CHAPTER 18

Engaging Communities to Build a Culture of Data Mutualism with Limited Resources

Jill Krefft, Jamie Rogers, Molly Castro, Elana Karshmer, and Rebecca Bakker

In the early 2000s, advances in data capture, storage, and analysis led to increased possibilities in the depth and breadth of data-driven research.[1] Reproducibility, research integrity, and institutional recognition also served as impetus for developing services to support institutional knowledge sharing.[2] What has followed is an awareness within the academic community regarding the importance of data management. As many universities were responding to the expanding research needs of students and faculty, funding agencies also began to add data management plans (DMPs) to their lists of proposal requirements.

CC BY NC ND

The Libraries at Florida International University (FIU) identified the pressing need for centralized data support (the Libraries will be referred to as "Library" throughout this chapter with the understanding that FIU is a multi-campus multi-library institution). However, while the university is a large R1 public university, with a strong commitment to facilitating student and faculty success in research, the Library operates within a resource-constrained environment. As outlined in OCLC's *The Realities of Research Data Management,* the Library understood early on that research data management (RDM) "is not a monolithic set of services duplicated across universities. It is a customized solution shaped by a range of internal and external factors operating on local decision making."[3] An understanding of the current research environment, the needs of researchers, and the Library's available resources was essential. Following a comprehensive survey of the university community in 2012, the Library utilized the findings to adopt a responsive strategy to build data services, including university engagement and collaboration. It was through these grassroots efforts the Library was able to deploy comprehensive data services, including RDM infrastructure, creating an interdisciplinary data culture guided by principles of data mutualism.

Borrowing from a concept in biological sciences used to describe a phenomenon such as pollination in plant/animal symbiosis, "data mutualism" refers to the ways in which the Library provides data-related services, encompassing data literacy, research consultation, and data infrastructure in a mutually beneficial relationship with the user community. It represents a collaborative and symbiotic approach where both the Library and its users benefit from the exchange and utilization of data-positioning the library as "data pollinators" working across the institution.

At the FIU Library, the data mutualism model encompasses several key aspects for data management, publishing, and literacy:

1. Data literacy: The Library plays a vital role in promoting data literacy skills within the university community. This includes providing training and resources on data analysis, visualization, interpretation, and ethical considerations surrounding data use. By enhancing data literacy, the Library empowers researchers and students to work with data effectively, evaluate information critically, and make informed decisions based on evidence, while also building the data literacy skills of library faculty and staff.
2. Research consultation: The Library plays a substantial role in assisting researchers, faculty, and students in effectively managing their data throughout the research lifecycle. This includes providing guidance on data collection, organization, documentation, analysis, mapping and visualization, and archiving. By offering data consultation support, the Library enables researchers to enhance the quality and reliability of their data-driven research, contributing to their academic pursuits.

3. Infrastructure: The Library facilitates access to STEM- and humanities-based data resources, software for data manipulation and analysis, as well as platforms and services for the dissemination and archiving of research data. This includes a library-hosted repository for the long-term accessibility of student- and faculty-generated data. By promoting open and transparent access and use of data, the Library fosters collaboration, reproducibility, and the advancement of knowledge.

The data mutualism model fosters a collaborative and mutually beneficial relationship with the user community, and through these partnerships and the development of ongoing collaboration representing a variety of research areas, there are opportunities to grow and expand services creating strategic associations with existing data communities, even when resources are minimal. It is our intention with this chapter to walk the reader through the history of how the Library came to this data mutualism model as well as examples of our approach to collaboration in data services in the Library.

Background

The evolution of data services at FIU progressed gradually over many years, beginning with the founding of the Geographic Information Systems (GIS) Center in 1998. Initially funded by FIU's Academic Affairs and Sponsored Research, the GIS Center was created and placed strategically within the Library with the mission to serve as a centralized service hub benefitting teaching and research in geospatial sciences across the university. Since then, the GIS Center has played a major role in the development of collecting, storing, and providing access to a wide variety of geospatial data that support a variety of disciplines.

