



# Understanding Graduate Students' Knowledge About Research Data Management: Workflows, Challenges, and the Role of the Library

Gesina A. Phillips, Rebekah S. Miller, and Cathryn F. Miller\*

*What are graduate students learning about research data management (RDM) and how are they learning it? This study will help librarians to understand the information behaviors of graduate students in their current roles as lab managers, research assistants, and researchers in their own right, and will help to assess the gaps in their knowledge. Through interviewing graduate students at a medium-sized university we sought to understand their knowledge of RDM and the potential role of the library to meet their needs through data-related services.*

## Introduction

In the fall of 2017, librarians from Duquesne University along with five other institutions participated in a pilot project that was designed to help librarians create data services. This project, “Facilitating the Development of Research Data Management Services at Health Sciences Libraries,” was led by librarians at the New York University Health Sciences Library and funded by the Middle Atlantic Region of the National Network of Libraries of Medicine. During the course of the pilot, NYU librarians provided guidance and materials as the six universities began to assess needs and implement research data management services on their campuses. The present research which focuses on graduate students’ knowledge of research data management (RDM) grew out of the environmental scan conducted at Duquesne University as a part of this pilot.

Duquesne University is a medium-sized doctoral degree granting institution located in Pittsburgh, PA; at the time of its acceptance into the pilot cohort, the library did not offer services related to research data management. Hoping to implement data services that met the needs of researchers, we (the Digital Scholarship, STEM, and Social Sciences Librarians at Duquesne at the time) completed an environmental scan that consisted of interviewing faculty about their RDM practices and needs. Throughout the interviews, we noticed that several faculty members mentioned learning their research data management skills as graduate students. Some also spoke about the importance of graduate students in their labs. These responses led us to wonder how graduate students are learning about data management and what they are learning.

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\* Gesina A. Phillips, *Digital Scholarship Librarian, University Library System, University of Pittsburgh, gap64@pitt.edu*. Rebekah S. Miller, *Research & Instruction Librarian, Health Sciences Library System, University of Pittsburgh, rsm61@pitt.edu*. Cathryn F. Miller, *Social Sciences Librarian, Gumberg Library, Duquesne University, millerc12@duq.edu*

## Literature Review

### *General RDM Services Offered by Librarians*

With the increase in funder and journal mandates requiring researchers to share their data, libraries have begun to offer data-related services that can range from consultations about best practices to assistance with metadata or data deposit.<sup>1</sup> Research data services were identified as being one of the top trends in academic libraries for 2016 by the ACRL Research Planning and Review Committee, though they note that library data management services have tended more toward traditional “informational and consultative” roles rather than technical services.<sup>2</sup> Eaker discusses the rise of training programs for research data management, often located within libraries, while also noting that these programs would ideally be integrated instead into undergraduate and graduate curricula.<sup>3</sup> Despite the importance of data management, many academic libraries are not offering RDM services; Tenopir et al. surveyed academic library directors in 2014 and found that 73% reported that they did not provide data management services.<sup>4</sup> In addition, Yoon and Schultz investigated 185 American academic libraries' websites and found that about one third of the libraries they studied provided data-related workshops or classes.<sup>5</sup>

### *Graduate Students as a Population with Unique Needs*

The research data management training of graduate students specifically has emerged as a site of potential intervention in order to promote better data management practices among researchers. Frugoli, Etgen, and Kuhar describe the scenario wherein busy PIs may “forget about, delay, miss or neglect opportunities to formally address data management issues” with their students, who then develop those skills through observation or by developing their own practices.<sup>6</sup> Thielen and Hess note that “without formal training in RDM, graduate students learn RDM skills independently, ad hoc, and at the point of need, resulting in each student acquiring a different subset of skills that may not be considered best practices.”<sup>7</sup> The laboratory has been specifically theorized as a site of learning with regard to data management practices.<sup>8</sup> However, not all faculty members may be confident formally teaching research data management principles due to lack of knowledge or familiarity.<sup>9</sup>

### *Libraries and RDM Services for Graduate Students*

As libraries begin to incorporate research data management services into their suite of services, some are focusing more specifically on graduate students. Discipline-specific workshops have emerged as a potential method of supplementing data management best practices training.<sup>10</sup> Other libraries have focused on for-credit courses for graduate students. Schmidt and Holles provide an overview of current for-credit research data management course offerings, finding that prior studies have found a need for “expansion of the course to cover theory and practice.”<sup>11</sup>

