made by academic librarians to the library and information science knowledge base on digital pedagogies during the past five years in their teaching practice. In alignment with the research questions, the searches were documented using relevant protocol criteria according to PRISMA (Zibani *et al.*, 2021).

According to Tharani (2021), the steps in using PRISMA statement include defining research questions, conducting a literature search for identifying, screening and selecting relevant articles, coding and analysing articles and reporting results which is applied in the study. Further, when using PRISMA, it is essential to ensure reporting transparency and quality are strictly followed (Sam *et al.*, 2020). The findings of this paper contains the qualitative analysis and the categorisation obtained through the analysis of the data set using PRISMA statement as applicable and usable in a systematic review.

4.1 Inclusion criteria

This paper refers to academic librarians as individuals involved in teaching support at higher education institutions. Some of the terms that are used interchangeably when referring to academic librarians are “subject librarians,” “faculty librarians,” “information librarians,” “information specialist,” “research librarians,” “postgraduate librarians,” “online instructional librarian,” “training librarian” and “embedded librarian.”

The systematic retrieval process used a combination of search terms incorporating the primary search terms of pedagogies/technology/digital skills/teaching/educational technology and academic librarians. Other secondary search terms used include college librarians, university librarians, professional development, learning theories and online teaching. The autonomy of the literature review, analysis and findings were not limited to developed or developing higher education institutions. In determining the articles to be included, a three-stage screening and selection criteria process was established as framed in the PRISMA protocols. The searches were conducted between August 2020 and March 2021. The results were updated between April 2021 and May 2021.

4.2 Exclusion criteria

Articles that were excluded are published articles in dialects other than English, published prior to 2015 including book reviews, books, editorials book chapters, theses and

commentaries. In determining, the eligibility for the study based on the research questions the abstract, introduction and findings section were read, concurrently scanning for duplications. This exercise resulted in the exclusion of 357 articles, resulting in a data set of 74 results. An in-depth reading and analysis of the remaining articles resulted in 50 articles being excluded because of the absence of the intersect of technology within pedagogies and academic librarianship. The process is represented through a PRISMA flow diagram in Figure 2. The final data set in Table 1 provides global perspectives from both developed and developing knowledge economics related to academic librarianship, pedagogies and intersect of technology within a digital environment. This includes South Africa, Pakistan, the USA, the UK, Canada, Australia and Nigeria amongst other countries. The qualitative analysis concluded with the data set of 24 articles.

4.3 Selected databases

An iterative process combining a systematic search strategy for relevant publications on digital pedagogies and academic librarians charted a clear path in identifying the eligibility criteria as defined by PRISMA. Within the context of PRISMA, the appropriate and relevant databases were selected in relation to the library and information science field. These databases were explored using a formulated search string and a combination of terms. The databases searched included Web of Science, Emerald, Library, Information Science & Technology Abstracts (LISTA) and Google Scholar.

These databases were restricted to English papers published from 2015 to 2020 using the following primary combination of terms: Academic librarians, Academic librarians AND pedagogies, Academic librarians AND educational technology, Academic librarians AND digital skills. The search terms were separated combined and modified using Boolean operators such as “OR,” “AND” and “NOT.”

Following PRISMA, information flow diagram (Moher *et al.*, 2010), studies identified were refined to include published articles between the years 2015 and 2020. Subsequently, the screening process continued after the articles were downloaded using the EndNote reference management tool. The EndNote referencing management tool was used to filter duplicates and delineate during the final step of the three-stage screening process resulting in 431 records. A total 431 published articles between the years 2015 and 2020 was retrieved, captured and organised using EndNote.

During the eligibility screening, 357 records were excluded after further refinements. The criteria applied in excluding these records included relevancy, currency, context and findings. The remaining 74 records examined through eligibility criteria guided the empirical identification, selection and qualitative synthesis of 24 records. The systematic use of the PRISMA method alleviated subjectivity and issues of bias.

Figure 1 shows that authority, currency and relevancy were the criteria applied when selecting databases for searching.

According to Figure 1, the databases selected were Web of Science, LISTA, Emerald and Google Scholar. LISTA was selected for its relevance within the field of library and information science, whereas Web of Science is the authoritative abstract database within academia providing

Table 1 Summarised findings

Study identity	Author (year)	Publication journal	Methodology
S01	Baro et al. (2019)	Digital Library Perspectives	Online questionnaire
S02	Chanetsa and Ngulube (2017)	International Information & Library Review	Questionnaire and interviews
S03	Chewe and Zulu (2020)	Zambia Journal of Library & Information Science	Online questionnaire
S04	Ciccione and Hounslow (2019)	Journal of University Teaching & Learning Practice	Reflective case study
S05	Corrall and Jolly (2019)	New Review of Academic Librarianship	Reflective case study
S06	Hays and Studebaker (2019)	International Journal for the Scholarship of Teaching and Learning	Explanatory sequential mixed method
S07	Hess (2019)	Journal of Library & Information Services in Distance Learning	Transformative learning theory
S08	Hiremath and Bankapur (2019)	International Journal of Librarianship and Administration	Structured questionnaire
S09	Julien et al. (2018)	College and Research Libraries	Online survey
S10	Khan (2020)	Digital Library Perspectives	Cross sectional survey
S11	Lewitzky (2020)	College & Undergraduate Libraries	Literature review methodology
S12	Llewellyn (2019)	New Review of Academic Librarianship	Literature review using thematic synthesis
S13	Martzoukou (2020)	Library Management	Conceptual paper
S14	Marzal and Saurina (2015)	Perspectivagem Ciência da Informação	Online questionnaire
S15	McTavish (2019)	Thesis	Online survey and content analysis
S16	O’Neil and Pegrum (2018)	Journal of Academic Librarianship	Longitudinal study
S17	Osborn (2017)	Journal of the Australian Library and Information Association	Community of practice
S18	Parramore (2019)	Reference Services Review	Conceptual paper
S19	Raju (2017)	South African Journal of Higher Education	Content analysis
S20	Saunders (2020)	College & Research Libraries	Online questionnaire
S21	Shahbazi and Hedayati (2016)	The Journal of Academic Librarianship	Content analysis
S22	Trembach and Deng (2018)	College & Undergraduate Libraries	Conceptual paper
S23	Wheeler and McKinney (2015)	Journal of Information Literacy	Phenomenography study
S24	Withorn and Willenborg (2020)	Journal of Library & Information Services in Distance Learning	Interviews

