



Navigating the Data-driven Landscape: Exploring Academic Libraries' Role in Data Literacy Education

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Abstract

This study explores the current landscape of data literacy education in academic libraries, analyzes how libraries equip users with data skills, identifies effective strategies for integrating data literacy instruction into the library setting, and uncovers challenges, best practices, and emerging trends in library-based data literacy programs. This study conducted a systematic literature review to analyze the role of academic libraries in data literacy education from January 2014 to January 2024. Following the PRISMA framework for rigor and transparency, we analyzed and coded selected articles to identify key themes, trends, methodologies, and findings. Three (3) major databases, such as EmeraldInsight, ProQuest, and ScienceDirect, were used to perform the literature review. The search focused on peer-reviewed articles published in English during the specified period. The study reveals that data literacy initiatives often include workshops, training programs, online resources, and collaborations with faculty and campus stakeholders. Challenges identified include resource constraints, staff training needs, and the evolving landscape of data technologies. However, opportunities exist in fostering interdisciplinary collaborations, leveraging emerging technologies, and promoting a data-informed culture. By addressing these challenges and seizing opportunities, academic libraries can empower individuals with the data literacy skills needed to succeed in the digital age. This study provides a comprehensive analysis of how academic libraries have evolved in promoting data literacy over the past decade. It highlights trends, effective practices, and challenges, fills a significant gap in the literature, and offers actionable insights for enhancing data literacy education in academic settings. This study is limited by the constraints of a systematic literature review, such as potential selection bias in the sources analyzed and the likelihood that rapidly evolving data literacy practices and technologies may outpace some findings. However, the study's implications are significant as it provides actionable insights for academic libraries to enhance data literacy education.

Keywords: *Data Literacy, Data Skills, Library Programs, Library Instruction, Academic Libraries, Literature Review*

INTRODUCTION

In an era increasingly defined by data-driven decision-making, cultivating data literacy has become imperative for individuals and institutions alike. Data literacy—commonly understood as the ability to understand, analyze, interpret, and ethically use data—has evolved into a foundational competence across disciplines, including business, healthcare, the social sciences, and the arts (Atlan, 2023; Hannigan et al., 2023).

Beyond technical proficiency, data literacy enables individuals to engage critically with information, uncover patterns, and make evidence-based judgments. As such, it is no longer a peripheral or specialized skill but a core requirement for meaningful participation in academic, professional, and civic life.

Within higher education, this growing demand has reshaped expectations for both students and faculty. Students are increasingly required to engage with data in empirical research, trend analysis, and evidence-supported argumentation, while faculty are expected to integrate data analysis and interpretation into teaching and research practices (Bowler & Shaw, 2024; Kjelvik & Schultheis, 2019; Ndukwe & Daniel, 2020).

For researchers, data literacy is essential not only for conducting rigorous studies but also

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for accurately interpreting and responsibly using research outputs (Tobin, 2024). At a societal level, data literacy plays a crucial role in enabling individuals to evaluate information critically, identify misinformation, and participate meaningfully in data-informed public discourse (Cui et al., 2023). As data increasingly informs policy development, institutional planning, and responses to global challenges, data literacy can be understood as a public good that supports informed, engaged, and resilient communities (Ruediger et al., 2022).

Against this backdrop, academic libraries have emerged as key institutional actors in advancing data literacy education. Traditionally positioned as centers for information access, literacy instruction, and lifelong learning, libraries are now expanding their mandates to address the growing complexity of data use in academic environments (Brodsky, 2019; Hutchins, 2024).

This shift reflects a broader transformation of libraries from repositories of information to active partners in teaching, research, and knowledge production. By leveraging their expertise in information organization, ethical information use, and user-centered instruction, academic libraries are uniquely positioned to support data literacy across disciplines and levels of study.

Despite this growing recognition, existing literature on data literacy in academic libraries remains fragmented and largely descriptive. Many studies document emerging practices, training initiatives, and service models, yet fewer critically synthesize how these efforts collectively shape libraries' role in data literacy education or examine the challenges and conditions that influence their effectiveness.

Moreover, integrative analysis that brings together approaches, best practices, challenges, and emerging trends to provide a coherent understanding of the current landscape remains limited. This gap is particularly significant as libraries are increasingly expected to lead or coordinate data literacy initiatives without clear frameworks or consolidated evidence to guide practice.

Responding to this need, the present study offers a systematic literature review that critically examines the role of academic libraries in fostering data literacy. Specifically, the study aims to: (1) explore the current landscape of data literacy education within academic libraries; (2) analyze the approaches libraries employ to equip users with essential data skills; (3) identify effective strategies for integrating data literacy instruction into library services; and (4) examine the challenges, best practices, and emerging trends shaping library-based data literacy programs. By synthesizing diverse strands of the literature, this study moves beyond isolated descriptions to offer a structured, analytical perspective on how academic libraries are responding to data literacy demands.

This study makes an original contribution by positioning data literacy as an extension of libraries' long-standing information literacy mission while critically examining how this expanded role reshapes library services, professional competencies, and institutional collaboration (Matteson & Gersch, 2020; Tewell, 2018).

By highlighting both enabling factors and persistent barriers, the findings offer actionable insights for librarians, educators, and academic leaders seeking to strengthen data literacy initiatives. Ultimately, this research underscores the strategic importance of academic libraries in cultivating data-literate communities and affirms their central role in supporting academic excellence, research innovation, and informed participation in the data-intensive knowledge society.