### *Where this Study Is Situated*

Previous studies have identified specific gaps in graduate student knowledge<sup>12</sup> or defined core competencies.<sup>13</sup> According to Carlson and Stowell-Bracke, “...a significant gap in efforts to understand the practices of researchers...is the overall lack of attention given to the role of graduate students and their work in generating, processing, analyzing, and managing data,” despite the large role these students play in using data.<sup>14</sup> The present study assesses the state of graduate training in RDM through the experiences of graduate students—their self-reported practices, challenges, and information seeking behaviors. In-depth interviews allowed us to probe self-reported gaps in learning that occurred during the students' graduate studies. These gaps were theorized as potential points of interaction with library services. The main questions addressed in this study are:

- What do graduate students know about research data management?

- What challenges do graduate students encounter when managing their data and what implications does this have for libraries?

## Methodology

In order to gain an in-depth understanding of graduate student experiences learning about RDM, we used grounded theory as our methodological approach. The selection criteria for participants included that they be current graduate students at Duquesne University who work with data or who have worked with data in the past. An email was sent out to the graduate student email listserv at Duquesne and a total of ten graduate students from various schools and departments participated in the study. Semi-structured interviews took place at the Gumberg Library at Duquesne in the fall semester of 2018 and lasted between 12 and 32 minutes; these interviews were audio recorded and later transcribed (see Appendix A: Interview Protocol). Each transcript was independently coded by two of the researchers, after which the codes were categorized in order to aid in the development of theory. This study was approved by the Duquesne University Institutional Review Board.

**TABLE 1**  
Number of interviewees by degree sought and discipline

Degree Sought	Social Sciences	Sciences/Health Sciences	Humanities
Master's	0	3	0
PhD	2	3	2

## Results

### *How are Students Learning about Research Data Management?*

When asked how they had learned about handling data, interviewees supplied a range of answers. Some had learned in research methods-related classes, either during a prior degree (four interviewees) or while at Duquesne (two interviewees). However, when expanding on the content of research methods-related classes, interviewees often mentioned learning about data collection, types of methods, and statistics; they tended not to mention documenting, sharing, storing, or preserving data when asked about their coursework. One student in the sample had taken a research data management course as an elective. Interviewees working in laboratories had a great deal to say about their hands-on experience with data management. The lab environment was described as a site of experiential learning (“I mean it’s more by experience and from our advisor, the way it’s set in the lab”), and processes varied in different labs. This focus on experience echoes multiple interviewee statements about pragmatic learning strategies, which centered on seeking point-of-need assistance and finding personal methods of completing tasks. Several interviewees expressed the idea that individual learning was expected with regard to research data management (“I definitely learned it on my own”). Although the interviewees’ information horizons occasionally extended beyond their departmental context (interviewees variously mentioned consulting the library, the internet, and graduate students from other programs), their information-seeking behaviors tended to be located within their discipline, where they would consult advisors, other faculty, lab managers, and peers.

### *What Do Students Know about Research Data Management?*

We were eager to see what students actually do when handling data, and whether the answers to our questions could either demonstrate knowledge (i.e. good practices) or knowledge gaps (i.e. incorrect or problematic practices). What they do would point to what they know—that is, what they have learned and retained.

To begin with, interviewees were asked whether they had heard the term “research data management,” and, if so, what the term meant to them. Only two said yes; one had a definition that only mentioned data collection and the other had a robust definition that included managing, organizing, analyzing, saving, and storing data. The interviewee with the more robust definition was also the only interviewee who had taken a course in research data management. Five reported never having heard the term, and two were unsure; one interviewee was not explicitly asked. Lack of knowledge of the term, however, did not translate to total lack of RDM knowledge. Interviewees who said they’d never heard the term spoke comfortably about backing up data, file naming conventions, and other tenets of RDM. This suggests that librarians have a jargon problem—students are unfamiliar with the terms being used to promote services.

## Practices

Interviewees mentioned specific needs with regard to various stages of the research data lifecycle. Their reported workflows tended to focus on early stages of the lifecycle—specifically data collection and analysis. Three interviewees mentioned analysis and statistics as specific areas of uncertainty (“I need to work on the analysis part of the data”). Three mentioned using Excel and expressed a desire for an alternative software that they could use to do more of the analysis for them (see “Challenges” for more about Excel).

