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Implementing and Learning from a Summer Research Data Management Training Program for Student Researchers
Mise en oeuvre et apprentissage d'un programme de formation d'été sur la gestion des données de recherches pour les chercheurs étudiants

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Résumé de l'article

Cette étude examine un programme de formation sur la gestion des données de recherche (GDR) mené par la bibliothèque d'un établissement postsecondaire canadien qui visait à rejoindre des étudiants travaillant sur des projets de recherche au cours de l'été. Dans cet article, nous décrivons le programme et nous partageons les résultats d'un travail de réflexion étudiant sur l'élaboration d'un plan de gestion des données (PGD). Les directeurs des étudiants devaient les inscrire au programme. Le programme de formation comprenait quatre exigences pour les participants étudiants: participer à une session d'introduction sur la GDR, participer à une formation sur les PGD, soumettre un PGD pour de la rétroaction, et compléter un travail de réflexion. Si les participants offraient leur consentement, leurs travaux de réflexion étaient analysés en utilisant une méthode d'analyse de contenu qualitative. Trente-cinq directeurs ont inscrit 53 étudiants. Trente-cinq étudiants ont complété toutes les exigences du programme et 19 ont accepté qu'une analyse de contenu de leurs travaux soit faite. Les étudiants ont indiqué que les bénéfices d'élaborer un PGD comprennent une meilleure gestion de projet, de meilleures pratiques, la réutilisation des données et la communication d'équipe. Les défis recensés comprennent le manque de flexibilité des PGD, des difficultés à remplir un PGD, les exigences en matière de temps des chercheurs et le manque de valeur à long terme. Quatorze des 19 étudiants ont indiqué que la rédaction d'un PGD a été utile pour leurs projets d'été. Grâce à l'enseignement, à l'engagement pratique et à la réflexion dans le contexte de la recherche dans le monde réel, le programme a aidé les étudiants à se familiariser avec la GDR et à élaborer un PGD.

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Mise en œuvre et apprentissage d'un programme de formation d'été sur la gestion des données de recherches pour les chercheurs étudiants

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Abstract / Résumé

This study explores a library-led research data management (RDM) training program at a Canadian post-secondary institution that targeted students working on research projects over the summer. In this paper we describe the program and share findings from a student reflection assignment about completing a data management plan (DMP). Students' faculty supervisors were required to register them for the program. The training program included four requirements for student participants: attending an introductory RDM session; attending a DMP workshop; submitting a DMP for feedback; and completing a reflection assignment. If participants consented, their reflection assignments were analyzed using a qualitative content analysis approach. Thirty-five faculty supervisors registered 53 students to participate. Thirty-three students completed all components of the program, with 19 providing consent for the analysis of the reflection assignment. Students reported that the benefits of completing a DMP included improved project planning, best practices, data reuse, and team

communication. Reported challenges included the inflexibility of DMPs, difficulty populating DMPs, demands on researchers' time, and lack of long-term value. Fourteen of 19 students reported that building a DMP helped them with their summer projects. Through instruction, practical engagement, and reflection within the context of real-world research, the program supported students in learning about RDM and developing a DMP. Insights for library employees who wish to refine or develop training in their local contexts include the utility of participation incentives such as co-curricular credit, the value of faculty participation in RDM programming for students, and the benefits of collaborating with institutional research offices.