LITERATURE REVIEW

Importance of Data Literacy Education

Data literacy is increasingly positioned as an extension of information literacy, particularly in academic contexts. The Association of College and Research Libraries (ACRL) Framework for

Information Literacy for Higher Education provides a useful conceptual anchor, emphasizing threshold concepts such as authority, inquiry, and ethical information use. Situating data literacy within this framework allows for a more structured understanding of how individuals engage with data as both consumers and producers of knowledge (Condon & Pothier, 2022).

At the same time, foundational scholarship conceptualizes data literacy as a multidimensional construct that extends beyond technical competence. For instance, Tibor Koltay (2015) highlights the integration of analytical, interpretive, and critical capacities, while Cui et al. (2023) emphasize ethical awareness and responsible data practices. Collectively, these perspectives suggest that data literacy should be understood not merely as a set of discrete skills but as a holistic and context-dependent competency, particularly relevant in academic library environments.

Across the literature, there is strong agreement that data literacy constitutes a core competency in higher education and beyond. Rather than presenting isolated findings, existing studies reveal several recurring patterns. First, data literacy is consistently associated with improved evidence-based decision-making and knowledge construction. Studies indicate that individuals equipped with data literacy skills are better positioned to interpret complex information and contribute meaningfully to academic and societal discourse (Cui et al., 2023; Kjølsvik & Schultheis, 2019).

Second, data literacy is often discussed alongside other literacies, particularly information and digital literacy. Virkus and Garoufallou (2020) argue that these literacies are deeply interconnected, creating both conceptual overlap and opportunities for integration. Similarly, Koltay (2015) underscores the importance of approaching data literacy as part of a broader literacy ecosystem rather than as an isolated domain.

Third, despite general agreement on its importance, the literature points to persistent inconsistencies in definition, scope, and implementation. Henderson and Corry (2020) note that variations in conceptualization often lead to fragmented instructional approaches, highlighting the need for more coherent frameworks to guide practice.

Data literacy education is a crucial aspect of professional development, particularly in education. Henderson and Corry (2020) conducted a literature review on data literacy for K-12 teachers and leaders and found that while the concept has become more concrete, disagreement remains about its parameters. This highlights the importance of ongoing data literacy education and training to ensure educators have the skills to use data effectively in practice. Suratno et al. (2024) highlight digital literacy, its impact on everyday life, and the need to integrate it into the education system.

This study shows that strengthening digital literacy in education policy positively prepares young people for the challenges and opportunities of the digital age. Furthermore, Harmoko (2021) highlighted the importance of digital literacy education in improving human resource quality, particularly in preparation for Indonesia's demographic bonus in 2030-2040.

Moreover, as cited in Tas (2024), data serves as the foundation for knowledge and value creation and underpins informed decision-making. To systematically extract knowledge and data in the future, all sectors and disciplines must handle data purposefully. These studies collectively emphasize the importance of data literacy education in enhancing professional competencies and improving overall workforce quality.

While data literacy education often focuses on professional development, financial literacy also plays a crucial role in sustainable entrepreneurship. Burchi et al. (2021) examined the effects of financial literacy on entrepreneurship, highlighting the interconnectedness of financial knowledge and entrepreneurial success. This underscores the importance of a multidimensional approach to literacy education that encompasses both data literacy and financial literacy, fostering

well-rounded professionals who can make sound decisions in their respective fields.

In conclusion, the literature reviewed underscores the importance of data literacy education in various professional contexts, from education to entrepreneurship. Ongoing training and education in data literacy are essential to ensure professionals have the skills to navigate an increasingly data-driven world. By incorporating data literacy education into professional development programs, individuals can enhance their competencies and contribute to overall workforce quality and sustainability. Bauder argued that:

“While the question of whether data literacy should be in the instruction portfolios of all liaison and/or instruction librarians remains, libraries need to provide the proper training and support for librarians to take on leadership roles and develop a deeper understanding of how campus stakeholders are using and working with data” – Bauder (2021), as cited in Hogenboom, Phillips, and Hensley.

Overall, data literacy and the ability to effectively handle and interpret data are increasingly vital skills, as they enable individuals and organizations to transform raw data into meaningful insights that support better decisions and innovation across fields. Modern society's growing reliance on data underscores the need for individuals to develop competencies in collecting, analyzing, and interpreting information responsibly.

With strong data-handling skills, people can discern patterns, scrutinize evidence, and make informed decisions rather than relying solely on assumptions or incomplete information. Consequently, strengthening data literacy across disciplines not only improves decision-making but also promotes efficiency, transparency, accountability, and innovation in addressing complex problems across sectors.

Role of Academic Libraries in Data Literacy Education

A cross-analysis of studies reveals that academic libraries are increasingly recognized as key actors in advancing data literacy, though their roles continue to evolve. One major trend is the shift from traditional support services to active instructional and research partnerships. Libraries are no longer limited to providing resources; they are becoming integral to teaching and research processes (Brodsky, 2019; Tzanova, 2020). This transformation aligns with broader developments such as open science and research data management initiatives.

Another recurring theme is libraries' positioning across the data lifecycle, including data creation, organization, preservation, and sharing. Boté-Vericad and Healy (2022) emphasize that this lifecycle approach enables libraries to support more comprehensive and sustainable data practices.

However, implementation remains uneven across institutions, often constrained by available resources and expertise. Additionally, the literature highlights significant variability in institutional capacity, with some libraries demonstrating advanced data services while others remain in early developmental stages (Chiware, 2020). This disparity underscores how local context shapes data literacy initiatives.