Of the data management topics prompted by the interview questions, interviewees most often reported strategies related to file naming conventions and backing up their data. When asked, eight interviewees mentioned using a naming convention with their data. The naming conventions that were described varied. Some were highly sophisticated:

*I just put the date first and then mark it with the experiment that I was trying to do and then if it's a different concentration, or if there's a specific tool [...] that I ran then probably like that and then ultimately [...] if I'm making three preparations out of it, then which preparation was it so if it's P1, P2, or P3. So I name the file that.*

Others were potentially problematic: “We just name the file used with the date of the observation.”

Eight interviewees also mentioned backup strategies. Similarly to self-reported behavior regarding naming conventions, answers ranged quite a bit. While reflecting on their own data practices, one interviewee became concerned that using Google Drive as the only method of backup was inadequate. One interviewee used email as a backup, while another went to great lengths to ensure data safety:

*You gotta back it up back it up back lots of places to back up. So we have the raw files on computers here at Duquesne obviously but then we also have external hard drives. Multiple. I even sent [...] an external hard drive to my parents in the mail today and they were like what is this and I'm like that's my life right now so treat it well. I'm like put it in a safe with a desiccator just please just keep it safe so yeah.*

Data security or the valuable nature of data came out in several of the interviews. A student in the social sciences reported locking transcripts in a filing cabinet and keeping them on an encrypted flash drive. This interviewee was also concerned for the recorded interviews themselves:

*[...] anything could happen to my phone. I don't want a situation to happen where somebody steals my phone and then I don't have the data or even worse somebody's information is out there for whoever to have.*

Others saw the value of their data for their lab or noted that the data they created belonged to the university.

*I don't mind sharing the data but I think before sharing the data, even though I have left the lab my lab would be working on that and thinking of something new, so I would probably contact my advisor first and ask [them] if it's ok if I share the file and if [my advisor] says that won't be ok or something. I give them the answer then that my advisor gives to me.*

Others also mentioned the importance of data to their PIs or labmates:

*You know I've seen people you know who have like a grab bag almost so that if there's a fire drill they just walk out the door and it's on the way out. I know you're not supposed to grab anything but it's like, it's on my way out the door, it has my hard drive and all my data in it, and seriously like people take that pretty seriously in our sciences.*

## Workflow

Interviewees described handling a variety of data: instrument output, patient data or questionnaires, Excel files, animal data, PDFs of research articles, poems, and letters. In dealing with these various types of data they also described varying workflows. Science and health sciences students described processes that were often dictated by instruments, patients, or experimental factors:

*The raw data was collected on a spectrometer so we got the file from the spectrometer, it was an Excel file.*

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*I will ask the patients to do some questionnaires to get some specific data... as well we use machines to test the changes of some objective indicators such as muscle strength, range of motion, et cetera.*

The social science and humanities students described practices that were often individual and ad hoc:

*Yeah I usually have like an annotated bib going on the side. Just to kind of categorize how I'm using this information, but I also include like an actual citation. Usually the URL if I find something online like an online journal article. But yeah, it's, there's a lot of steps in the process [laughs].*

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*Yeah, so I keep [articles] in piles, literally in piles. Like, this is for this topic, and this is for the next topic and I'll have notes all over them. Like I'll take notes on the whole article. And then I'll try to organize from there.*

Perhaps due to the lack of lab- or experiment-imposed structures, two non-science students mentioned the need for creativity in managing data:

*So you find out these different ways that work for you, sometimes hacks, if you will [...]. Really you gotta think kinda creatively about it.*

And I think I'm pretty savvy with the internet to find things in interesting ways. It's really—you've got to be creative.

The interviewees who were not in labs also sometimes conflated research data management and research. When we asked about data management, we sometimes received answers about research processes themselves such as research topic selection or database search strategies.