Cette étude examine un programme de formation sur la gestion des données de recherche (GDR) mené par la bibliothèque d'un établissement postsecondaire canadien qui visait à rejoindre des étudiants travaillant sur des projets de recherche au cours de l'été. Dans cet article, nous décrivons le programme et nous partageons les résultats d'un travail de réflexion étudiant sur l'élaboration d'un plan de gestion des données (PGD). Les directeurs des étudiants devaient les inscrire au programme. Le programme de formation comprenait quatre exigences pour les participants étudiants: participer à une session d'introduction sur la GDR, participer à une formation sur les PGD, soumettre un PGD pour de la rétroaction, et compléter un travail de réflexion. Si les participants offraient leur consentement, leurs travaux de réflexion étaient analysés en utilisant une méthode d'analyse de contenu qualitative. Trente-cinq directeurs ont inscrit 53 étudiants. Trente-cinq étudiants ont complété toutes les exigences du programme et 19 ont accepté qu'une analyse de contenu de leurs travaux soit faite. Les étudiants ont indiqué que les bénéfices d'élaborer un PGD comprennent une meilleure gestion de projet, de meilleures pratiques, la réutilisation des données et la communication d'équipe. Les défis recensés comprennent le manque de flexibilité des PGD, des difficultés à remplir un PGD, les exigences en matière de temps des chercheurs et le manque de valeur à long terme. Quatorze des 19 étudiants ont indiqué que la rédaction d'un PGD a été utile pour leurs projets d'été. Grâce à l'enseignement, à l'engagement pratique et à la réflexion dans le contexte de la recherche dans le monde réel, le programme a aidé les étudiants à se familiariser avec la GDR et à élaborer un PGD.

Keywords / Mots-clés

Research Data Management, RDM, Data Management Plans, DMPs, Academic Librarianship, research services, Library instruction; GDR, gestion des données de recherche, plans de gestion des données, pgd, bibliothéconomie universitaire, services de recherche, formation documentaire

Background

In response to the Tri-Agency Research Data Management Policy (Government of Canada, 2021) and increasing attention to research data management (RDM) and scholarly data sharing globally, research support units in Canadian universities have been developing services and strategies to help researchers meet emerging expectations in this area. RDM refers to the management, storage, access, preservation, and dissemination of data across the lifecycle of a research project, and it

can be articulated in a data management plan (DMP) that describes these processes (CODATA, n.d.).

Academic libraries often provide strategic leadership for RDM within their institutions, and strive to foster robust and coherent supports for researchers both within the library and across campus units (Bardyn et al., 2018; Cooper et al., 2022; Dressel, 2017; Kim & Syn, 2021; LaPolla et al., 2021; Read et al., 2019; Southall & Scutt, 2017). Library support for RDM may incorporate consultation, training, curation and deposit services, infrastructure solutions, or information resources, based on local needs and organizational capacity. While library RDM service portfolios vary among institutions, most offer formal training such as lectures, workshops, and workshop series that aim to develop researchers' data management awareness and skills.

A 2017 survey of 170 academic libraries in European and Commonwealth countries found that at the time of writing, RDM training and instruction was already a growing or well-developed service at many institutions, even as knowledge and capacity to support advisory and curation services were in their earliest stages (Cox et al., 2017). A 2022 systematic review of English-language articles detailing RDM training initiatives highlights the ongoing centrality of training efforts that have "learning objectives mapped to clear demonstrable learning outcomes" (Oo et al., 2022, p. 251), and in the Canadian context, an unpublished 2023 environmental scan we performed showed that all libraries within the U15 Group of Canadian Research Universities offer RDM instruction and training for researchers.

A recent scoping review of studies examining RDM training initiatives between 2010 and 2021 suggested that these efforts most frequently targeted faculty and research staff, librarians seeking to build RDM competencies, or mixed campus audiences; fewer were intended for student audiences, and we could only identify a small number of initiatives specifically for undergraduates (Xu et al., 2022). A review of the available literature also revealed minimal representation of RDM training and instruction in the Canadian context, although literature does exist about other RDM topics and initiatives in Canada (Rod et al., 2024; Rod et al., 2023; Thompson et al., 2023). Providing RDM training for students lays a foundation of knowledge that can prepare them to meet emerging requirements for research and publishing in the future. There is value in continuing to investigate and share findings from innovative RDM programming designed to meet the real-world needs of diverse campus communities such as undergraduates, particularly at Canadian institutions.

The present study explores a collaborative, library-driven pilot RDM training program that took place at the University of Saskatchewan, a Canadian U15 institution, from May to August 2022. In the 2022-2023 academic year, the University Library supported a student body of over 26,000, with a complement of approximately 30 faculty librarians and an equivalent of 85 full-time library staff. This unique program targeted students engaged in research over the summer and their supervising faculty, employing elements of lecture, workshop, practice, and reflective writing to teach RDM concepts and facilitate practical experience relevant to participants' real-world research contexts.