As the GIS Center's services continued to grow, it became apparent that faculty, researchers, and students needed support for broader data types, not just geospatial data. This was true not only at FIU but at other institutions as well. In a 2012 ACRL white paper on the "Current Practices and Plans for the Future," data curation was named one of the top ten trends in the academic library community.[4]

That same year, the GIS Center conducted a survey of graduate students and faculty to determine their data management needs. The survey results showed an overwhelming need for data storage and data support services, including tutorials and workshops. These results were true across all disciplines. In response to the survey results, the interim dean of libraries appointed a Task Force for Research Data Curation and Policy. The task force was charged with developing a planning and proposal document to depict the supporting staff structure, infrastructure, workflow, stakeholders, and funding models.

The resulting planning document was distributed in 2013 and proposed both a technical infrastructure and service model. This analysis indicated that efforts in data management at the institution were highly decentralized. The three tiers of services outlined

in the document included Data Management Planning, Data Management Support, and Data Sharing and Archiving. In addition, a proposal for the development of the Research Information Exchange Hub (RiCH) was made. The goal of RiCH was to develop a centralized information network connecting a research data repository with the institutional repository and sponsored research grant information while also providing a set of research tools and services. This planning document took a top-down approach and was resource-intensive.

While the planning document encompassed a wide range of services and infrastructure that the committee deemed to be ideal, it also demonstrated that both the Libraries and university were not equipped with the resources to begin providing all levels of services and related infrastructure at once. It was at this point that the Library initiated their collaborative and scaffolded approach to developing data services. Using the Research Data Lifecycle[5] as the broad categories of service, existing resources and skill sets within the Library were identified for each of the categories. Existing collaborations and relationships were then assessed and leveraged to meet the data needs within each category based on survey results.

In this data support model, the Library established themselves as vital partners in the research process, supporting the scholarly community by enabling them to navigate the data landscape more effectively, enhance their research impact, and contribute to the broader knowledge ecosystem. Strategic collaborations allow for the curation of library-based data resources and services to meet the unique needs of diverse disciplines and user communities.

Building a Data-Savvy Community

The core concepts informing public services include a focus on a variety of types of literacy. One type, especially—information literacy or IL—incorporates elements that can also be found in data literacy, visual literacy, and other literacies that FIU's data infrastructure model combines. Although IL is a highly specialized field composed of individual frames, knowledge practices, and dispositions that work together to demonstrate how individuals should interact with information to ensure it is used, created, cited, and understood, ACRL's *Framework for Information Literacy for Higher Education* offers a short definition that gets to the heart of the framework as a whole:

> …information literacy is the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning.[6]

This description can also be applied to the integration of processes and collaborations taking place within the Library's approach to data services.

Librarians and information professionals working with students and faculty to achieve research goals must be data literate to advise in evaluating, collecting, producing, and analyzing data, regardless of the researcher's discipline.[7] Data literacy has always been essential to STEM fields, but the integration of data collection and analysis techniques such as systematic review is becoming more common in humanities disciplines.[8] This has necessitated the adoption of research models that incorporate similar data methodologies in the social sciences and the humanities to ensure that these fields are as rigorous as their STEM cousins. Thus, collaboration with subject specialists is not only integral to understanding and meeting discipline-specific data needs within the data collection and curation process, but these subject specialists must also be prepared to discuss and manipulate data in increasingly more sophisticated ways. The collective endeavors of subject specialists, librarians, and information professionals in the Library are instrumental in supporting students and faculty to achieve their research goals.

In 2015, the Library began offering RDM workshops that covered many of the topics requested in the 2012 survey. These topics included DMPs, funder requirements, data formats, data analysis, data access, and data publishing. Initially, these workshops were offered to the entire university community. However, it was later decided to focus on providing these workshops to PhD students who were anticipated to be most likely to engage with RDM and least likely to have had formal training. As demand for the workshops grew beyond graduate students, the Library again began to offer these workshops to all students, faculty, and researchers. In addition to these synchronous learning opportunities, the Library began to gather and organize resources both within the libraries and across campus that supported students and faculty data literacy.