Surprisingly, our questions about workflow also revealed varying levels of student agency over their own projects. One social scientist was not sure where survey data went:

*Interviewer: So that's where the data was stored. On SurveyMonkey?*

*Interviewee: Yeah.*

*Interviewer: And if you needed to access did you just...*

*Interviewee: You could just go on there and look at it. I don't think we ever printed anything out. I don't think so.*

*Interviewer: Did you kind of download it from SurveyMonkey? Or did it just...*

*Interviewee: Yeah. I think the department chair had it like on like on [their] computer. [They] had it downloaded. But I never [...] downloaded it or had it.*

A humanities student mentioned not knowing where data was coming from in a collaborative project: "We've been getting a lot of information from [the research assistant]. I'm not entirely sure where [they're] getting it from." Other interviewees were solely or mostly responsible for data collection:

*Okay so I work under my advisor Dr. \_\_\_\_\_ and pretty much it's just me as far as data collection. The actual process.*

*[At previous institution] I did my thesis work on [redacted]. So in that I was working with one of my seniors, [they were] the second author on the paper. And then there was my post-doc and there were two other professors who helped me, like analyze some data and would give me the right direction. So mostly data collection was me and the senior student but it was always like, we were both present at that time, it wasn't that one was present and one was not.*

Two PhD health sciences students had an exceptionally good grip on data practices, and spoke about data in terms of the entire lifecycle:

*Don't just throw stuff out and, you know [...]. With respect to the amount of what actually gets published versus what experiments are actually done that is a very, very narrow fraction that's actually published. We generate a lot of experiments that don't pan out and I stress always that we need to get those in the notebook too so that we don't make that same mistake over and over again and it seems like common sense but sometimes people are like "it doesn't work so why record it" but those are so important to record.*

*We create a lot of data [...] so we need to analyze those numbers and everything. So to do that, we need to first organize it and save it and then ultimately be able to analyze it, right, and get the product out of it. But before that we have to manage the data. Like how do—where do we store it, where do we keep it.*

Overall, however, when discussing data management, interviewees tended to describe pieces of a project rather than a workflow from beginning to end. Many of them seemed to see themselves as a small part of a larger project or lab (being assigned a research “node,” interviewing a certain population, leaving data with an advisor post-graduation). Once they performed their portion of the study, that was that: “I don’t even remember what happened to the tapes to be honest. I don’t know if I gave them to [the PI] and that was it”; “I believe there’s a CRM that’s kind of holding all this information together. I don’t know where it is because I don’t have access to it but I think that’s typically where all this information is kind of just being dumped.” For those working on individual projects, interviewees equated the projects (and processes) with Duquesne, and did not necessarily intend to continue those projects after graduation.

### Challenges

When asked about their greatest challenges related to research data management, interviewees tended to focus on technological and organizational challenges. There was a great deal of crossover between these areas of concern because interviewees often mentioned technological barriers as being the cause of their organizational challenges.

### Technological challenges

Interviewees identified several areas of concern related to technology: access to software, lack of knowledge of analytical techniques, sharing, and storage. In terms of software access, one interviewee mentioned issues with legacy software:

*So if, suppose if an instrument, if you’ve not upgraded the software—sometimes they’re really expensive so you just don’t want to upgrade it—so then that becomes a problem.*

Another mentioned their inability to use tools such as Google Drive in China. Several interviewees expressed workflow challenges due to the interplay between physical and digital formats, both in terms of lab notebooks (“we can’t take the laptop into the lab so we just had to write down and later we put all the information to the laptop to arrange it”) and journal articles (“well I don’t have time or patience to download everything on EndNote and separate it and do all that, because that’s a whole other project in itself”; “if I work with just digital copies then I don’t have the luxury to annotate”). This challenge also relates to access to and proficiency with software:

*So I like to feel and touch—I can remember more, I can take notes on an article, things like that. But when you have them electronically it’s harder to do that, ‘cuz it’s PDF. And I know there’s certain software you can use where you can put sticky notes but that’s too complicated. That’s another job [...]. And then software’s not free, so then you have to pay for it and so. That’s a challenge.*

Methods of analysis and the use of analytical tools emerged as a challenge for many interviewees. Interviewees mentioned Excel as being a particular source of frustration (“Yeah so I want to study some software that will allow me to classify and mark the data more convenient and not to just use Excel. Excel is always difficult to

do the data”; “Yeah I used Excel for most of the things but for plotting the graphs Excel doesn’t give that good quality graphs so I had to use other softwares to get a good graph”). One interviewee expressed a need to learn about statistical analysis using tools such as SPSS. One humanities interviewee expressed frustration with learning digital humanities tools, saying that the platform they were attempting to use was “so expansive and unless you have really in-depth knowledge about that kind of stuff it’s, it’s frustrating.” This interviewee also expressed frustration with finding a tool that fit their needs: “I know what kind of media I want to use and sometimes the tools don’t necessarily correlate very well.”