A secondary goal of the program was, through a reflection assignment, to gather qualitative data on students' impressions of learning about RDM and creating a DMP.

Below, we first describe the RDM Summer Program in detail. We then share an analysis of student responses from the reflection assignment. We conclude with a discussion of the program's challenges and successes, including implications for practice drawn from both the analyzed student reflections and our experiences and observations while implementing the program.

Materials & Methods

RDM Summer Program

Program Development and Overview

The RDM Summer Program was developed by the University Library as part of the institution's Summer 2022 Student Undergraduate Research Experience (SURE) program. An initiative of the Office of the Vice President Research (OVPR), SURE is a co-curricular program designed to support student research and professional skill development. Participants receive training in multiple aspects of the research process and take part in a capstone symposium, receiving credit toward their academic progress at the institution.

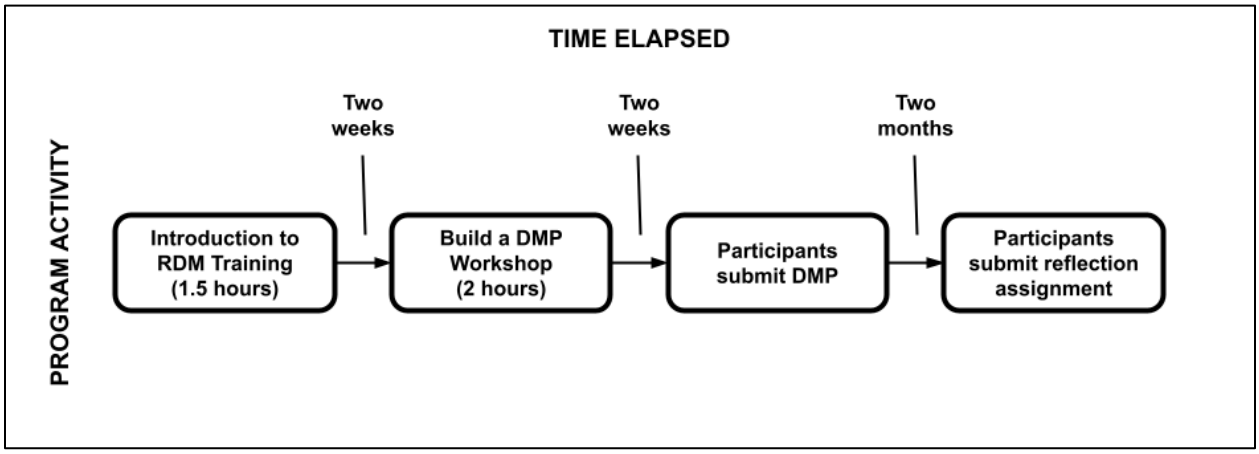
Two librarians specializing in RDM and multidisciplinary data services collaborated with OVPR staff to run the RDM Summer Program, which took place between May and August 2022. OVPR staff promoted the Summer Program and managed its integration with SURE, while librarians managed participant recruitment, content development and delivery, and the collection and analysis of student reflections. The program's initial target audiences were undergraduate student research assistants and their faculty supervisors, who were responsible for enrolling students in the program and supporting its outcomes. Enrollment was later extended to undergraduate and graduate students with or without research assistantships after we received multiple expressions of interest from faculty supervisors. All students who successfully completed the RDM Summer Program received one co-curricular credit through SURE.

Figure 1 shows that the program required students to:

- attend an introductory RDM training session
- attend a DMP workshop
- create and submit a DMP for their summer research work with the assistance of their faculty supervisor
- complete a reflection assignment exploring their experience learning and practicing RDM

Figure 1

RDM Summer Program Workflow Timeline



Faculty supervisors were required to:

- sign their students up for the program
- commit to having their students take part in all program requirements
- be available for consultation with their students regarding the development of the DMP

The goals of the program were to provide RDM training for students in the real-world context of their summer research assistantships and projects, and to better understand students' perceptions of learning about RDM and creating a DMP. Rather than pursuing specific learning outcomes, this initiative was experiential in nature and focused on completion of the program requirements. This created space for us to observe any possible outcomes and successes expressed by participants.