Academic libraries play a crucial role in data literacy education by supporting teaching, learning, and research priorities across educational settings. Psaki et al. (2019) highlighted the potential impact of adolescent childbearing on literacy and numeracy skills, emphasizing the importance of continuous education beyond school. Rafi et al. (2019) focused on integrating technology into students' information and digital literacy education in academic libraries, using statistical techniques to assess students' technological competence.

Soltani and Nikou (2020) explored the information literacy skills of international and

domestic students at Finnish universities, showcasing the diverse ways academic library services are utilized. [Guo and Huang \(2020\)](#) examined information literacy education in China's mobile environment, focusing on how university libraries enhance students' data literacy. [Aharony et al. \(2019\)](#) surveyed information literacy instructional practices in Israeli academic libraries to understand how librarians use methods to enhance students' information literacy skills.

[Tzanova \(2020\)](#) discussed the changes in academic library services driven by the Open Science movement, emphasizing the importance of data science literacy and research data management. [Ocran and Afful-Arthur \(2021\)](#) assessed the role of digital scholarship in academic libraries at the University of Cape Coast, highlighting the opportunities and challenges faced in integrating digital scholarship into library services. [Rizal and Rodin \(2021\)](#) analyzed how libraries can strengthen scholarly communication, emphasizing their role in facilitating academic research and communication.

[Kostyrko \(2022\)](#) discussed the impact of digital transformations on university libraries, emphasizing libraries' role in implementing Open Science and Open Education initiatives. [Dei and Asante \(2022\)](#) explored the role of academic libraries in achieving quality education as a Sustainable Development Goal, highlighting libraries' significance in promoting educational development. Academic libraries play a crucial role in enhancing data literacy education and helping students develop essential skills for academic success and research.

Instructional practices in data literacy exhibit both commonalities and variations across institutions. Common approaches include workshops, embedded instruction, online modules, and hands-on training sessions. These methods reflect a shared emphasis on active and experiential learning, often tailored to disciplinary contexts.

However, institutions differ in how fully they integrate data literacy into formal curricula. Some institutions adopt fully embedded models through faculty collaboration, while others rely on standalone sessions or optional programming. Additionally, instructional focus varies from foundational competencies to more advanced analytical skills, depending on institutional priorities and learner needs. These variations suggest that while there is broad agreement on pedagogical strategies, no single dominant model exists, reinforcing the importance of adaptable, context-sensitive approaches.

Recent scholarship points to a shift toward more integrated and forward-looking approaches to data literacy in academic libraries. These include expanding online and hybrid learning environments, developing dedicated data spaces such as data labs, and aligning more closely with open science practices. Notably, there is also a growing emphasis on ethical and critical engagement with data, reflecting broader societal concerns about data privacy, bias, and responsible use. This trend reinforces the view of data literacy as a comprehensive competency that extends beyond technical proficiency.

Taken together, the literature reveals three key insights. First, while there is general agreement on the importance and scope of data literacy, implementation remains inconsistent across institutions. Second, academic libraries are playing increasingly central roles, yet standardized frameworks do not always guide their practices. Third, theory-informed, integrative approaches are still needed to move beyond descriptive accounts toward more cohesive models of practice. These gaps highlight the need for further research on how academic libraries can systematically develop and sustain data literacy initiatives within clearly defined conceptual frameworks.

RESEARCH METHOD

This study employed a systematic literature review to analyze the role of academic libraries in data literacy education over ten years, from January 2014 to January 2024. The systematic review

followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) framework to ensure a rigorous and transparent process (Haddaway et al., 2022). Document analysis systematically examined the selected articles through detailed review and coding to identify key themes, trends, methodologies, and findings related to data literacy education in academic libraries.

The PRISMA flow diagram also illustrated the selection process, including the phases of identification, screening, eligibility, and inclusion, ensuring clarity and transparency in the methodology and study selection. The literature search covered three major databases: EmeraldInsight, ProQuest, and ScienceDirect. The search terms were designed to capture relevant literature comprehensively: ("Data literacy" OR "data skills" OR "data competencies") AND "Academic libraries" AND ("Library instruction" OR "library education" OR "library programs").

Table 1. Search Terms, Inclusion and Exclusion Criteria

Particular	
Keywords	("data literacy" OR "data skills" OR "data competencies") AND "academic libraries" AND ("library instruction" OR "library education" OR "library programs")
Search Fields	Abstract, title, keywords
Time Window	January 2014 - January 2024
Language	English
Document Type	Peer-reviewed articles only
Source Type	Journals only
Exclusion Criteria	Not related to academic library Not related to data literacy Duplicates No full text available Not empirical research

Two authors screened the identified records for inclusion or exclusion, with a third author arbitrating tied decisions. The search focused on articles published over the specified period. To include relevant, high-quality studies, we applied the following criteria: articles were in English; they included pertinent information in the title, abstract, or keywords; and they were peer-reviewed journal articles to ensure academic rigor. The initial search retrieved 3,250 articles, which underwent a thorough screening process to remove duplicates and apply the exclusion criteria, resulting in 48 unique articles selected for inclusion in the study (See Table 3).