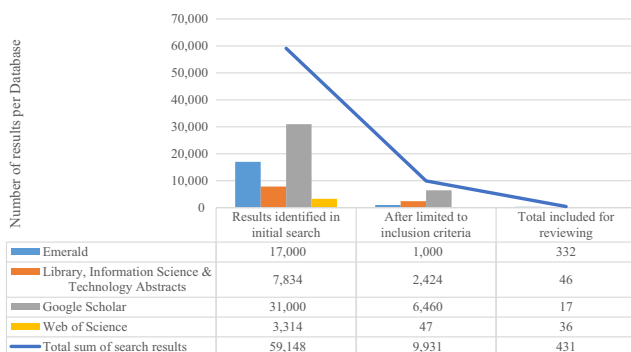
interdisciplinary database with records from several bibliographic databases, among them science citation index expanded and social sciences citation index. Additionally, Emerald and Google Scholar were searched to expand the sources examined in the study.

Figure 2 shows the PRISMA flow diagram of literature review.

5. Findings

Table 1 provides an overview of the findings for the 24 articles selected by PRISMA.

Figure 1 Search strategies



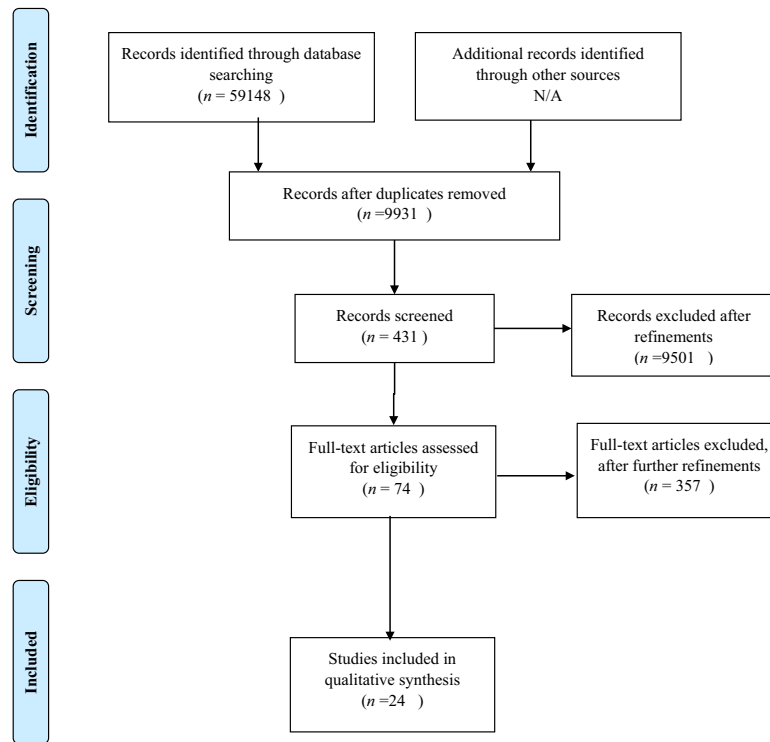
Twelve explicitly addressed the importance of a pedagogical background for academic librarians who teach, facilitate and mediate library instruction (S04, S05, S06, S07, S11, S13, S16, S17, S18, S19, S20, S23). Six explicitly noted the importance of digital skills needed by academic librarians (S01, S02, S03, S10, S14, S21), whereas one clearly indicated the proficient digital skills of academic librarians (S08). However, only five articles (S12, S09, S15, S22, S24) address the impact of technology on pedagogy and the emerging role of the librarian as facilitator, mediator or teacher in the digital environment:

RQ1. Are digital pedagogies an emerging theme in academic librarianship in the literature between 2015 and 2020?

Figure 3 shows publications by year from 2015 to 2020.

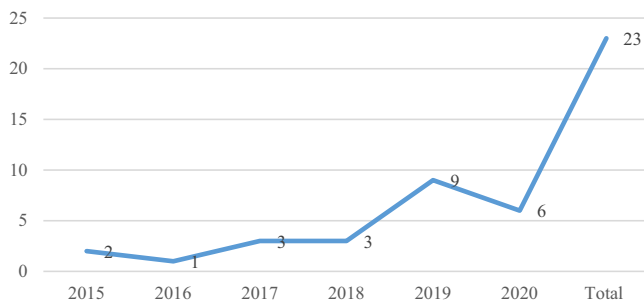
In Figure 3, the earliest year of publication is 2015, in which the article recommends teacher related professional development of the academic librarian in higher education. The article encourages teacher workshops, trainings and conferences, as this will enable academic librarians to speak with authority on library instruction within their institutions. In 2016, an article written by Shahbazi and Hedayati addresses salient issues such as website design skills to support library requirements unrelated to digital pedagogies and online library instruction. It is not until 2017 and 2018 that there is mention of the influence of technology on pedagogy and online library instruction. However, in 2019, there is a slight

Figure 2 PRISMA flow diagram of literature retrieval



Source: Adapted from Moher *et al.* (2010)

Figure 3 Publications by year



increase in the literature addressing the issue of academic librarians and digital pedagogies with the publication of nine articles:

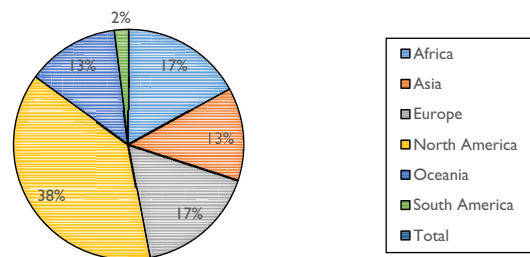
RQ2. What digital skills sets are needed by academic librarians who teach online?