Interviewees approached sharing their data in different ways. Challenges emerged when groups did not have a unified method of sharing data; in such cases they expressed concern and confusion about their ability to share their data with current team members, document processes for future researchers, and access their data in the future. Interviewees had many technological concerns in terms of storing and keeping their data overall. Some concerns were related to catastrophic hardware failure, with one interviewee noting that had happened to them personally (“it was a big folder on my computer that ended up crashing. It was a big folder that I had I just deleted the whole folder”) and others mentioning instances of technological failure (“it was not related to me directly, but in one of our experiments the computer crashed [laughs] so that was a bad thing and that drove us to always keep a backup”; “we may face some bugs, and that’s very terrible I think”).

### *Organizational challenges*

Interviewees expressed concerns, both technological and otherwise, regarding the organization of their data. Organizational tools such as EndNote presented a learning barrier due to the time necessary to learn to use them. Other tools may introduce their own organizational challenges due to students experiencing technological failures: “some softwares they don’t give you the entire data at once, so you have to convert it into an Excel file and then copy and paste it into Excel and sometimes, you know, Excel jumbles everything up. And then you have to check everything again.” Physical distribution of computers and equipment, if these devices are not networked, may present an additional challenge:

*I think the toughest part, again, is organizing and collecting everything at once in one space. Like I might do another experiment and I have all the data but getting it in one computer at one time, that’s a task [...]. And sometimes like the instruments, like my lab is very dispersed over here.*

Other organizational challenges include the time required to organize data and the effort required to be consistent and accurate:

*I think organizing the data is the most difficult part. Getting it—like doing the experiment is time consuming enough that you have to organize your data as well, so a lot of time goes into both of these things so sometimes students just decide to do the experiment and then organize the data later. So then it becomes a problem sometimes. Because then you have to go back and forth and then you actually waste more time than you would have if you had done it at one time.*

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*Then there are some previous experiments, the data is like “oh my god I have so much data.” And then it’s a bit confusing, especially if you don’t store it properly, then especially if you have multiple data on the same day, like after two hours, it becomes a bit [laughs] difficult to handle, is all I can say. I guess I need to work on that.*

These organizational and technological challenges may offer opportunities for library workers to provide support for graduate students in terms of research data management.

## Opportunity for Librarians

It is evident that the interviewees recognized their own research-related challenges with technology and organization. They expressed a desire for support, and in particular, many interviewees mentioned wanting assistance with analysis and organization. A desire to know about tools and technology to help in the RDM process was also common in their understanding of their struggles. In particular, interviewees wanted hands-on, practical trainings that would streamline their processes.

*I want to know something about here. I want to know if we have the chances to know about the handling data here.*

— — — —

*[...] I know that Duquesne has that list of all the various [digital humanities] tools that you can use but I think for me it would be useful to have like a workshop where you kind of went into more depth about like what those tools can do and what are some of the pitfalls more extensively. Maybe doing a workshop on a specific tool where you can kind of play around with it and talk in a collaborative setting of like how you see this working for you project or how you don't see it working for your project.*

Throughout the interviews, interviewees expressed a desire for workshops, manuals, certification programs, courses, and software training. Two interviewees said that they had been interested in courses related to data collection and management, but had been unable to find what they needed; one of these interviewees mentioned that the call for interview participants had sparked their interest for this reason.

Interviewees also mentioned struggles which reflect the need for more traditional help from librarians. Help with managing citations, finding sources, and evaluating sources for quality were mentioned throughout the interviews.

*It's so hard to find research and then you get down these rabbit holes once again, where you don't know if it's a reliable source, you pull up thirty five thousand different things.*

Interviewees expressed a need for help with conducting searches of the literature and organizing their sources, which are services already offered by many libraries. However, as mentioned previously, they also had an interest in a variety of learning opportunities related to overcoming their challenges related to organization, analysis, and tools and technology.

While understanding challenges provides insight for the role of the librarian, understanding student workflows and practices also points to a need to address the complexity of the interrelated practices related to RDM.

## Discussion

### Future Directions

This study investigated a small, cross-disciplinary sample of graduate students—both at the Master's and doctoral level—at a mid-sized institution. These results were intended to capture general information about the graduate student experience, but are limited in scope due to the sample size and specific institutional context.