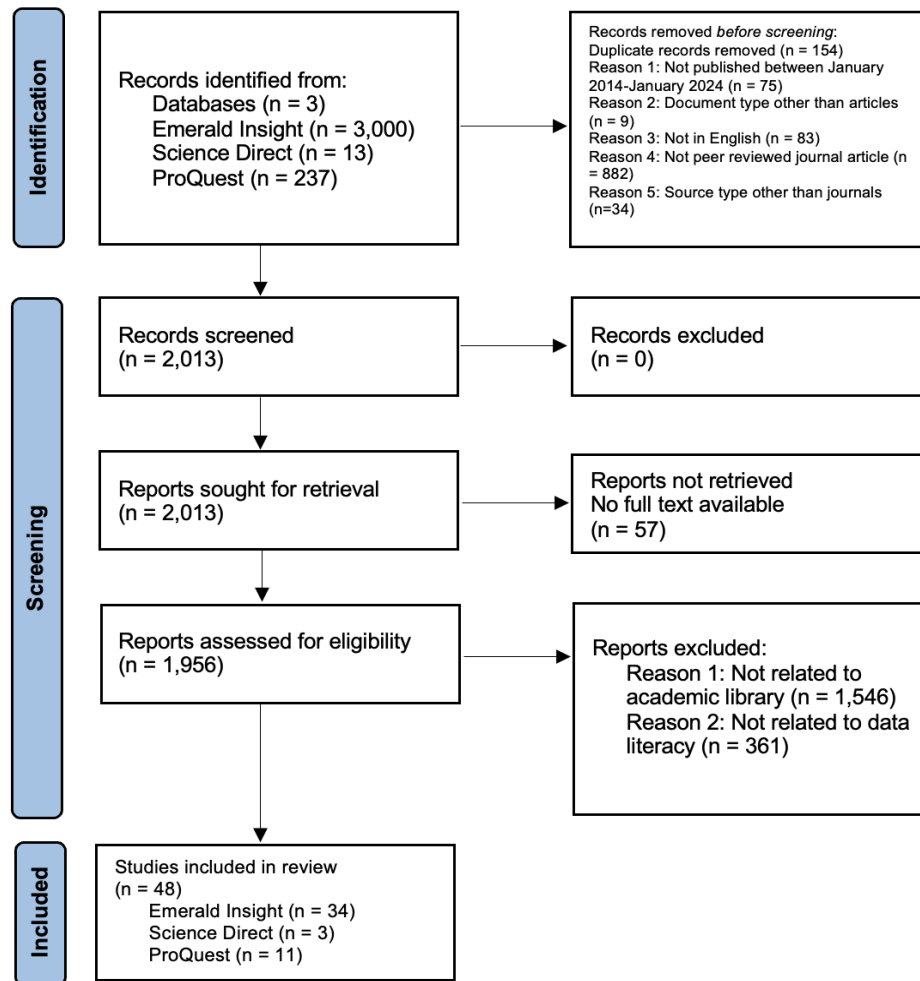


Figure 1. PRISMA Flow Diagram

FINDINGS AND DISCUSSION

Table 2. The distribution of articles across databases highlights EmeraldInsight's predominant role in publishing research on academic libraries and data literacy education. Of the total articles analyzed, EmeraldInsight accounts for the majority, with 34 articles, representing 70.8% of the total. This indicates a strong concentration of relevant research in this database, suggesting it as a key resource for scholars in this field.

ProQuest follows with 11 articles, comprising 22.9% of the total. This contribution underscores ProQuest's role as another important repository for research on this topic, though with a smaller share than EmeraldInsight. ScienceDirect has 3 articles, making up 6.3% of the total. Although it represents a smaller share, the articles in ScienceDirect indicate cross-disciplinary interest in data literacy education within academic libraries, extending beyond traditional library and information science databases.

Table 2. Databases with the Total Average of Published Articles

Database	Articles	Persentase
EmeraldInsight	34	70.8%
ProQuest	11	22.9%
ScienceDirect	3	6.3%
Total	48	100%

Figure 2. The analysis of publications from 2014 to 2024 reveals a dynamic, evolving landscape in academic discourse on the role of academic libraries in data literacy education. The trend demonstrates a growing interest and increasing scholarly output over the decade, with notable fluctuations in certain years.

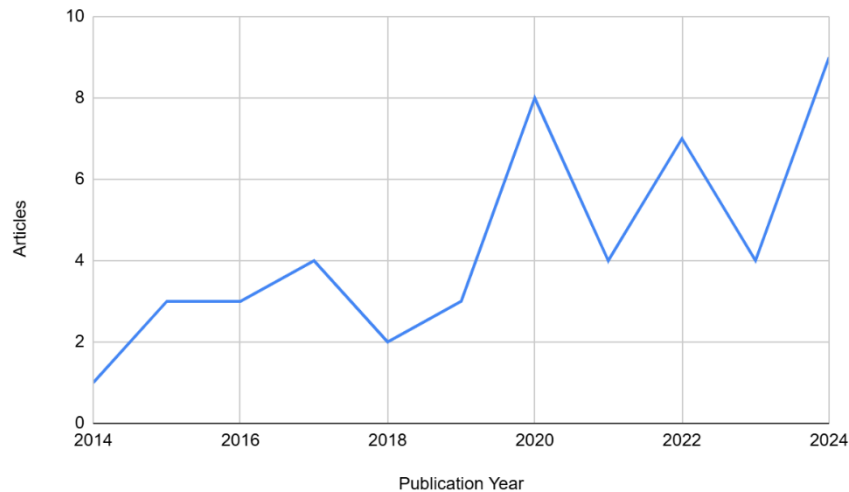


Figure 2. Number of Articles Published

In 2014, the topic garnered attention with a single publication. The subsequent year, 2015, saw a moderate increase, tripling the output to three articles. This level of interest continued in 2016, with another three articles published. A more significant rise occurred in 2017 with four articles, indicating a growing recognition of the importance of data literacy education in academic libraries.