Figure 4 shows the distribution of selected articles by continent.

It is important to recognise studies related to pedagogical and technological development of academic librarians mainly occurred in developed knowledge economies. The developing world such as in Africa and Asia focused on digital skills of academic librarians vaguely related to pedagogies and technology. Nevertheless, it is important to acknowledge the baseline study facilitated by Raju (2017) within the South

Figure 4 Distribution of selected articles by continent

Publication by Continent



African context that was the impetus for research conducted in Australia, Canada and the USA.

The research is geographical evenly distributed between European (17%) and African (17%) countries. However, the European studies focused on pedagogies and technology in the digital environment closely followed by Oceania (13%). The depth of the Australian perspective covering aspects such as online learning theories, online curriculum design, digital teaching tools and pedagogies is noteworthy (Figure 4). The majority of studies (38%) covering pedagogies and the influence of technology on online library instruction occurred in North America. The countries that have been probing the influence of teaching with technology and academic librarians within Northern America are the USA and Canada. However, over three-quarters of the published articles (80%) can be

categorised as investigational. The remaining research of (20%) does provide substantial coverage of digital pedagogies within academic librarianship in higher education globally.

The analysed results in the findings as per [Table 1](#) and [Figure 3](#) suggest a two-fold emerging situation within academic librarianship. One is the need for a greater understanding of 21st century pedagogical frameworks including learning and instructional design theory for the digital environment ([Hallis, 2017](#)). The second is the type of digital skills needed by academic librarian when teaching library instruction in a digital environment. Globally, however, there are limited findings that clearly indicate the emergence of online learning theories, online instructional design and the use of digital teaching tools related to library instruction within a digital environment ([Khan, 2020](#)).

In general, teachers have reached a tipping point in education, as the digital era and knowledge society has changed the nature of learning from the directed learner to the learner as consumer and evaluator ([De Rosa et al., 2014](#)). This has led to a paradigmatic shift from face-to-face learning to increased blended and online learning provision. In the findings, [Llewellyn \(2019\)](#) posits that digital transformation has also had a significant impact on the knowledge economy with a move from didactic teacher-centred approaches to a learning approach, which is active, personalised and social, mediated by technology.

Currently, technology is also reshaping the job description of academic librarians in higher education ([Raju, 2017](#)). [Corrall and Jolly \(2019\)](#) elaborate as a profession we have been complicit in being described as “non-academics” and accepting our role as “supporting” learning; however, in the present digital environment, it is increasingly clear academic librarians have a major role to play in teaching and learning in the transformed higher education sector. Therefore, [Hays and Studebaker \(2019\)](#) impress on the importance of academic librarians establishing their teacher identity, as this will allow them to be active and become crucial role players within teaching and learning at higher education institutions. Library schools, centres of teaching and learning, library management and academic coordinators at universities have an important role to play by designing qualifications suited for the digital environment. This needs to include a component that covers teaching with technology to help prepare academic librarians for online teaching.

In an extensive literature review, [McTavish \(2019\)](#) clarifies the role of the librarian as a teacher in an emerging role within the digital environment. [McTavish \(2019\)](#) states that academic librarians must possess key technological and pedagogical skills to teach within the digital environment at higher education institutions. This signifies the changing role of the academic librarian. There is a need for a succinct understanding of technological and 21st century pedagogical frameworks, as this drives the type of expertise needed by academic librarians to teach online. It is important for academic librarians to develop their knowledge in theories of teaching and learning within the context of the digital environment. This will help them prepare for their online role as teachers. Therefore, academic librarians who teach need to understand their online instructional role in a digital environment, as this will enable productive learning outcomes when teaching library instruction. The findings in this study

further revealed the various digital identities incorporated within the job description of an academic librarian at higher education institutions. These digital identities include online facilitators, instructional designers and mediators in teaching and learning of library instruction. Globally, this makes the role of the academic librarian far more complex within the current context at higher education institutions.

[Trembach and Deng \(2018\)](#) findings suggested that academic librarians must re-assess their understanding of educational tools when designing library content for teaching keeping in mind digital learners. It is important to reimagine our roles as enabled facilitators, teacher and advocates of teaching with technology. Thus, [O’Neil and Pegrum, \(2018\)](#) also question the technological and pedagogical preparedness of academic librarians involved in teaching at higher education institutions. The technological and pedagogical preparedness of academic librarians needs addressing, as this will contribute to meaningful patterns of learning for students in the digital environment. Similarly, the findings in [Martzoukou \(2020\)](#) revealed that there is a coherent need to focus on the evolving digital role of the academic librarian and the need for training in pedagogic theory and practice, online curriculum design and opportunities that will provide continuous professional development in readiness to teach online.

Academic librarians need to recognise that 21st century digital pedagogies are important. The foundational knowledge in education and technology will help design innovative student-centred online library instruction. Academic librarians must have knowledge of online learning theories, online instructional design and “how and when” to use germane digital teaching tools to make a significant impact when teaching in a digital environment. Therefore, the knowledge of digital pedagogies can guide academic librarians on how to teach in a digital environment. The goal is to be proactive within the online environment rather than reactive when engaging with pedagogies and technologies in a digital environment. The 21st century academic librarian needs to engage students in active participation through project base learning, self-placed learning, asynchronous activities and interactive learner engagement tasks enabling them to arrive at a point of acquiring knowledge through applying their own cognitive skills in a digital environment. Academic librarians can only attain this through a process of identifying the skills needed for online teaching within the current digital context.