During this time, an advisory board primarily consisting of humanities and social sciences faculty was convened to assist in identifying technologies and services that would best meet their students' needs. Subsequently, the Library submitted an internal grant proposal to develop a space to support students and faculty in these disciplines. The proposal was successful, and the Digital Scholar Studio (DSS) at FIU Libraries was founded in 2016 as an active learning space, offering workshops, training sessions, software, hardware, and resources promoting the digital humanities, digital scholarship, and data literacy skills. The Library also hired a digital humanities librarian to provide technology support, workshops, and training to students and faculty through the DSS.

Following the founding of the DSS in 2017, a Data Services Initiative was launched as a library-wide effort to connect decentralized resources, tools, and data service points across the Library and the university as a whole. The group consisted of library faculty and staff in Digital Collections, GIS, Government Resources & Information Department, as well as Information & Research Services. The first phase of the initiative consisted of surveying existing skill sets within the Library, identifying partners within the university,

and identifying gaps in existing skill sets and services. The initiative group conducted an environmental scan of data services at peer and aspirational peer institutions, homing in on examples of distributed data service models. The initial findings indicated that existing expertise was heavily STEM-focused; thus, the Library developed additional services for the arts, social sciences, and humanities. The group then outlined twelve distinct areas of focus for data support services beginning with the research process, data collection and creation, data sources, metadata and documentation, data copyright and reuse, survey design, data management, data computing resources, data processing and preparation, data analysis, mapping and data visualization, and data presentation. Resource guides were subsequently developed for each area, pulling together existing library services and technologies, university services and technologies, trusted external repositories, and additional subject expertise. This collective effort culminated in the creation of a comprehensive data guide for faculty and students supporting all stages of the research data process.[9]

The centralization of data services within the Library not only provided a unified access point for FIU students and faculty, but it also streamlined the process of collaboration between library departments in providing data literacy training through the Digital Scholar Studio (DSS). As the DSS's popularity and offerings grew, so did awareness of our student and faculty needs based on current academic research data trends and the need for additional training of library personnel.

Since FIU doesn't have the resources to hire a dedicated data librarian—at some universities called a "databrarian"—the Library encourages a "data-savvy"[10] approach for current librarians and staff by providing time for professional development activities as well as partnerships with other divisions on campus. Librarians working with students and faculty to achieve research goals must be data literate in order to assist in producing, evaluating, and analyzing the meaning of the information collected. Thus, public services librarians across all disciplines must now be prepared to provide support for research that includes methodologies once expected only in STEM. Examples of the Library's data-savvy approach include supporting three librarians in pursuing Carpentries instructor certification with a group of faculty and staff from the Instructional & Research Computing Center (part of FIU's Division of Information Technology) with plans in the future to work together to offer Carpentries workshops.

As a combined impetus and result of the broad upskilling of FIU librarians, the Digital Scholar Studio was able to begin providing additional workshops to support data literacy skills across the university beginning in 2021. DSS workshops cover a wide range of topics related to general data literacy, survey data, data anonymization, RDM, Python scripting, and text analysis. These workshops are designed to cater to different skill levels, from beginners to advanced users, and provide both hands-on training and practical knowledge. The workshops offered by DSS are open to all members of the FIU community as well as external guests. In order to enhance offerings on more computationally and technically complex subjects, DSS has collaborated with various members of the university

community to expand its offerings and cater to diverse disciplinary interests. This has resulted in a broader reach and increased participation from not only the humanities but also social sciences and STEM. The Library also works directly with programs and funded projects to provide bespoke data support. For the Department of Biological Sciences NIH-funded MARC U*Stars Undergraduate Fellows program, the Library provides workshops that prepare undergraduates for graduate-level research by developing their data management, analysis, and research publishing skills.

When DSS invited students from the Google Developer Student Club (GDSC), a Google-sponsored student group focused on developing programming skills for all academic backgrounds, the participation increased significantly in a previously low-engagement area—undergraduates in non-humanities majors. Student presenters taught a workshop on PANDAS, a popular data manipulation package available for Python. By offering more computationally complex workshops, DSS also recruited a new group of users, expanding its importance and reach on campus. By partnering with campus organizations outside of the Library, we are able to increase visibility in both directions, bringing new student members to the GDSC as well.