Further studies focusing on the disciplinary or demographic aspects of a student population may add finer detail to this topic. Although we did not ask interviewees specifically about ethics, some displayed a knowledge of research ethics while others mentioned potentially unethical practices—this may be an area of future study. While the interview data revealed important aspects of graduate student experiences, further research is needed to gain a better understanding of student experiences over time, at a variety of institutions, and in a wider variety of programs.

## Conclusions

In this article we sought to analyze what graduate students know about RDM by gaining a deeper understanding of their experiences working with data. By focusing on practices and workflows, we were able to see that what we view as a system of interrelated processes—the research data lifecycle—was described instead as a set of isolated processes applied to data. Interviewees mentioned learning about RDM in a variety of ways, but largely described an experience of learning bits and pieces of RDM over time. Research methods-related courses did not necessarily result in a comprehensive understanding of RDM, nor did the experience of being on a research team. Though some interviewees expressed that they would reach out for help to their advisor and a variety of other individuals, it seems as though their information seeking is based solely on their own conceptions of their need. However, from their practices it's clear that they aren't understanding when their practices fall short of standards. By analyzing the practices and workflows of graduate students we found lack of a conceptual framework of RDM.

The present research also focused on understanding the potential role of the library. What do the varying workflows, practices, and challenges described by interviewees mean for how we teach? Interviewees described challenges related to analysis, technology, and data organization, which may require the development of specialized data services. We also can help students strengthen skills they already have, like creating meaningful file names or backing up data. While none of the interviewees mentioned a desire for one-on-one consultations, individualized consultations might be advantageous in order to address the variety of research methods that graduate students engage in. Interviewees also mentioned challenges related to more fundamental research skills, which libraries are already situated to address. The interviewees expressed a desire to learn more about RDM through courses and workshops; if these are not offered within their majors, then the library may be a key support mechanism for the development of data management skills among graduate students.

In order to anchor an understanding of RDM within graduate students' workflows, universities must provide learning opportunities to sharpen student understanding and enhance everyday RDM practices. Partnerships between disciplinary experts and library workers will be key in developing RDM services for graduate students. Due to the variations in practice across disciplines, it is clear that teams of individuals will be better able to tackle some of these challenges and interests. Key goals of this collaboration will be to support student learning and development and to expand the understanding of RDM as an integral part of the research process.

# Appendix (Interview Guide)\*

## Demographic

- Please describe your role(s) at Duquesne:
  - ◊ Department:
  - ◊ Degree sought:
  - ◊ Years in program:
- Are you a Research Assistant, do you work in a lab, do you work with faculty on research projects, and/or do you conduct your own research?

## Interview Context

- Have you heard of RDM? What do you know about it?
- Here's our definition of RDM: Research data management a system of interrelated processes undertaken to create organized, documented, accessible, and reusable quality research data. We'll speak about this as the process of "handling data" throughout this interview.

## Learning RDM

- If you needed more information about data management practices, who would you ask or where would you look?
- Does RDM ever come up in your coursework? Were you trained how to handle data in your lab or as part of a research team?
- Is there anything else you'd like to add about how you learned to handle data?
- Is there anything you feel like you still need to learn or that you're not sure about in terms of handling data?

## Choose a single project to focus on where you've collected data. Describe that project to us briefly, including who else is involved.

- As a part of this project did you search for data or collect data? What are your experiences searching for/collecting data? Tell me about the data that you work with.
- After you obtained your data, how did you organize it or name it? Where did you keep the data while you were working with it and analyzing it?
  - ◊ What are the most difficult aspects of organizing or working with your data?
- Do you work on a team? If so, are there standard procedures you follow? Please tell us about them.
- Do you backup your data?
  - ◊ What are the challenges of storing and accessing data?
- What do you do with your data once you have finished your research project? Or what do you plan to do with your data once you're finished with your project?
  - ◊ How long do you think your data should be available and usable (what is the lifespan)?