Globally, research in understanding of digital skills and pedagogies related to academic librarians is ambiguous. The findings in the systematic review illustrate academic librarians in developing and developed knowledge economies varies significantly ([Figure 4](#)). In countries such as Zambia, Nigeria, Pakistan, Chile and Botswana ([Baro et al., 2019](#); [Chanetsa and Ngulube, 2017](#); [Chewe and Zulu, 2020](#); [Khan, 2020](#)), the findings indicate a low level of digital skills by academic librarians who teach. The challenges in these developing economies include compromised technological infrastructure leading to an absence of individual and organisational readiness for the digital environment. Academic librarians are engaged in acquiring digital skills to navigate the digital environment ([Chewe and Zulu, 2020](#)) rather than exploring, identifying and using relevant digital educational tools for online library instruction.

Baro *et al.* (2019) identified lack of funding allocated to support library professionals training, lack of physical facilities and shortage of skilled ICT educators as some of the challenges they encountered in acquiring digital skills. Khan (2020) shares the same view as Baro *et al.* (2019) encouraging stakeholders in higher education institutions in Pakistan to organise training programs to enhance digital skills of academic librarians. There is minimal mention of pedagogical knowledge and the influence of technology in online library instruction. Juxtapose, in developed knowledge economies, such as Australia, Canada, America and the UK, the findings suggest that academic librarians are digitally skilled; however, these skills are linked to “soft computer” skills and not digital tools for teaching and learning (Martzoukou, 2020; Hess, 2019; O’Neil and Pegrum, 2018).

The findings in these studies link digital skills and academic librarians to computer basics, internet, database search skills, electronic services, website design and management, computerised cataloguing, library software, digital preservation, uploading documents, skills in using different social media, MS Office applications and ability to use open source software (Chewe and Zulu, 2020; Hiremath and Bankapur, 2019; Shahbazi and Hedayati, 2016). Worldwide, results from the studies exclude the importance of digital pedagogies in relation to teaching online library instruction. It also excludes critical online pedagogy and the effective use of technological pedagogical content knowledge in academic librarianship at higher education libraries. The studies do not relate digital skills to online educational tools and teaching library instruction in a digital environment. The findings in the systematic review conclude that a large majority of studies in higher education libraries have been exploring the pedagogical competencies of academic librarians for many years; however, the intersect with the emergence of technology and the impact on teaching has been minimal (Withorn and Willenborg, 2020).

6. Visualisation of the collection of selected articles

Latent Dirichlet Allocation (LDA), a machine learning algorithm was used to visualise the semantic relationship between the 25 selected publications in accordance with the PRISMA method. LDA was used to discover topics (individual words or phrases) to suggest the shared themes in the document collection (25 publications). LDA makes the assumption that documents are a mixture of topics (Belikina *et al.*, 2019, Onah and Pang, 2021) and used to visualise these topics that were pervasive in the selected collection of 24 publications. The LDA experiments were based on topic modelling of unsupervised classification of documents, which discovered five predominant topics with keywords from the corpus of 24 publications. Figure 5 shows the topic keywords and their weights from the corpus output from the model using article titles to simplify the evaluation.

All five topics discovered are contained in the collection of the 24 publications. These topics converted into themes are, namely, Topic 0 (“digital literacy”), Topic 1 (“session design”), Topic 2 (“online academic”), Topic 3 (“academic library”) and Topic 4 (“librarian teaching”), as shown in Table 2.

Figure 5 Keyword and weight from the corpus

```
[0,
'0.063*"digital" + 0.052*"literacy" + 0.042*"skill" + 0.031*"librarian" +
'0.029*"emerge" + 0.027*"indicate" + 0.024*"tool" + 0.022*"technology" +
'0.022*"finding" + 0.011*"competency"'],
(1,
'0.017*"session" + 0.017*"design" + 0.012*"active" + 0.012*"view" +
'0.012*"question" + 0.012*"form" + 0.011*"technological" + 0.011*"job" +
'0.009*"group" + 0.007*"element"'],
(2,
'0.072*"online" + 0.058*"academic" + 0.055*"role" + 0.042*"learn" +
'0.040*"finding" + 0.036*"teacher" + 0.035*"librarian" + 0.030*"institution"
'+ 0.024*"development" + 0.016*"learning"'],
(3,
'0.074*"academic" + 0.051*"learn" + 0.051*"library" + 0.041*"practice" +
'0.034*"study" + 0.032*"skill" + 0.030*"technology" + 0.026*"learning" +
'0.022*"student" + 0.021*"information"'],
(4,
'0.046*"librarian" + 0.036*"teaching" + 0.030*"teach" + 0.021*"less" +
'0.021*"help" + 0.021*"millennial" + 0.021*"feel" + 0.017*"technology" +
'0.012*"instructional" + 0.012*"understand"']]
```

Figure 6 shows the word clouds of top N keywords in each topic. The size of the words is an indication of the probability of the word belonging to that topic in the corpus.

In order to visualise the most discussed topics in the collection of documents, we plot the number of documents by dominant topics and by topic weightage as shown in Figure 7.

7. Discussion

The systematic review explored the pedagogical skills of academic librarians in a digital environment at higher education institutions using PRISMA. This paper also examined the digital skills of academic librarians in an online environment in relation to pedagogies at higher education institutions. The literature presented in the systematic review explored the intersection of pedagogy and technology in online library instruction. The purpose of this paper was to identify the impact of emerging technologies on 21st century pedagogies related to academic librarians. The literature explored was unable to provide clarity regarding the technological influence on pedagogical practices of academic librarians. The data collected from the articles does not provide sufficient evidence in the teaching methods of academic librarians driven by technology within a digital environment.