Consultation and Contextual Learning

In addition to the workshops offered through the Digital Scholar Studio, the Library established a robust consultation program. Data consultation services are provided through several librarians, across departments, assisting students and faculty with research methods, data management, large sponsored research projects, class projects, and skill-building with digital scholarship methods. Data literacy is fundamental to digital scholarship, as many methods rely on either data input or result in producing a dataset.[11] Understanding how data fits into the scholarly conversation is crucial, and through consultations, librarians are able to establish where scholars are in their understanding of how to store, clean, and manipulate data. This is important to be able to provide effective support.

The idea that research skills can be connected to contextual learning is an important part of how services within the Library have developed in response to both user needs and developments within the field of librarianship. Whereas reference and instruction models of the past focused on helping users learn how to use resources with the end goal of training them to use databases for a specific purpose, the Association of College & Research Libraries (ACRL)'s *Framework for Information Literacy for Higher Education* now places stronger emphasis on the concepts surrounding research. Thus, the researcher looking for data sets will not only be taught where to find these resources but also will be able to discuss how the data can fulfill the research project being completed, the processes used to create the data, how to publish the data, and how to cite the data appropriately. This

knowledge is transferable to other projects within the field of research and in disparate areas. By incorporating a conceptual model instead of one based only on providing information, the Library emphasizes the transferability of skills and the importance of concepts, reinforcing many of the frames found in the ACRL document, such as demonstrating the cyclical nature of research and illustrating the interconnectedness of all research projects regardless of their ostensible discipline. This real-world application is especially important given that even though such connections seem easy, students and researchers often have difficulty understanding that research does not change; once goals and resources have been identified, the process remains the same and requires an iterative approach.

Along these lines, other outreach efforts in support of data literacy include class instruction sessions on topics ranging from creating digital exhibits to performing computational text analysis. Depending on the goals of the class, these sessions may require multiple meetings with teaching faculty in order to design scaffolded assignments that introduce the concepts of data literacy that are essential for working with digital scholarship platforms and methods. The Library also provides guidance to faculty and students on where and how to publish and archive data. These consultations typically focus on the deposit of data to FIU's research data repository (Dataverse). These consultations range from how to access and make a deposit to the organization of data, file formats for long-term access, metadata, and documentation.

While library staff make every effort to assist with research questions related to data, they are aware of their limitations, and scholars may be referred to other university areas if the questions are too discipline-specific and outside of the Library's expertise. To this end, the Library focuses their consultation work on general data best practices, data publishing resources, and technology instruction rather than trying to understand all methods that researchers are using. That said, if library faculty or staff have a personal research interest in an area or method (such as text analysis), or if a common question is popping up in consultation work, these instances may be seen as opportunities to further develop skills in those specific areas. Consultation work grows the Library's capacity by providing opportunities to both improve knowledge of research tools and methods, while also providing opportunities to grow the Library's referral network, by connecting researchers to disciplinary experts outside of the library.

It should also be recognized that many library personnel have existing expertise in data that they can and should draw on while providing data support to scholars. Library personnel are responsible for interacting with data in two meaningful ways. First, because of their responsibility for collecting statistics on gate counts, journal and database usage, technology lending, print usage, instruction and consultation, etc., they must be able to analyze and make data-driven decisions for the improvement and development of services. Second, collecting and analyzing this information is essential to ensuring that libraries can show universities they are essential to student and faculty success, allowing them to prove their worth to stakeholders and, hopefully, receive the most funding possible. As a field,

we are well aware of the importance of data for supporting the University's performance in national and international rankings—this existing expertise should not be discounted when developing a data-savvy team for research consultation.

Establishing Infrastructure for Data Collaboration

In 2016, during the transition of presidential administrations, librarians and archivists across the United States launched a national response to preserve public federal, state, and local governmental websites and data, particularly those related to climate and the environment. This period of change demonstrated both the importance of data curation and preservation as well as the gaps in infrastructure at many institutions.[12] Around this time, the Data Curation Network (DCN) was also conducting research to explore how institutions could leverage expertise and resources to better meet faculty data management needs.[13] The resulting findings of the DCN study indicated broad researcher dissatisfaction across many areas of RDM. This was another clear indication to the Library of the need to be responsive to changes and increases in data use.