Eligibility, Promotion, and Recruitment

Eligibility for the program originally included undergraduate students completing a summer research assistantship with a faculty supervisor. The requirement for Faculty supervisors to enroll their students was intended to help secure student participation and commitment, ensure that students would have their supervisors' support in completing program requirements throughout the summer, and reduce attrition. After we received significant interest from faculty supervising students who were not undergraduate level or research assistants, eligibility was extended to accommodate any student working with a faculty supervisor. This resulted in a mixed cohort of students working on a diversity of projects, with various relationships to faculty supervisors (e.g., theses, honours projects, paid research assistantships).

The program was advertised via OVPR emails and newsletters, college and departmental research support staff, and emails from liaison librarians. The

advertisement contained a detailed overview of the program and its requirements, emphasizing that faculty were expected to support students in completing program activities and that students would not receive co-curricular credit unless they completed all program requirements (see Appendix A).

Before the registration deadline, librarians led an information session for faculty supervisors interested in learning more about the program. Those who chose to participate then registered themselves and their students using an online form that had been linked in promotional emails. The form asked them to indicate their college and department, how many students they were registering, whether those they were enrolling were undergraduate or graduate students, and faculty and student contact information.

Program Requirements

Requirement 1: Introductory RDM Training Session

Students attended a 1.5-hour introductory RDM training session that was held online via Zoom. Supervisors were encouraged but not required to attend. The session was delivered by a librarian and was primarily didactic in nature, with participatory activities incorporated to help students consider how well they may already be applying RDM best practices in their work. The training session discussed the following topics: what RDM is, why it matters, creating a data inventory, keeping files organized, storing and preserving data, sharing data, and building a DMP. Students also anonymously characterized their current RDM practices in reference to a rubric categorizing RDM practices on a spectrum from “ad-hoc” to “optimized for reuse” (Borghi et al., 2018), and were asked to share an entertaining GIF with the class representing their RDM style using Padlet software (https://padlet.com). At the end of the session, students were given time to create an account and project in the DMP Assistant (2022), an online tool for creating structured data management plans using templates and examples.

Between the first and second sessions, students used the basic template in the DMP Assistant to complete a rough draft of a DMP for their summer project in preparation for the DMP workshop. Students were asked to consult with their faculty supervisors for help populating the DMP with information relevant to their research contexts.

Requirement 2: DMP Workshop

Held two weeks after the introductory session, the goal of the 2-hour workshop was to provide participants with real-time training and support for building their DMPs. Prior to meeting, students completed a brief online form with a single free-text field asking them to describe the main challenges they faced when drafting their DMP, which allowed librarians to address these during the session. Faculty supervisors were again encouraged but not required to attend.

The workshop was taught by two librarians, held online via Zoom, and recorded so participants could use it as a resource when finalizing their DMP. The session was formatted to address DMPs step-by-step (data collection, data documentation and

metadata, data storage, responsibilities and resources, ethical and legal restrictions, and data sharing), with librarians presenting the DMP Assistant's default Portage Template question prompts and highlighting strategies for completing them. During the workshop, students had 15 minutes per section to work on their draft DMPs within the DMP Assistant, with those working as a team under the same faculty supervisor working together. After the workshop, students were given two weeks to complete their DMPs.

Requirement 3: Submit a DMP for Feedback

After participating in the workshop and completing a final DMP draft with the support of their faculty supervisor, students used the DMP Assistant to export their work and submit it to the librarians for feedback. The librarians did not use a grading rubric to evaluate the DMP. Instead, they provided feedback about the clarity, completeness, and transparency of the information provided, with suggestions for revisions where appropriate. If a DMP was submitted, this portion of the program was marked complete.

Requirement 4: Reflection Assignment

On August 31, 2022, approximately two months after DMPs were submitted, students were asked to complete a 500-word written assignment reflecting on their experiences during the program. This timing was chosen to align with the end of student research assistants' summer projects. The goals of the reflection assignment were to reinforce student learning and to help the librarians better understand students' perceptions of learning about RDM and creating a DMP. We chose the reflection format to allow students to share their thoughts as freely as possible, and we developed the prompts in line with Tracy's (2020) and Saldaña's (2016) approaches to avoid imposing pre-conceived themes onto students. Whereas other elements of the program asked students to collaborate with faculty supervisors (and team members where applicable), the reflection assignment was completed independently. Students responded to the following prompts:

1. What do you see as the benefits of building a DMP (if you see none, describe why)?

2. What do you see as the challenges and/or drawbacks of building a DMP?

3. Did building a DMP help you when working on your summer project? Why or why not?

4. What impact (if any) do you think DMPs can have on the future of research?

Students' written responses to these prompts constituted our dataset for analysis.