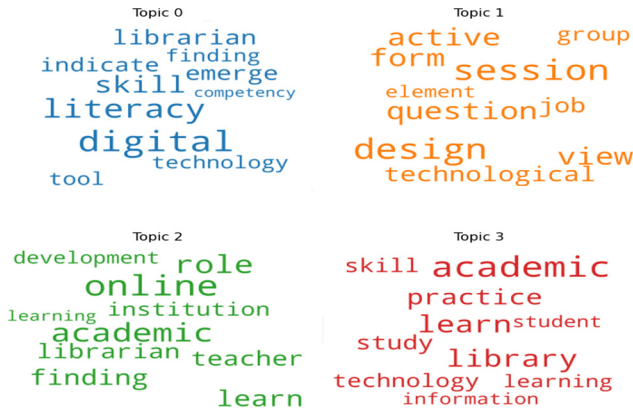
Each article focused on the role of the librarian as a teacher and deliberated against the backdrop of establishing their pedagogic preparedness or their digital skills. These two concepts are discussed in isolation and their interdependence including their interrelatedness to the digital environment when teaching is lacking in the literature reviewed. A few authors identified the transformative nature of current pedagogical practices driven by technology; however, in general, there is a lack of published research on digital pedagogies and academic librarians. The current literature refers to digital skills in relation to “soft skills” such as using MS Office applications in academic libraries.

A few studies relate to the impact of emerging technologies and pedagogies within academic librarianship (McTavish and Robertson, 2020). In a literature review, McTavish and Robertson (2020, p. 172) found that “the teaching role of academic librarians continues to grow despite librarians having less than ideal opportunities to learn how to teach during their professional librarian education. As a result, academic librarians often find themselves in teaching positions with insufficient background knowledge of pedagogy or having to learn to teach on the job. This is further complicated by the proliferation of online learning models which often require

Table 2 Topics and keywords extracted by latent Dirichlet allocation (LDA)

Topic	Theme	Keywords
0	Digital literacy	digital, literacy, skill, librarian, emerge, indicate, tool, technology, finding, competency
1	Session design	session, design, active, view, question, form, technological, job, group, element
2	Online academic	online, academic, role, learn, finding, teacher, librarian, institution, development, learning
3	Academic library	academic, learn, library, practice, study, skill, technology, learning, student, information
4	Librarian teaching	librarian, teaching, teach, help, millennial, feel, technology, instructional, understand

Figure 6 Word clouds of top N keywords in each topic



academic librarians to teach in both face-to-face and online learning environments seamlessly. They are required to understand how to use technology in the online teaching and learning process, despite a documented gap in training or experience in a traditional classroom environment.” The role of library schools is therefore crucial. Library schools need to include modules such as learning theories and library instruction, designing online curriculum in library instruction and teaching with technology in the classroom.

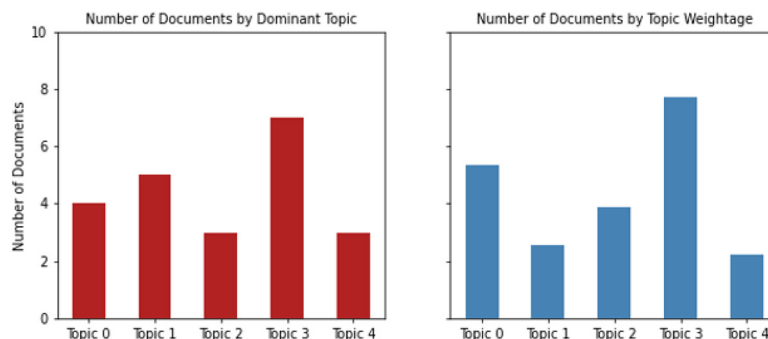
Similarly, findings in a study done by [Ciccone and Hounslow \(2019\)](#) indicate that academic librarians need to have a theoretical understanding of curriculum development and pedagogy to create appropriate content in an online environment. [Hallis \(2017\)](#) agrees it is important academic librarians consider seeking out formal training in curriculum development and pedagogy. [Chanetsa and Ngulube \(2017, p. 199\)](#) also found that although academic librarians are

experts in the understanding and use of information, there is also a need to have technological and pedagogical competencies, as this will ensure meaningful learning outcomes in teaching.

A five-year longitudinal study by [O’Neil and Pegrum \(2018\)](#) on professional development of academic librarians aimed to evaluate the influence of digital technologies and associated pedagogies delivered to academic librarians. The findings indicated that participants improved their technological skills and developed a sound understanding of pedagogies. Academic librarians were able to bridge the gap between digital technologies and pedagogies. This allowed academic librarians to decide how best to make pedagogical use of the digital technologies. This resulted in productive interactions between librarians, faculty and wider support staff. Professional development opportunities at universities for academic librarians can chart a path to rectify some of the gaps in pedagogical and technological knowledge for academic librarians. However, to be able to teach it is critical to have an understanding of foundational knowledge in theories of education. This can help understand social, cultural, economic and political norms in society when planning, designing and engaging with students in the theory and practices of learning. Generally, social cultural factors are the main drivers when one is designing a curriculum, deciding to use technology, adopting teaching methods or the type of assessment in a digital environment for the 21st century student. The other drivers include stimulating cognitive thinking, critical and objective behavioural patterns, independent learning skills and active engagement in the online class resulting in developing a student who facilitates their own learning process responsibly. These are key areas academic librarians should consider in their teaching methods.

[Julien et al. \(2018\)](#) conducted an online survey in the USA targeting academic librarians who provide library instruction.