However, 2018 experienced a slight decline to two publications, suggesting a brief period of reduced emphasis or a possible shift in research focus. The number of articles returned to three in 2019, followed by a substantial surge in 2020 with eight publications. This peak may reflect the growing integration of data literacy initiatives within academic libraries and the broader impact of the COVID-19 pandemic, which increased reliance on digital resources and data proficiency. Despite a drop to four articles in 2021, the topic regained momentum in 2022, matching the previous high of eight publications. In 2023, interest remained strong, with four articles.

The most significant finding is the marked increase in 2024, with nine articles, the highest annual output observed over the analyzed period. This suggests growing scholarly interest and underscores the critical role academic libraries increasingly play in fostering data literacy. In summary, the findings indicate a positive trend toward greater engagement and research activity in data literacy education within academic libraries, highlighting its emerging significance in the academic community.

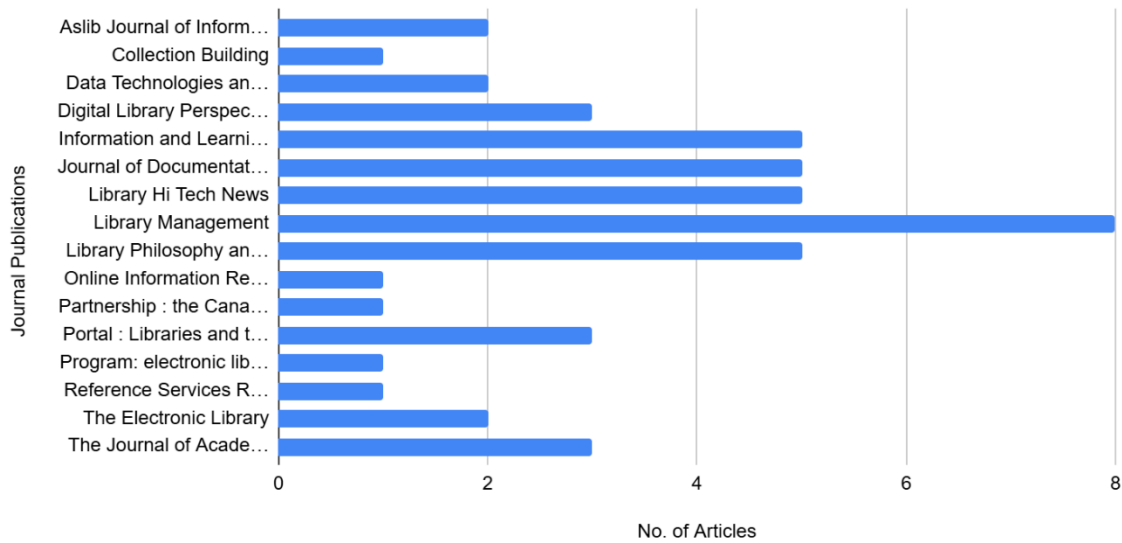


Figure 3. Number of Articles Published in the Journal

Figure 3. Analysis of journal publications on the role of academic libraries in data literacy education reveals diverse, widespread interest across multiple journals. Library Management leads with 8 articles, underscoring its focus on integrating data literacy into library practices.

Information and Learning Sciences, Journal of Documentation, Library Hi Tech News, and Library Philosophy and Practice each published 5 articles, highlighting these journals' significant engagement with data literacy from various angles. The Journal of Academic Librarianship follows with 3 articles, reflecting its emphasis on the academic aspects of librarianship.

Table 3. List of articles included in the review

No.	Author	Publication Year	Title	Journal
1	Adika, Fredrick Odhiambo; Kwanya, Tom	2020	Research data management literacy amongst lecturers at Strathmore University, Kenya	Library Management
2	Ahmad, Khurshid; JianMing, Zheng; Rafi, Muhammad	2019	An analysis of academic librarians' competencies and skills for implementation of Big Data analytics in libraries	Data Technologies and Applications
3	Ahmad, Khurshid; JianMing, Zheng; Rafi, Muhammad	2020	Librarian's perspective for the implementation of big data analytics in libraries based on the lean-startup model	Digital Library Perspectives
4	Ajibade, Patrick; Muchaonyerwa, Ndakasharwa	2023	The importance of data mining, user information behavior and interaction audit for information	Library Hi Tech News