Reflection Assignment Analysis

The librarians coded students' written reflection assignments using Hsieh and Shannon's (2005) approach to thematic analysis and content categorization. Each

reflection assignment was coded individually in Microsoft Word. When a new theme was identified, it was coded and defined. When the same theme emerged in subsequent assignments, it was assigned that same code. Once the coding of all reflection assignments was complete, the codes were compiled and categorized into thematic groups in Microsoft Excel.

This project received ethics approval from the University of Saskatchewan's Behavioural Research Ethics Board (ID# 3375). Of the 33 students who submitted a reflection assignment, 19 provided informed written consent for their assignment to be analyzed for this study. The assignments were accessed for research purposes between September 1, 2022 and December 1, 2022. All assignments were anonymized before undergoing analysis. The categorized themes and analysis codebook are available in Appendix B.

Program Completion

Students who completed all four components of the RDM program received their co-curricular credit through the SURE program. After the RDM program was complete, librarians reached out to faculty supervisors for informal feedback about their experience with the program and encouraged them to engage with their students about their experiences. This feedback is addressed in the Discussion section.

Results

Program Participation

Thirty-five faculty supervisors from a diverse range of colleges and departments registered 53 students (34 undergraduate and 19 graduate) for the RDM Summer Program (see Table 1). Different numbers of students participated in in each requirement:

- The introductory training session hosted 75 student and faculty attendees.
- The DMP workshop was attended by 34 students (no supervisors attended), 3 of whom indicated that they could not attend the workshop live and would watch the recording.
- Thirty-six students submitted a DMP either individually or with their team, and 33 students submitted an individual reflection assignment.
- 62.2% of the students (33/53) successfully completed the program and received a co-curricular credit.

Table 1

College and Department Breakdown of Faculty Who Registered Students for the RDM Program

College	Department	Faculty	Undergraduate Students	Graduate Students
Agriculture and Bioresources	Plant Sciences	3	2	3
Arts & Science	Anthropology and Archaeology	1	1	0
Arts & Science	Biology	1	1	0
Arts & Science	Chemistry	1	1	0
Arts & Science	Computer Science	2	1	3
Arts & Science	Linguistics	1	1	0
Arts & Science	Psychology and Health Studies	3	5	0
Engineering	Chemical and Biological Engineering	1	0	1
Engineering	Mechanical Engineering	2	3	3
Medicine	Anatomy, Physiology, and Pharmacology	3	2	1
Medicine	Biochemistry, Microbiology, and Immunology	2	4	0
Medicine	Community Health and Epidemiology	1	0	1
Medicine	Continuing Medical Education	1	2	0
Medicine	Emergency Medicine	1	1	0
Medicine	Oncology	1	0	1
Medicine	Pathology and Laboratory Medicine	1	0	2
Medicine	Pediatrics	1	3	0
Medicine	Psychiatry	1	1	0
Medicine	Rehabilitation Science	1	0	1
Medicine	Undeclared	1	1	0
Nursing	N/A	1	0	1
Pharmacy and Nutrition	Pharmacy	3	4	0
Public Health	N/A	1	0	2
Veterinary Medicine	N/A	1	1	0
Totals	N/A	35	34	19

Reflection Assignment Results

The goal of the reflection assignment was to better understand students' perceptions of learning about RDM and creating a DMP. In the following sections, we share results that illustrate the benefits, challenges, usefulness, and potential future impacts of DMPs as reported by students. This structure reflects the four question prompts presented in the assignment.

Perceived Benefits of Completing a DMP

The thematic analysis of student reflections revealed that students perceived project planning (*n* = 18), applying data management best practices to their projects (*n* = 16), facilitating data sharing and reuse (*n* = 16) and, to a lesser extent, team communication (*n* = 4), to be the benefits of developing a DMP.