Figure 7 Topic distribution by dominant topics and weightage



There were significant themes that emerged. These included the following:

A lack of formal training – the study emphasised there were no opportunities at library schools to prepare librarians for teaching; librarians with a teaching role are involved preparing for the class, timetabling the class for library instruction and balancing instruction with other job duties such as reference queries and collection development; limited staffing – librarians who teach are covering more than one position in their workplaces. This leads to lack of time to plan, strategize and use technology in teaching to increase active engagement by students. It also hinders instructional librarians from designing content aligned to a students learning experiences and in a manner that suits their learning styles. However, the study also indicated technology has increased participation but is no replacement for poorly designed or prepared instruction.

Currently, the evolution of the academic librarian at higher education institutions in relation to digital pedagogies and digital skills need to include delineated “skills sets” to encapsulate the profession within a digital environment. This includes knowledge of digital learning theories, digital pedagogical approaches, effective use of educational technologies, identify and select relevant digital teaching tools germane to library instruction, create and design innovative online library courses, superior understanding of how to use digital skills to actively engage with students, using digital pedagogies and skills to formulate online library assessments. This is discernible; however, there is a lack of literature addressing these issues within the current context of academia.

The impact of emerging technologies on pedagogies has provided opportunities for the academic librarian at higher education institutions. However, for the academic librarian to have effective teaching skills within the context of academia, the development of digital pedagogical skills is necessary. Initiatives such as workshops, short courses, support from centres of excellence for teaching at higher education institutions, mentoring programmes, library and information science schools including a teaching component for the digital environment with technologies and formalised qualifications on digital pedagogies can be key in the professional development of the academic librarian as a teacher in the 21st century. This can help bridge the gap and create collaborative working relationships with subject specialists from within the university environment. These type of teaching partnerships with subject specialist can be an impetus for the academic librarian as a teacher in the digital environment to provide valuable and insightful learning opportunities for students through online library instruction. At the same time, creating prospective channels to credit bearing modules and similar teaching partnerships with other subject specialist in a digital environment.

Academic librarians need to investigate the suitability of 21st century oriented pedagogical frameworks such as Technological Pedagogical Content Knowledge, Substitution, Augmentation, Modification and Redefinition and Community of Inquiry. These type of pedagogical frameworks needs to be unpacked understood and applied by academic librarians who teach online. These educational frameworks place the student as

a communicator, collaborator and creative thinker. Academic librarians need to plan, implement, reinforce and provide feedback to students in online library instruction using these types of pedagogical frameworks. These frameworks guide the technology against the backdrop of pedagogical knowledge. Thus, academic librarian need to be drivers of change by using these type of frameworks to develop their subject matter for the digital environment. Further, library assessments whether formative and summative must allow flexibility for online library instruction using educational technology. The understanding of when, why and how to use educational technologies such as Edpuzzle, Kahoots and Peardeck are important with the purpose of transforming pedagogy with technology in teaching and learning within a digital environment by academic librarians.

The importance of information and knowledge sharing communities of practices for academic librarians at higher education institutions has never been vital, as it is within the current context. It is critical to collaborate, engage and reflect on online teaching practices, digital pedagogies, digital skills, educational technologies and digital tools related to online library instruction. Some of the findings in the systematic review saliently link to the research objectives suggesting the need for academic librarians to have knowledge of pedagogies, learning theories, instructional design and digital skills in an online environment. Historically, the studies persistently question the “academic librarian as a teacher,” within higher education. Recently the emergence of digital pedagogies intersecting with technology in the digital environment has further complicated the role of the academic librarian.

8. Conclusions

The unpacking of pedagogies, technology and digital skills of academic librarians within the digital environment is “work in progress” and topical in nature. Thus, the term “digital pedagogies” has relevance to the field of academic librarianship. Academic librarians at higher education institutions must have knowledge of online learning theories, online instructional design and “how and when” to use digital teaching tools to make a significant impact when teaching in a digital environment. This is achievable through a clear understanding of 21st century online pedagogical theories, frameworks and necessary digital technological skills when teaching in a digital environment.

Pedagogies should direct the library instruction in the digital environment using technology as the support mechanisms not inversely. Ultimately, this will lead to “deep engagements” with students in the digital environment ensuring active learning and participation. “Technology must be used as an intermediary for inquiry, developing a perspective, producing critical reflection in online teaching and not merely as a tool for the mindless transmission of knowledge. Then, and only then, will it unveil its true potential to transform lives through education as the new millennium rapidly gathers momentum (Trembach and Deng, 2018).” Therefore, the emergence, deliberations and perspectives within the topic of “digital pedagogies” is

presently crucial to the dynamic role of the 21st century academic librarian at higher education institutions.

Thus, the emergence of digital pedagogies and academic librarians is a pressing topic. The systematic review reveals the need for well-designed and documented policies by major stakeholders in the field of academic libraries. Globally, policy can guide library schools, centres of teaching and learning at universities and academic libraries to plan, design, test and implement online library modules simultaneously preparing academic librarians for their online teaching role. This should include teaching and learning kit to help academic librarians teach in the digital environment.

To determine if digital pedagogies are effecting change in academic librarian's future research should include the following: emerging 21st century pedagogical frameworks and academic librarians; academic librarians transforming pedagogy with technology; academic librarians understanding of learning theories and online library instruction; digital skills and pedagogical practices of academic librarians in an online environment; and the role of library and information science schools in preparing librarians for teaching.