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\* *The research team worked with Kevin Read and Alisa Surkis and previously relied upon their interview tool. This tool has been thoroughly changed and adapted for the current project. For the previous tool, see: Read, Kevin B., Alisa Surkis, Catherine Larson, Aileen McCrillis, Alice Graff, Joey Nicholson, and Juanchan Xu. "Starting the Data Conversation: Informing Data Services at an Academic Health Sciences Library." *Journal of the Medical Library Association: JMLA* 103, no. 3 (2015): 131–35. <https://doi.org/10.3163/1536-5050.103.3.005>.*

- ◇ Will you be able to access this data when you leave Duquesne? (think about technological or ownership barriers) Do you want to be able to access and/or use it?
- Have you ever searched for a dataset or asked a researcher to share their data?
- What challenges or barriers have you experienced when handling your data?

## Endnotes

1. Lisa Federer, "Research Data Management in the Age of Big Data: Roles and Opportunities for Librarians," *Information Services & Use* 36, no. 1–2 (2016); <https://doi.org/10.3233/ISU-160797>; Carol Tenopir, Ben Birch, and Suzie Allard, "Academic Libraries and Research Data Services: Current Practices and Plans for the Future," White Paper (Association of College and Research Libraries, June 2012), [http://www.ala.org/acrl/sites/ala.org.acrl/files/content/publications/whitepapers/Tenopir\\_Birch\\_Allard.pdf](http://www.ala.org/acrl/sites/ala.org.acrl/files/content/publications/whitepapers/Tenopir_Birch_Allard.pdf).
2. ACRL Research Planning and Review Committee, "2016 Top Trends in Academic Libraries: A Review of the Trends and Issues Affecting Academic Libraries in Higher Education," *College & Research Libraries News* 77, no. 6 (2016), <https://doi.org/10.5860/crln.77.6.9505>.
3. Christopher Eaker, "Educating Researchers for Effective Data Management," *Bulletin of the Association for Information Science and Technology* 40, no. 3 (2014), <https://doi.org/10.1002/bult.2014.1720400314>.
4. Carol Tenopir et al., "Research Data Services in Academic Libraries: Data Intensive Roles for the Future?," *Journal of eScience Librarianship* 4, no. 2 (2015), <https://doi.org/10.7191/jeslib.2015.1085>.
5. Ayoung Yoon and Teresa Schultz, "Research Data Management Services in Academic Libraries in the US: A Content Analysis of Libraries' Websites," *College & Research Libraries* 78, no. 7 (2017), <https://doi.org/10.5860/crl.78.7.920>.
6. Julia Frugoli, Anne M. Etgen, and Michael Kuhar, "Developing and Communicating Responsible Data Management Policies to Trainees and Colleagues," *Science and Engineering Ethics* 16, no. 4 (2010), <https://doi.org/10.1007/s11948-010-9219-1>.
7. Joanna Thielen and Amanda Nichols Hess, "Advancing Research Data Management in the Social Sciences: Implementing Instruction for Education Graduate Students Into a Doctoral Curriculum," *Behavioral & Social Sciences Librarian* 36, no. 1 (2018): 18, <https://doi.org/10.1080/01639269.2017.1387739>.
8. Jake Carlson and Marianne Stowell-Bracke, "Data Management and Sharing from the Perspective of Graduate Students: An Examination of the Culture and Practice at the Water Quality Field Station," *portal: Libraries and the Academy* 13, no. 4 (2013): 347, <https://doi.org/10.1353/pla.2013.0034>.
9. Jacob Carlson et al., "Determining Data Information Literacy Needs: A Study of Students and Research Faculty," *portal: Libraries and the Academy* 11, no. 2 (2011): 638, <https://doi.org/10.1353/pla.2011.0022>.
10. Jessica Adamick, Rebecca Reznik-Zellen, and Matt Sheridan, "Data Management Training for Graduate Students at a Large Research University," *Journal of eScience Librarianship* 1, no. 3 (2012), <https://doi.org/10.7191/jeslib.2012.1022>; Thielen and Hess, "Advancing Research Data Management in the Social Sciences: Implementing Instruction for Education Graduate Students Into a Doctoral Curriculum."
11. Lawrence Schmidt and Joseph Holles, "A Graduate Class in Research Data Management," *Chemical Engineering Education* 52, no. 1 (2018): 57.
12. Cecily Marcus et al., "Understanding Research Behaviors, Information Resources, and Service Needs of Scientists and Graduate Students: A Study by the University of Minnesota Libraries," Report (University of Minnesota Libraries, June 2007), <http://conservancy.umn.edu/handle/11299/5546>; Carlson and Stowell-Bracke, "Data Management and Sharing from the Perspective of Graduate Students."
13. Carlson et al., "Determining Data Information Literacy Needs."
14. Carlson and Stowell-Bracke, "Data Management and Sharing from the Perspective of Graduate Students," 346.