To meet the needs of graduate students, the Library began the planning phase of an Electronic Theses and Dissertation (ETD) Data Pilot Program in May 2017. This was a collaboration between the University Graduate School and the University Libraries. The ETD Data Pilot Program was structured to provide several benefits to FIU graduate students, including 1) resources and support in areas of data management planning, data formats, documentation, and data archiving through an expanded service model; 2) increased value and visibility of graduate student research; 3) expanded opportunities for citation and re-use of graduate student data and research; and 4) practical exposure to managing data through the entire research data lifecycle in preparation for future professional activities as PIs on funded research projects. The ETD Data Pilot Program was very successful in regard to research data management training, awareness of services offered through the Institutional Repository, and expansion of publication best practices such as the use of ORCID. However, as students were directed toward discipline-specific data repositories, the Library began to see gaps in the availability of trusted data repositories for all disciplines.

The decision to build an institutional data repository aligned both with trends in academic libraries and was also identified as important institutional infrastructure that is seen at institutions with the Carnegie "Highest Research Activity" designation.[14] It was both a strategic initiative at the university level as well as means to fill a gap in library services. Dataverse, Harvard's open-source data repository software, was selected. The platform supports a wide range of disciplinary metadata schemas, follows FAIR data

principles, has a strong community of support, and provides the flexibility required to support a wide range of users at the university.

To secure funding for data repository infrastructure, an internal grant proposal was submitted. The proposal requested funds to bring up a locally hosted instance of Dataverse to support interdisciplinary datasets and provide a repository space for those researchers and disciplines that did not already have a readily available data repository. The proposal was awarded, providing the necessary funds to host Dataverse on FIU servers in coordination with FIU's Division of IT. The existing Institutional Repository coordinator led the Dataverse initiative. With the expansion of the institutional repository infrastructure to include a data repository, this role was expanded to Research and Data Repository coordinator. The launch of Dataverse required an in-house library developer to work with the Division of IT on technical implementation. The completed repository accepted its first dataset in 2019.

In 2021, a second proposal to expand the infrastructure to support Dataverse was awarded. The goal of this second internal grant was to expand research data infrastructure specifically to support data literacy for students through broader access to tools and workshops. While the Library's initial environmental scan in 2017 demonstrated that there was a large gap in services to support data needs in the social sciences, arts, and humanities, the highest usage of the data repository was in fact by the STEM faculty and students.

Once Dataverse was made available to the FIU community, library workshops began to evolve to support faculty and students in the use of Dataverse. There was an increase in consultations related to data archiving and data publishing, and users slowly began to recognize the Library as a resource and support for data management services.

The Digital Scholar Studio also provides access for students and faculty to commercial text analysis products, such as JSTOR's Constellate and Gale Digital Scholar Lab. While these products are primarily directed toward a digital humanities audience, there has been increased engagement across the disciplines when they are marketed more broadly, highlighting the features that allow users to build subject-specific corpora out of academic literature contained in vendor databases. These tools are also useful in teaching fundamental data science skills, such as data cleaning and organization and basic Python programming, which is a highly sought-after skill in both data science and research computing, regardless of academic discipline. Vendors often offer regular training and support directly to users, thus easing the burden on librarians and staff who may not have advanced knowledge of programming and complex text analysis methods. At the Library, direct collaborations with vendors have facilitated the scheduling of joint workshops tailored specifically for the FIU community as well as providing access to subscriber-wide tutorials. This is another example of data mutualism; by taking advantage of vendor offerings, the Library is able to expand services to patrons and enhance their capacity as data stewards. While these products add value to the Library's data offerings, because of budget constraints, creative funding approaches sometimes become necessary, such as negotiating package deals with databases.

As the Library expanded its role as a trusted resource hub for data-related services, opportunities emerged enabling the allocation of additional resources and personnel to build a deeper breadth of service and sponsorship through collaborative grants and support of data-intensive research and partnerships outside of the university. An example of this type of collaboration includes their participation in a recently awarded Collections as Data grant in partnership with the University of Florida and the Digital Library of the Caribbean (dLOC). This sponsored project resulted in the creation of a massive Caribbean newspaper dataset, sample text analysis projects, and tutorials on the use of text analysis tools in historical research.