References

- Alt, D. (2017), "Constructivist learning and openness to diversity and challenge in higher education environments", *Learning Environments Research*, Vol. 20 No. 1, pp. 99-119.
- Austin, T. and Bhandol, J. (2013), "The academic librarian: buying into, playing out, and resisting the teacher role in higher education", *New Review of Academic Librarianship*, Vol. 19 No. 1, pp. 15-35.
- Bell, S. and Shank, J.D. (2004), "The blended librarian: a blueprint for redefining the teaching and learning role of academic librarians", *College & Research Libraries News*, Vol. 65 No. 7, pp. 372-375.
- Baro, E.E., Obaro, O.G. and Aduba, E.D. (2019), "An assessment of digital literacy skills and knowledge-based competencies among librarians working in university libraries in Africa", *Digital Library Perspectives*, Vol. 35 Nos 3/4, pp. 172-192.
- Chanetsa, B. and Ngulube, P. (2017), "Qualifications and skills of subject librarians in selected African countries", *International Information & Library Review*, Vol. 49 No. 3, pp. 187-200.
- Chewe, P. and Zulu, Z. (2020), "A survey of digital literacy skills among librarians in Zambia", *Zambia Journal of Library & Information Science (ZAJLIS)*, Vol. 4 No. 1.
- Ciccone, A. and Hounslow, L. (2019), "Re-envisioning the role of academic librarians for the digital learning environment: the case of UniSA online", *Journal of University Teaching & Learning Practice*, Vol. 16 No. 1.
- Corrall, S. and Jolly, L. (2019), "Innovations in learning and teaching in academic libraries: alignment, collaboration, and the social turn", *New Review of Academic Librarianship*, Vol. 25 Nos 2/4, pp. 113-128.
- Crawford, J., Butler-Henderson, K., Rudolph, J., Malkawi, B., Glowatz, M., Burton, R., Magni, P. and Lam, S. (2020), "COVID-19: 20 countries' higher education intra-period digital pedagogy responses", *Journal of Applied Learning & Teaching*, Vol. 3 No. 1, pp. 1-20.
- Davidson-Shivers, G.V., Rasmussen, K.L. and Lowenthal, P.R. (2018), "Overview of online instruction and learning environments and communities", in *Web-based Learning*, Springer, pp. 3-41.
- Davies-Hoffman, K., Alvarez, B., Costello, M. and Emerson, D. (2013), "Keeping pace with information literacy instruction for the real world: when will MLS programs wake up and smell the lilacs?", *CommInfoLit*, Vol. 7 No. 1, pp. 9-23.
- De Rosa, C., Cantrell, J., Gallagher, P., Hawk, J., Hoffman, I., Page, R., Haricombe, L.J. and Wallace, D. (2014), "At a tipping point: education, learning & libraries: a report to the OCLC membership", available at: www.oclc.org/research/publications/2014/tipping-point.html (accessed 18 January 2021)
- Hall, R.A. (2013), "Beyond the job ad: employers and library instruction", *College & Research Libraries*, Vol. 71 No. 1, pp. 24-38.
- Hallis, R. (2017), "Internet outfitters: librarians in the twenty-first century", *Library Management*, Vol. 38 No. 6/7, pp. 369-379.
- Hays, L. and Studebaker, B. (2019), "Academic instruction librarians' teacher identity development through participation in the scholarship of teaching and learning", *International Journal for the Scholarship of Teaching and Learning*, Vol. 13 No. 2.
- Hensley, M.K. (2015), ". "Improving LIS education in teaching librarians to teach", Mueller, D.M. (Ed.), *The Proceedings of the ACRL 2015 Conference*, ACRL, Chicago, pp. 1-19.
- Hess, A.N. (2019), "Instructional modalities and perspective transformation: how academic librarians' experiences in face-to-face, blended/hybrid, and online instruction influence their teaching identities", *Journal of Library & Information Services in Distance Learning*, Vol. 13 No. 4, pp. 353-368.
- Hiremath, S.S. and Bankapur, V. (2019), "Awareness and proficiency in digital literacy skills among librarians of first grade degree colleges of bagalkot district with respect to age group", *International Journal of Librarianship and Administration*, Vol. 10 No. 1, pp. 11-18.
- Julien, H., Gross, M. and Latham, D. (2018), "Survey of information literacy instructional practices in U.S. Academic libraries", *College & Research Libraries*, Vol. 79 No. 2.
- Khan, A. (2020), "Digital information literacy skills of Pakistani librarians: exploring supply-demand mismatches, adoption strategies and acquisition barriers", *Digital Library Perspectives*, Vol. 36 No. 2, pp. 167-189.
- Kitchenham, B. (2004), "Procedures for performing systematic reviews", Technica l Report TR/SE-0401. pp.1-28.
- Lewitzky, R.A. (2020), "Educating, learning, and growing: a review of the teaching role in academic librarianship", *College & Undergraduate Libraries*, Vol. 27 No. 1, pp. 32-40.
- Llewellyn, A. (2019), "Innovations in learning and teaching in academic libraries: a literature review", *New Review of Academic Librarianship*, Vol. 25 No. 2-4, pp. 129-149.