With respect to project planning, students mentioned that completing a DMP allowed them to think ahead about how their project would take shape and set expectations for themselves and their team. One student noted that the DMP was an opportunity to scope their data-related needs for their project before it began: "I also think that developing a DMP helps you to identify the scope of your data use/sharing early in the project so you and your team know what is expected of you as researchers." Another wrote:

> DMPs are beneficial for helping the researcher plan a project. Knowing how data will be stored and preserved is especially helpful in allowing the research to be re-visited later to ensure efficiency and save time. It sets everything up in a short, concise manner so that those involved understand their roles and expectations, and how a given project will be managed.

Students also wrote about how a DMP helped them refine their processes for data collection, organization, and file naming. For example:

> The knowledge about data management helped considerably with organization. Before joining this workshop, I spent hours searching for files - each file having a different name. After creating the DMP, we started standardizing naming practices and documenting hard drives and what experiments/data are stored on each drive. […] I was collecting many sample bags while out in the field which could have been hard to organize and keep track of. By making a DMP I had a naming convention and procedure in place to keep track of all my samples, even if my conventions evolved as needed.

Some students wrote about the value of DMPs for improving research reproducibility and data reuse, and how they can facilitate better data sharing. One student noted the DMP's ability to make research data more reusable as its most beneficial attribute:

> I see the most beneficial part of building a DMP being how reusable it can make the data. One can imagine how this kind of planning has the potential to lead to saving a fortune on resources. This improves reproducibility the reusability of data *[sic]* and leads to/helps provide robust methodology.

Finally, several students highlighted how the DMP improved their team communication, citing how it fostered more clarity between them and their supervisors, helped with onboarding new team members, and clearly established roles and responsibilities within the project team. One expressed how a DMP can be particularly beneficial in contexts where data changes hands:

> From building a DMP, I found that the data gathered can be preserved in a much more organized fashion. This is very important for sharing information between people and/or storing information for long periods of time. This is especially prevalent in my case as I am only working on the project for the summer and the data in my DMP is going to someone else for analysis.

Perceived Challenges of Completing a DMP

Students' descriptions of the challenges they faced while creating their DMPs focused on a lack of flexibility within the DMP Assistant's standard DMP template (*n* = 14), not having the information needed to respond thoroughly to questions posed in the template (*n* = 11), the burden of having to create a plan at all (*n* = 10), and the lack of long-term value the DMP provided (*n* = 4).

The most common challenge reported was that the default Portage Template in the DMP Assistant was inflexible, which could hamper students' ability to plan realistically for the management of their data: "I think building a DMP that is too rigid early in the research process can be limiting and present barriers and challenges when it comes to engaging with the data."

Students also indicated that more discipline-specific templates would improve their ability to tailor a DMP to their research project:

> I found that one of the issues with building the DMP was that a number of sections highlighted within it were not relevant to my research. This made it difficult to find an answer for those parts. If the plan was more catered to my research in particular, it would have been more useful to me in the long term.

Students also reported difficulty foreseeing all aspects of their project, making completing the DMP a challenge. For example, some indicated that they could not answer certain questions without knowing what the data collection process would look like or what the data would reveal. Others discussed how estimating storage needs at the outset of a project was difficult:

> It can be challenging to have a DMP planned out prior to starting a project. For example, I found it rather difficult to estimate how much storage would be required for our study. This is why it is important to know that the DMP is a

> "working document" that changes from time to time when needed and that things may not always go as initially planned.

In other cases, students the challenge of gathering information for the plan and the time it required:

> Much of the information required to develop the plan was unknown to me, forcing me to ask others for that information. While this isn't a problem in itself, it definitely made the plan take a lot longer than what is likely to be necessary.

Many students discussed the burden of completing a DMP in addition to their other work. However, several also reflected on the fact that the DMP would save them time and effort later in their project. For example: "the high up-front time requirement was somewhat off-putting, but I just had to remind myself that it saves me heaps of time in the future." Others were more direct in their assessment: "Writing a DMP can be tedious and sometimes boring."