			literacy	
5	Ashiq, Murtaza; Warraich, Nosheen Fatima	2024	Librarian's perception on data librarianship core concepts: a survey of motivational factors, challenges, skills and appropriate training platforms	Library Hi Tech News
6	Borkakoti, Rituraj; Singh, Sanjay Kumar	2021	Research Data Management in Central Universities and Institutes of National Importance: a perspective from North East India	Library Philosophy and Practice
7	Bowler, Leanne; Lopatovska, Irene; Rosin, Mark S.	2024	Teen-adult interactions during the co-design of data literacy activities for the public library: insights from a natural language processing analysis of linguistic patterns	Information and Learning Sciences
8	Bishop, Bradley Wade; Borden, Rose M	2020	Scientists' Research Data Management Questions: Lessons Learned at a Data Help Desk	Portal: Libraries and the Academy
9	Burrell, Theresa; Mann, Emily; Neville, Tina	2020	Exploring data literacy via a librarian-faculty learning community: A case study	The Journal of Academic Librarianship
10	Cheung, Melissa; Cooper, Alexandra; Dearborn, Dylanne; Hill, Elizabeth; Johnson, Erin; Mitchell, Marjorie; Thompson, Kristi	2022	Practices Before Policy: Research Data Management Behaviors in Canada	Partnership: The Canadian Journal of Library and Information Practice and Research
11	Chiwara, Elisha R. T.	2020	Open research data in African academic and research libraries: a literature analysis	Library Management
12	Chiwara, Elisha R. T.	2020	Data librarianship in South African academic and research libraries: a survey	Library Management
13	Chollom, K M; Michael, Obaje Alfred; Adigun, T. A.	2023	Characteristics and Nature of Academic Staff's User Experiences in Electronic	Library Philosophy and Practice

			Library Database Utilization	
14	DeLuca, Lisa	2016	Navigating United Nations data sources	Collection Building
15	Dulla, Nisrutha; Sahoo, Malabika; Priyadarshini, Sugyanta; Mishra, Sumita	2022	Leveraging the Digital Space for Social Science Research: Data Exploration for Information Literacy	Library Philosophy and Practice
16	Evans, Sarah Amber; Hong, Lingzi; Kim, Jeonghyun; Rice-Oyler, Erin; Ali, Irhamni	2024	Community college students' self-assessment of data literacy: exploring differences among demographic, academic, and career characteristics	Information and Learning Sciences
17	Graves, Stephanie J.; Anders, Kathy Christie; Balester, Valerie M.	2017	Mining writing center data for information literacy practices	Reference Services Review
18	Ismail, Nazia; Asghar, Mahe Bushra; Al Shaheer, Muhammad Ahmad	2021	Predicting LIS scholarly research directions in the era of Data Science	Library Philosophy and Practice
19	Johansson, Veronica; Stenlund, Jörgen	2022	Making time/breaking time: critical literacy and politics of time in data visualization	Journal of Documentation
20	Joo, Soohyung; Schmidt, Gisela M.	2021	Research data services from the perspective of academic librarians	Digital Library Perspectives
21	Katulić, Anita; Katulić, Tihomir; Grgić, Ivana Hebrang	2022	Application of the principle of transparency in processing of European national libraries' patrons' personal data	Digital Library Perspectives
22	Koltay, Tibor	2015	Data literacy: in search of a name and identity	Journal of Documentation
23	Koltay, Tibor	2017	Research 2.0 and Research Data Services in academic and research libraries: priority issues	Library Management
24	Li, Ak Wai; Sinnamon, Luanne S.; Kopak, Rick	2022	Exploring learning opportunities for students in open data portal use across data literacy levels	Information and Learning Sciences
25	Liu, Xia; Ding, Ning	2016	Research data management in	The Electronic Library

			universities of central China: Practices at Wuhan University Library	
26	McDowell, Kate; Turk, Matthew J.	2024	Teaching data storytelling as data literacy	Information and Learning Sciences
27	Melvin, Darnelle Omar	2014	Managing Metadata Interoperability within Audio Preservation Framework: Integrating the Metadata Encoding & Transmission Standard (METS) and Multichannel Source Material into Digital Library Audio Collections	Library Philosophy and Practice
28	Mosha, Neema Florence; Ngulube, Patrick	2023	Teaching research data management courses in higher learning institutions in Tanzania	Library Management
29	Mthembu, Mpilo Siphamandla; Ocholla, Dennis N.	2024	Research data management competencies of researchers in selected public universities in South Africa	Library Management
30	Nero, Neil; Langley, Anne	2017	Subject Liaisons in Academic Libraries: An Open Access Data Set from 2015	Portal: Libraries and the Academy
31	Oakleaf, Megan	2016	Getting Ready & Getting Started: Academic Librarian Involvement in Institutional Learning Analytics Initiatives	The Journal of Academic Librarianship
32	Oh, Sein; Mon, Lorri	2024	Community-based learning and data literacy: the role of the public library	Information and Learning Sciences
33	Oyelude, Adetoun A.	2022	Innovatively doing data design in libraries in the fourth industrial revolution (4IR)	Library Hi Tech News
34	Raffaghelli, Juliana Elisa; Manca, Stefania	2023	Exploring the social activity of open research data on ResearchGate: implications for the data literacy of researchers	Online Information Review

35	Robinson, Lyn; Bawden, David	2017	"The story of data"	Library Management
36	Rod, Alisa B.; Isuster, Marcela Y.; Chandler, Martin	2021	Love Data Week in the time of COVID-19: A content analysis of Love Data Week 2021 events	The Journal of Academic Librarianship
37	Sant-Geronikolou, Stavroula	2018	Understanding in-library use data lifecycle within Greek and Spanish higher education ecosystems	Library Hi Tech News
38	Searle, Samantha; Wolski, Malcolm; Simons, Natasha; Richardson, Joanna	2015	Librarians as partners in research data service development at Griffith University	Program: electronic library and information systems
39	Si, Li; Xing, Wenming; Zhuang, Xiaozhe; Hua, Xiaoqin; Zhou, Limei	2015	Investigation and analysis of research data services in university libraries	The Electronic Library
40	Sukovic, Suzana	2024	Just the way my brain works: capabilities for working with data in non- clinical practice	Journal of Documentation
41	Travis, Tiffini A; Ramirez, Christian	2020	Big Data and Academic Libraries: The Quest for Informed Decision-Making	Portal: Libraries and the Academy
42	Vilar, Polona; Zabukovec, Vlasta	2019	Research data management and research data literacy in Slovenian science	Journal of Documentation
43	Virkus, Sirje; Garoufallou, Emmanouel	2020	Data science and its relationship to library and information science: a content analysis	Data Technologies and Applications
44	Wang, Lin	2018	Twinning data science with information science in schools of library and information science	Journal of Documentation
45	Xiao, SiZhe; Ng, Tsz Yan; Yang, Tao T.	2022	Research data stewardship at the University of Hong Kong	Library Management
46	Yan, Chunlai; Li, Hongxia; Pu, Ruihui; Deeprasert, Jirawan; Jotikasthira, Nuttapong	2024	Knowledge mapping of research data in China: a bibliometric study using visual analysis	Library Hi Tech News
47	Yoon, Ayoung;	2019	Understanding social	Aslib Journal of