- McGuinness, C. (2011), *Becoming Confident Teachers: A Guide for Academic Librarians*, Elsevier, Glasgow.
- McTavish, H. (2019), "Emerging online roles for academic librarians in Canada".
- McTavish, H. and Robertson, L. (2020), "Canadian academic librarians as online teachers", *Learning*, Vol. 4 No. 10, pp. 171-174.
- Manriquez, J., Andino-Navarrete, R., Cataldo-Cerda, K. and Harz-Fresno, I. (2015), "Bibliometric characteristics of systematic reviews in dermatology: a cross-sectional study through web of science and scopus", *Dermatologica Sinica*, Vol. 33 No. 3, pp. 154-156.
- Martoukou, K. (2020), "Academic libraries in COVID-19: a renewed mission for digital literacy", *Library Management*, Vol. 42 Nos 4/5.
- Marzal, M.Á. and Saurina, E. (2015), "Diagnosis of the state of information literacy (IL) in Chilean Universities", *Perspectivas em Ciência da Informação*, Vol. 20 No. 2, pp. 58-78.
- Michael, V. and Evangelia, L.-V. (2016), "Digital pedagogy from the perspective of early childhood education", Elena, A. R., Gabriela, W., Atilla, E. and Liz, J. (Ed.), *Handbook of Research on Applied Learning Theory and Design in Modern Education*, IGI Global, Hershey, pp. 93-114.
- Miller, M.J. (2007), "Information communication technology infusion in 21st century librarianship: a proposal for a blended core course", *Journal of Education for Library and Information Science*, Vol. 1, pp. 202-217.
- Moher, D., Liberati, A., Tetzlaff, J. and Altman, D.G. (2010), "Preferred reporting items for systematic reviews and Meta-analyses: the PRISMA statement", *International Journal of Surgery*, Vol. 8 No. 5, pp. 336-341.
- Onah, D.F. and Pang, E.L. (2021), "MOOC design principles: topic modelling-PyLDA visualization & summarisation of learners' engagement", *13th annual International Conference on Education and New Learning Technologies*.
- O'Neil, F. and Pegrum, M. (2018), "Keeping up the momentum: a longitudinal evaluation of professional development in digital technologies for academic librarians at an Australian university", *The Journal of Academic Librarianship*, Vol. 44 No. 4, pp. 439-445.
- Parramore, S. (2019), "Online active-learning: information literacy instruction for graduate students", *Reference Services Review*, Vol. 47 No. 4, pp. 476-486.
- Raju, J. (2017), "To teach or not to teach? The question of the academic librarian & pedagogical competencies in the digital age", *South African Journal of Higher Education*, Vol. 31 No. 2, pp. 251-269.
- Sam, C., Naicker, N. and Rajkoomar, M. (2020), "Meta-analysis of artificial intelligence works in ubiquitous learning environments and technologies", *International Journal of Advanced Computer Science and Applications*, Vol. 11 No. 9, pp. 603-613.
- Sappington, J. and Bedford, D.A. (2017), "Assessment of intellectual capital of library and information professionals", *Proceedings of the Association for Information Science and Technology*, Vol. 54 No. 1, pp. 798-799.
- Saunders, L. (2020), "Core knowledge and specialized skills in academic libraries", *College & Research Libraries*, Vol. 81 No. 2, p. 288.

- Shahbazi, R. and Hedayati, A. (2016), "Identifying digital librarian competencies according to the analysis of newly emerging IT-based LIS jobs in 2013", *The Journal of Academic Librarianship*, Vol. 42 No. 5, pp. 542-550.
- Shank, J.D. and Bell, S. (2011), "Blended librarianship: [re] envisioning the role of librarian as educator in the digital information age", *Reference & User Services Quarterly*, Vol. 51 No. 2, pp. 105-110.
- Taber, K. (2017), "The role of new educational technology in teaching and learning: a constructivist perspective on digital learning", Quinn, A. M. and Hourigan, T. (Eds.), *Handbook on Digital Learning for K-12 Schools*, Springer, Ireland, pp. 397-412.
- Tharani, K. (2021), "Much more than a mere technology: a systematic review of Wikidata in libraries", *The Journal of Academic Librarianship*, Vol. 47 No. 2, p. 102326.
- Trembach, S. and Deng, L. (2018), "Understanding millennial learning in academic libraries: learning styles, emerging technologies, and the efficacy of information literacy instruction", *College & Undergraduate Libraries*, Vol. 25 No. 3, pp. 297-315.
- Uzwysyn, R. (2018), "Academic libraries and technology: an environmental scan towards future possibility", Holbrook, G. J. (Ed.), *Academic and Digital Libraries: emerging Directions and Trends*, Nova Publishers, New York, NY, pp. 63-86.
- Walter, S. (2006), "Instructional improvement: building capacity for the professional development of librarians as teachers", *Reference & User Services Quarterly*, Vol. 45 No. 3, pp. 213-218.
- Walter, S. (2008), "Librarians as teachers: a qualitative inquiry into professional identity", *College & Research Libraries*, Vol. 69 No. 1, pp. 51-71.
- Wheeler, E. and McKinney, P. (2015), "Are librarians teachers? Investigating academic librarians' perceptions of their own teaching skills", *Journal of Information Literacy*, Vol. 9 No. 2, p. 111.
- White, W. (2017), "Libraries and research: five key themes for sustainable innovation in strategy and services", *New Review of Academic Librarianship*, Vol. 23 Nos 2/3, pp. 85-88.
- Withorn, T. and Willenborg, A. (2020), "A foot in both worlds: current roles and challenges of academic online learning librarians", *Journal of Library & Information Services in Distance Learning*, pp. 1-17.
- Zibani, P., Rajkoomar, M. and Naicker, N. (2021), "A systematic review of faculty research repositories at higher education institutions", *Digital Library Perspectives*, available at: <https://doi.org/10.1108/DLP-04-2021-0035>

Further reading

- Belkina, A.C., Ciccolella, C.O., Anno, R., Halpert, R., Spidlen, J. and Snyder-Cappione, J.E. (2019), "Automated optimized parameters for T-distributed stochastic neighbor embedding improve visualization and analysis of large datasets", *Nature Communications*, Vol. 10 No. 1, pp. 1-12.
- De Lannoy, A., Graham, L., Patel, L. and Leibbrandt, M. (2020), "Why is youth unemployment so intractable in South

- Africa? A synthesis of evidence at the micro-level”, *Journal of Applied Youth Studies*, Vol. 3 No. 2, pp. 115-131.
- Macgilchrist, F., Allert, H. and Bruch, A. (2020), “Students and society in the 2020s. three future ‘histories’ of education and technology”, *Learning, Media and Technology*, Vol. 45 No. 1, pp. 76-89.
- Rafi, M., Jianming, Z. and Ahmad, K. (2019), “Technology integration for students’ information and digital literacy

- education in academic libraries”, *Information Discovery and Delivery*, Vol. 47 No. 4, pp. 203-217.
- Tamrat, W. and Teferra, D. (2020), “COVID-19 poses a serious threat to higher education”, *University World News*, No. 9, pp. 1-4.

Corresponding author

Nalindren Naicker can be contacted at: naickern@dut.ac.za