These types of collaborations, which reflect the changing data needs of researchers across the world, have enabled the Library to showcase their services and support FIU researchers as well as local and global partners. In addition to the value of the grant deliverables to Caribbean research and scholarship, personnel within the Library were able to significantly grow their text analysis skills and available tools. In turn, this provided a foundation for broadened services to FIU students and faculty. This scaffolded approach to building data services has allowed the Library to continuously expand support while remaining responsive to institutional priorities, national and international data trends, and organizational policies.

Conclusion/Future Directions

As libraries continue to navigate a more data-intensive world and as data analysis and interpretation skills become increasingly essential for new graduates, the Library will need to continue to pursue mutualistic relationships to scale services strategically within the university. To match the pace of data literacy requirements at all degree levels and disciplines, along with the rising expectations for data-intensive research, the Library must be open to reconsideration of their structures for services, roles, and the extent of knowledge required. Increasing technical resources will also be necessary to handle the growing demand for data-related services. To fill the resource gap, the Library will actively seek additional collaborative opportunities internally with the university's Office of Research and Economic Development (ORED), FIU's Department of Information Technology (DoIT), as well as with other institutions and researchers to exchange expertise and leverage shared resources. To grow and foster the university's data culture, the Library can establish community-minded initiatives with social aspects such as clubs for text analysis and scripting with Python.

With increased focus on research data in the academic community, the Library continues to take proactive steps to address the needs of the research community. The scalability and sustainability of these services will also require a continuous process of evaluation. The Library plans to implement mechanisms to measure the impact of their data support services on research productivity, collaboration, and knowledge dissemination.

By implementing a systematic and rigorous evaluation process, the Library can gather valuable feedback from researchers, faculty, and students and use it to refine and enhance their data support offerings.

Notes

1. Jim Gray et al., "Scientific Data Management in the Coming Decade," *ACM SIGMOD Record* 34, no. 4 (December 1, 2005): 34–41, https://doi.org/10.1145/1107499.1107503.
2. Lorcan Dempsey and Constance Malpas, "Academic Library Futures in a Diversified University System," in *Higher Education in the Era of the Fourth Industrial Revolution*, ed. Nancy W. Gleason (Singapore: Springer, 2018), 65–89, https://doi.org/10.1007/978-981-13-0194-0_4.
3. Rebecca Bryant, Brian Lavoie, and Constance Malpas, "Part Two: Scoping the University RDM Service Bundle," The Realities of Research Data Management (Dublin, OH: OCLC, 2017), https://doi.org/10.25333/C3Z039.
4. Carol Tenopir, Ben Birch, and Suzie Allard, "Academic Libraries and Research Data Services: Current Practices and Plans for the Future" (report, Association of College and Research Libraries, June 2012), https://alair.ala.org/handle/11213/17190.
5. "Biomedical Data Lifecycle," Longwood Medical Area Research Data Management Working Group, LMA Research Data Management Working Group, accessed December 18, 2023, https://datamanagement.hms.harvard.edu/plan-design/biomedical-data-lifecycle.
6. *Framework for Information Literacy for Higher Education*, Association of College and Research Libraries, text, Association of College & Research Libraries (ACRL), February 9, 2015, https://www.ala.org/acrl/standards/ilframework.
7. Matt Burton et al., "Shifting to Data Savvy: The Future of Data Science In Libraries," monograph, 2018, http://d-scholarship.pitt.edu/33891/.
8. Nedelina Tchangalova et al., "Working Across Disciplines and Library Units to Develop a Suite of Systematic Review Services for Researchers," *Collaborative Librarianship* 11, no. 4 (February 21, 2020), https://digitalcommons.du.edu/collaborativelibrarianship/vol11/iss4/6.
9. "Research & Data Support," FIU Libraries, accessed August 24, 2023, https://library.fiu.edu/data-support.
10. Burton et al., "Shifting to Data Savvy."
11. Kayla Abner, "Data Literacy as Digital Humanities Literacy: Exploration of Threshold Concepts," text, *Dh+lib* (blog), June 22, 2020, https://acrl.ala.org/dh/2020/06/22/data-literacy-as-digital-humanities-literacy-exploration-of-threshold-concepts/.
12. John Baez, "Azimuth Climate Data Backup Project," John Baez's Stuff, 2017, https://math.ucr.edu/home/baez/azimuth_backup_project/.
13. Lisa R Johnston et al., "Results of the Fall 2016 Data Curation Pilot," University of Minnesota, Data Curation Network Special Report, Data Curation Network, March 15, 2017, https://hdl.handle.net/11299/188640.
14. Kristin Briney, Abigail Goben, and Lisa Zilinski, "Do You Have an Institutional Data Policy? A Review of the Current Landscape of Library Data Services and Institutional Data Policies," *Journal of Librarianship and Scholarly Communication* 3, no. 2 (September 22, 2015), https://doi.org/10.7710/2162-3309.1232.