Utility of DMPs for Student Research

Of the 19 students, 14 indicated that developing a DMP helped them with their projects, while five provided mixed responses indicating that it helped in some respects but not others. No students indicated that building a DMP was not helpful for their research at all.

The following themes emerged among responses that indicated that completing a DMP was useful: Students felt that it helped them be considerate and mindful of their data practices (n = 14), they could apply RDM practices that they had not applied before (n = 14), and they felt that communication among team members or with their supervisor was improved (n = 3). Many students expressed that the DMP facilitated an awareness and intentionality around data collection and organization that would not have occurred without the plan. One student reflected,

> Notably, it brought to my attention the importance of having a solidified plan [as] opposed to working with the assumption that whatever naming scheme I derive makes sense to myself. Additionally, it emphasized the importance of simply being organized with your work. It is very easy to just save documents on whatever format is convenient. However, ensuring that all my work is organized properly in easy-to-understand file names is a habit to acquire for work on this project and further studies.

Others indicated that developing file naming conventions, improving data organization, and creating documentation materially benefitted their summer projects. For instance:

> One of the most useful ideas presented to me was metadata. Metadata allowed me to put my own notes into the data I managed for anyone who read it in the future. It helped me note the 'who's, 'what's, 'why's, 'when's, and 'where's *[sic]* of the data with the data.

Finally, of those students who indicated that team communication was improved by the DMP, all mentioned improved communication with their supervisor:

> Going through the DMP information with my supervisor was very beneficial to how we will continue to work together, especially when we are sharing information and sending edited documents back and forth. It allowed for some fruitful discussions on how to manage future projects for both of us.

For those who were ambivalent about the utility of the DMP in the context of their project, responses focused primarily on the fact that after creating the plan, students did not update or refer to it at any point over the course of the summer. One student explained that while developing the plan was educational, the completed document itself was not useful:

> I learned the most while developing the plan and once it was finished, I did not really have a need to access it. Much of the data and storage methods had already been decided before I started my research so there was less decisions *[sic]* on my part when creating the plan.

Impact of DMPs on the Future of Research

Students' reflections on how DMPs may impact the future of research centered around four themes: DMPs will improve researchers' processes and workflows (*n* = 17), more conscientious data management will result in better protections for the privacy of data (*n* = 8), DMPs will encourage more rigorous and transparent research (*n* = 6), and they will facilitate better data sharing and reuse (*n* = 6).

On the topic of research efficiency, this student highlighted the interconnected outcomes of transferability and reuse of data:

> the importance of DMPs is exemplified with their potential to promote greater data retention and transferability between researchers. Accordingly, projects can be built upon one another if there is a mutual understanding in naming schemes of files and data. Therefore, the effective and consistent creation of DMPs can facilitate interconnectivity between researchers globally. Less resources are wasted in collecting data that has already been recorded and collaboration is encouraged to advance research.

Within the theme of data privacy and protection, students noted that DMPs require researchers to speak directly about how they will safeguard their research data and manage it responsibly. One student noted that DMPs may become tools that can support best practices related to Indigenous data: "I also believe this [the DMP] will be mandatory because it is good practice for preserving privacy consent. Specifically, with Indigenous research, their data needs to be managed according to the community principles." Another student addressed the related issues of rigour and transparency: "DMPs will help ensure that rigour is maintained throughout research projects and help when explaining changes or divergences from the initial research methods as projects evolved, as one can track exactly what changed and explain why it changed." In

response to this reflection prompt, students also revisited the ideas of data sharing and reuse: “[DMPs] could be a powerful tool in the push to ensure research is replicable, useable, and published even in the case of insignificant results.”

Responses from the student reflections demonstrate that students engaged with RDM concepts throughout the program, which they put into practice when creating their DMPs. Many responses affirm that students perceive value in developing a DMP and in RDM best practices generally. The challenges they shared offer insights that may be valuable for the development and delivery of RDM instruction.