## References

- ACRL Research Planning and Review Committee. "2016 Top Trends in Academic Libraries: A Review of the Trends and Issues Affecting Academic Libraries in Higher Education." *College & Research Libraries News* 77, no. 6 (2016): 274–281. <https://doi.org/10.5860/crln.77.6.9505>.
- Adamick, Jessica, Rebecca Reznik-Zellen, and Matt Sheridan. "Data Management Training for Graduate Students at a Large Research University." *Journal of eScience Librarianship* 1, no. 3 (2012): 180–88. <https://doi.org/10.7191/jeslib.2012.1022>.
- Carlson, Jacob, Michael Fosmire, C. C. Miller, and Megan Sapp Nelson. "Determining Data Information Literacy Needs: A Study of Students and Research Faculty." *portal: Libraries and the Academy* 11, no. 2 (2011): 629–57. <https://doi.org/10.1353/pla.2011.0022>.
- Carlson, Jake, and Marianne Stowell-Bracke. "Data Management and Sharing from the Perspective of Graduate Students: An Examination of the Culture and Practice at the Water Quality Field Station." *portal: Libraries and the Academy* 13, no. 4 (2013): 343–61. <https://doi.org/10.1353/pla.2013.0034>.
- Eaker, Christopher. "Educating Researchers for Effective Data Management." *Bulletin of the Association for Information Science and Technology* 40, no. 3 (2014): 45–46. <https://doi.org/10.1002/bult.2014.1720400314>.

- Federer, Lisa. "Research Data Management in the Age of Big Data: Roles and Opportunities for Librarians." *Information Services & Use* 36, no. 1–2 (2016): 35–43. <https://doi.org/10.3233/ISU-160797>.
- Frugoli, Julia, Anne M. Etgen, and Michael Kuhar. "Developing and Communicating Responsible Data Management Policies to Trainees and Colleagues." *Science and Engineering Ethics* 16, no. 4 (2010): 753–62. <https://doi.org/10.1007/s11948-010-9219-1>.
- Marcus, Cecily, Stephanie Ball, Leslie Delserone, Amy Hribar, and Wayne Loftus. "Understanding Research Behaviors, Information Resources, and Service Needs of Scientists and Graduate Students: A Study by the University of Minnesota Libraries." Report. University of Minnesota Libraries, June 2007. <http://conservancy.umn.edu/handle/11299/5546>.
- Schmidt, Lawrence, and Joseph Holles. "A Graduate Class in Research Data Management." *Chemical Engineering Education* 52, no. 1 (2018): 52–59.
- Tenopir, Carol, Suzie Allard, Mike Frame, Ben Birch, Lynn Baird, Robert Sandusky, Madison Langseth, Dane Hughes, and Andrew Lundeen. "Research Data Services in Academic Libraries: Data Intensive Roles for the Future?" *Journal of eScience Librarianship* 4, no. 2 (2015). <https://doi.org/10.7191/jeslib.2015.1085>.
- Tenopir, Carol, Ben Birch, and Suzie Allard. *Academic Libraries and Research Data Services: Current Practices and Plans for the Future*. White Paper. Association of College and Research Libraries, 2012. [http://www.ala.org/acrl/sites/ala.org/acrl/files/content/publications/whitepapers/Tenopir\\_Birch\\_Allard.pdf](http://www.ala.org/acrl/sites/ala.org/acrl/files/content/publications/whitepapers/Tenopir_Birch_Allard.pdf).
- Thielen, Joanna, and Amanda Nichols Hess. "Advancing Research Data Management in the Social Sciences: Implementing Instruction for Education Graduate Students Into a Doctoral Curriculum." *Behavioral & Social Sciences Librarian* 36, no. 1 (2018): 16–30. <https://doi.org/10.1080/01639269.2017.1387739>.
- Yoon, Ayoung, and Teresa Schultz. "Research Data Management Services in Academic Libraries in the US: A Content Analysis of Libraries' Websites." *College & Research Libraries* 78, no. 7 (2017). <https://doi.org/10.5860/crl.78.7.920>.