Bibliography

Abner, Kayla. "Data Literacy as Digital Humanities Literacy: Exploration of Threshold Concepts." Text. *Dh+lib* (blog), June 22, 2020. https://acrl.ala.org/dh/2020/06/22/data-literacy-as-digital-humanities-literacy-exploration-of-threshold-concepts/.

Association of College and Research Libraries. *Framework for Information Literacy for Higher Education*. Text. Association of College & Research Libraries (ACRL). February 9, 2015. https://www.ala.org/acrl/standards/ilframework.

Baez, John. "Azimuth Climate Data Backup Project." John Baez's Stuff. 2017. https://math.ucr.edu/home/baez/azimuth_backup_project/.

Briney, Kristin, Abigail Goben, and Lisa Zilinski. "Do You Have an Institutional Data Policy? A Review of the Current Landscape of Library Data Services and Institutional Data Policies." *Journal of Librarianship and Scholarly Communication* 3, no. 2 (September 22, 2015). https://doi.org/10.7710/2162-3309.1232.

Bryant, Rebecca, Lavoie, Brian, and Malpas, Constance. "Part Two: Scoping the University RDM Service Bundle." The Realities of Research Data Management. Dublin, OH: OCLC, 2017. https://doi.org/10.25333/C3Z039.

Burton, Matt, Liz Lyon, Chris Erdmann, and Bonnie Tijerina. "Shifting to Data Savvy: The Future of Data Science In Libraries." Monograph, 2018. http://d-scholarship.pitt.edu/33891/.

Dempsey, Lorcan, and Constance Malpas. "Academic Library Futures in a Diversified University System." In *Higher Education in the Era of the Fourth Industrial Revolution*, edited by Nancy W. Gleason, 65–89. Singapore: Springer, 2018. https://doi.org/10.1007/978-981-13-0194-0_4.

FIU Libraries. "Research & Data Support." Accessed August 24, 2023. https://library.fiu.edu/data-support.

Gray, Jim, David T. Liu, Maria Nieto-Santisteban, Alex Szalay, David J. DeWitt, and Gerd Heber. "Scientific Data Management in the Coming Decade." *ACM SIGMOD Record* 34, no. 4 (December 1, 2005): 34–41. https://doi.org/10.1145/1107499.1107503.

Johnston, Lisa R., Jake Carlson, Cynthia Hudson-Vitale, Heidi Imker, Wendy Kozlowski, Robert Olendorf, and Claire Stewart. "Results of the Fall 2016 Data Curation Pilot." University of Minnesota. Data Curation Network Special Report. Data Curation Network. March 15, 2017. https://hdl.handle.net/11299/188640.

Longwood Medical Area Research Data Management Working Group. "Biomedical Data Lifecycle." LMA Research Data Management Working Group. Accessed December 18, 2023. https://datamanagement.hms.harvard.edu/plan-design/biomedical-data-lifecycle.

Tchangalova, Nedelina, Eileen Harrington, Stephanie Ritchie, Sarah Over, and Jodi Coalter. "Working Across Disciplines and Library Units to Develop a Suite of Systematic Review Services for Researchers." *Collaborative Librarianship* 11, no. 4 (February 21, 2020). https://digitalcommons.du.edu/collaborativelibrarianship/vol11/iss4/6.

Tenopir, Carol, Ben Birch, and Suzie Allard. "Academic Libraries and Research Data Services: Current Practices and Plans for the Future." Report, Association of College and Research Libraries, June 2012. https://alair.ala.org/handle/11213/17190.