	Copeland, Andrea		impact of data on local communities	Information Management
48	You, Sukjin; Joo, Soohyung; Katsurai, Marie	2024	Data mining topics in the discipline of library and information science: analysis of influential terms and Dirichlet multinomial regression topic model	Aslib Journal of Information Management

Digital Library Perspectives and Portal: Libraries and the Academy each had 3 articles, showing their consistent interest in digital and academic library innovations. Journals such as Aslib Journal of Information Management, Data Technologies and Applications, and The Electronic Library published 2 articles each, indicating a focused yet notable interest in this area.

Additionally, Collection Building, Online Information Review, Partnership: the Canadian Journal of Library and Information Practice and Research, Program: electronic library and information systems, and Reference Services Review each contributed 1 article, demonstrating the relevance of data literacy education across a wide range of library and information science journals. In summary, the findings suggest a growing presence and recognition of the importance of data literacy education in academic libraries, explored through diverse perspectives in the field.

Current Landscape of Data Literacy Education within Academic Libraries

The current landscape of data literacy education shows that academic libraries are actively delivering data literacy training to staff, students, and faculty to develop competencies essential for academic and professional success, particularly in areas such as research data management ([Evans et al., 2023](#)). This education encompasses a wide range of dimensions, including data consciousness, data capabilities, data ethics, and technical skills such as data analysis, visualization, and data management planning ([Yan et al., 2024](#); [Evans et al., 2023](#)).

University-wide data literacy initiatives are increasingly evident, with librarians and faculty collaborating to embed data-focused assignments and instructional support into curricula and library services, highlighting the need to reskill both librarians and faculty to deliver data literacy education effectively ([Ashiq & Warraich, 2024](#)). Within academic libraries, data literacy efforts also involve developing specialized competencies, providing data consultation services, and supporting research data management across the entire data lifecycle, including planning, curation, metadata creation, and data conversion ([Koltay, 2015](#)).

Overall, data literacy in academic libraries is viewed as a continuum of scientific and investigative learning that begins in early education and becomes more specialized in higher education, emphasizing the gradual development of critical thinking skills through the integration of information and data literacy.

Various Approaches for Equipping Users with Data Skills in Libraries

Academic libraries use a range of approaches to equip users with essential data skills, including training programs such as workshops, seminars, and in-house sessions designed to strengthen data literacy and data management competencies ([Chiware, 2020](#); [Mthembu & Ocholla, 2024](#); [Oh & Mon, 2024](#)). To increase accessibility, libraries also offer online data literacy courses, enabling homebound users and individuals with disabilities to participate in data skills training ([Chiware, 2020](#)).

Collaboration with professional bodies further supports specialized instruction in areas such as data curation, metadata creation, and data management planning (Mthembu & Ocholla, 2024; Oh & Mon, 2024). In addition, academic libraries work closely with universities to integrate data literacy into academic curricula, ensuring that students acquire essential data skills as part of their formal education (Searle et al., 2015; Oh & Mon, 2024).

Libraries also organize customized, hands-on workshops tailored to specific disciplines, such as Data Carpentry sessions facilitated by eResearch staff with expertise in fields like bioinformatics and geoinformatics (Oh & Mon, 2024). Continuous professional development through workshops, conferences, and independent study helps librarians stay current in data-related knowledge and practices (Mthembu & Ocholla, 2024; Ashiq & Warraich, 2024).

Moreover, libraries adopt interdisciplinary approaches to data science education to address the complex nature of data services provision (Searle et al., 2015), and some establish specialized data science labs within library spaces to provide hands-on experience in data analysis, manipulation, and long-term data preservation (Ashiq & Warraich, 2024).

Effective Strategies for Integrating Data Literacy Instruction into the Academic Library Setting

Best practices in data literacy education within academic libraries emphasize strong collaboration between disciplinary faculty and librarians to ensure cohesive, effective integration of data information literacy skills into academic programs (Evans et al., 2023). Providing specialized data literacy training for librarians, particularly in data management and data analysis, is considered essential to equip them with the competencies needed to support students and faculty (Evans et al., 2023).

Integrating data literacy into the academic curriculum through mechanisms such as faculty learning communities and campus-wide data literacy frameworks helps embed data literacy across different levels and disciplinary contexts (Evans et al., 2023). Continuous professional development and re-skilling of both librarians and faculty are also highlighted as critical to keeping pace with evolving data skills and knowledge, thereby strengthening instructional capacity (Ashiq & Warraich, 2024; Evans et al., 2023).

Moreover, adopting an interdisciplinary approach to data science education allows academic libraries to address diverse user needs and foster a holistic understanding of data literacy. In contrast, organizing hands-on workshops, seminars, and training programs within library settings provides practical experience in data analysis, manipulation, and data management that further enhances users' data literacy skills.

Challenges, Best Practices, and Emerging Trends in Library-Based Data Literacy Programs

Academic libraries face several challenges in implementing effective data literacy programs, including the lack of clear data policies and insufficient infrastructural support, which significantly hinder program development and sustainability (Ashiq & Warraich, 2024). Human resource issues further complicate these efforts, as libraries often struggle with a shortage of experienced staff, resistance to adopting new data-related roles, and the need for stronger cooperation between libraries and academic institutions (Ashiq & Warraich, 2024).

Additionally, the complexity of collaboration, limited technical resources, and the rapid pace of technological change remain ongoing obstacles to delivering data literacy initiatives successfully. The absence of strong national leadership, coupled with some library professionals' reluctance to assume data-centric roles and a lack of adequate qualifications and skills, also impedes progress in this area (Ashiq & Warraich, 2024; Oh & Mon, 2024).

Moreover, accessibility barriers, such as limited access to the internet, technology, and specialized software, restrict the reach and effectiveness of data literacy training, particularly for the general public.

Best Practices

Best practices in data literacy education emphasize strong collaboration among libraries, academic institutions, and professional bodies to improve the effectiveness and reach of data literacy programs and promote a comprehensive approach to data education (Ashiq & Warraich, 2024). Continuous professional development for librarians and faculty is also essential to ensure they have the necessary, up-to-date skills to deliver effective data literacy instruction (Ashiq & Warraich, 2024). Additionally, integrating data literacy into academic curricula through faculty learning communities and campus-wide frameworks supports a systematic and sustainable approach to data education within academic libraries.

Emerging Trends

Emerging trends in data literacy within academic libraries highlight the growing adoption of online training programs, which expand access to data skills education for homebound users and individuals with disabilities (Oh & Mon, 2024). Libraries are also increasingly embracing an interdisciplinary approach to data science education, allowing them to address diverse user needs and promote a more holistic understanding of data literacy across various disciplines (Rafi et al., 2019).

Additionally, specialized data science labs within libraries are gaining prominence, providing users with hands-on opportunities to engage in data analysis, data manipulation, and long-term data preservation (Ashiq & Warraich, 2024).

CONCLUSIONS

In conclusion, this study highlights the growing integration of data literacy education into academic library programs and services. Despite this trend, many academic libraries still do not offer data literacy programs, potentially due to a lack of resources or training. The findings underscore the crucial role of academic libraries in promoting data literacy education, empowering communities to become critical users and producers of data.

The research outcomes are valuable for librarians, educators, and researchers aiming to enhance data literacy education within academic institutions. Beyond these practical insights, the findings also reveal important theoretical and conceptual implications for data literacy education and the evolving mission of academic libraries.

Conceptually, the study reinforces that data literacy extends beyond technical skills to encompass critical thinking, ethical reasoning, and analytical interpretation—positioning it as a multidimensional literacy aligned with long-standing information literacy frameworks. This situates data literacy within the broader intellectual and pedagogical landscape of libraries, suggesting that academic libraries are transitioning from information service providers to active partners in data-driven learning and research ecosystems.

The results also indicate a fundamental shift in academic libraries' professional identity and institutional mission. As data becomes central to academic work, libraries are adopting expanded roles such as data educators, data consultants, and data stewards. These evolving roles signify a reconceptualization of the library's mission: from supporting information access to enabling deeper engagement with data as a core academic practice. This mission shift reflects broader transformations in higher education where data-driven inquiry, digital scholarship, and interdisciplinary collaboration are increasingly essential.

Practically, the study shows that data literacy initiatives in academic libraries include workshops, training programs, online resources, and collaborations with faculty and other campus stakeholders. Challenges identified include resource constraints, staff training needs, and the evolving landscape of data technologies.

However, opportunities exist to foster interdisciplinary collaborations, leverage emerging technologies, and promote a data-informed culture. By addressing these challenges and seizing opportunities, academic libraries can empower individuals with the data literacy skills needed to succeed in the digital age.

Overall, this research affirms that strengthening data literacy is both a strategic imperative and a conceptual expansion of the library's educational mission, highlighting the central role libraries play in cultivating data-literate academic communities. Future research should continue exploring emerging trends, innovative practices, and the evolving role of libraries in data literacy education to advance knowledge and best practices, ensuring libraries remain integral to supporting academic excellence and research innovation.

LIMITATION & FURTHER RESEARCH

While this study provides valuable insights into academic libraries' role in fostering data literacy, it is important to acknowledge several limitations. The systematic literature review method relies on the availability and accessibility of published research, which may introduce selection bias if relevant studies are not included in the reviewed databases.

Additionally, the rapid evolution of data technologies and educational practices means that some findings may quickly become outdated, necessitating continuous updates to the research. Despite these limitations, this study's implications are significant. By identifying effective strategies, challenges, and emerging trends, this research offers actionable guidance for academic libraries aiming to enhance data literacy education.

It underscores the necessity for libraries to adapt to technological advancements and changing educational needs, promoting a proactive approach to equip users with essential data skills. Consequently, the study contributes to the academic discourse on data literacy and provides practical recommendations for libraries to support academic excellence and research innovation in a data-driven world.

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