Discussion

The level of enrollment and engagement in the 2022 SURE Summer RDM Program, the opportunity it provided participants to practice RDM in real-world research contexts, and the learning demonstrated in the completed assignments illustrate a successful initiative that can serve as model for librarians and research support staff seeking to expand their RDM training portfolios. The program also provided valuable insights into student perceptions of RDM that can help inform the work of anyone responsible for championing RDM at their home institution. In this section we discuss what we consider to be the program’s most prominent successes, its challenges and strategies to address them, and implications for the development of RDM training drawn from the student reflection assignments.

RDM Summer Program: Successes and Challenges

We consider the three main successes of the SURE Summer RDM Program to be: a level of participant retention that exceeded expectations, the degree to which faculty engaged with and supported the program, and the level of student engagement evident throughout the DMP and reflection assignments. We also believe that collaboration with the OVPR, which facilitated our ability to offer co-curricular credit to student participants, was a key factor in these successes.

We believe that our relatively high level of student retention, which was 62.2% at the end of this long and multifaceted program, was facilitated by the promise of co-curricular credit for completing all elements, students’ accountability to their faculty supervisor, and the way the program’s practical activities were tied directly to students’ research and summer projects. Because students were required to complete all aspects of the program to receive credit, including attending every training session, completing a DMP, and writing a robust reflection that demonstrated retention of and critical thinking around RDM concepts, we saw a high level of engagement across all aspects of the program.

Having faculty register their students for the program and engage with them around each requirement created an environment of support and accountability for student participants, which we believe helped them move through the program successfully. Faculty were also encouraged to attend training sessions if desired and gained exposure to RDM by assisting students with their DMPs. As a result of these strategies, a secondary success of the program was that 35 faculty supervisors engaged with

foundational RDM concepts and practices that they may be required to apply in their own work via Canada's Tri-Agency Data Management Policy.

While library RDM training initiatives frequently target diverse audiences through open campus-wide sessions (Bardyn et al., 2018; Dressel, 2017; Kim & Syn, 2021; LaPolla et al., 2021; Oo et al., 2022; Read et al., 2019; Southall & Scutt, 2017; Xu et al., 2022), there is evidence that researchers desire discipline- or even project-specific guidance (Bauder, 2022; Clare et al., 2019; Tayler & Jafary, 2021); feedback from our previous workshops and sessions have also highlighted this. By intentionally bringing together students and faculty around their own research contexts, we were able to provide RDM training that was uniquely relevant to the program's diverse participants.

The successes we described were in many ways facilitated by collaboration with our institution's OVPR. The OVPR was willing to assign co-curricular credit for completing the program, and by association with the SURE initiative the program gained visibility as part of a prominent annual calendar of workshops and events. The initial call for participants and registration details were communicated by our OVPR collaborator via SURE's channels, which allowed us to target faculty supervisors.

Our experience demonstrates that library RDM programming can be enhanced by collaborating with other campus units supporting research, incorporating incentives such as co-curricular credit, requiring faculty to commit their students to participate, and building in opportunities for students and faculty to engage collaboratively in real-world contexts. Librarians seeking to develop or adapt RDM programming at their own institutions may benefit from exploring one or more of these approaches.

Challenges and Lessons Learned

Based on the project team's experience as well as student and faculty feedback, the main challenges of the RDM program were the time commitment required of the librarians and the pacing of program requirements for students.

To ensure the success of the program, librarians were required to prepare and deliver two interactive instructional sessions, provide feedback on 36 DMPs, and review 33 reflection assignments; they also needed to manage communication and logistics after the initial call for participants. These responsibilities had a significant impact on librarians' capacity during the months in which the program was active and became the major focus of their work over the summer.

We identified three ways that this time burden could be mitigated in future iterations of the program. All course communications, materials sharing, and assignment submissions and grading were managed using email. Using a learning management system to consolidate these activities would significantly reduce the time commitment required and ease the organizational burden for librarians. Further, having another project collaborator such as a library assistant handle all program communications would save additional time. We also believe that the range of disciplines represented in the program presents an opportunity for liaison and subject librarians to participate in

the program. This could enhance the level of discipline-specific support available to participants, allow librarians to engage with their research communities around RDM, and distribute responsibility for providing feedback on DMPs.

From student and faculty feedback we learned that participants considered the two-month gap between submitting the DMP and completing the reflection assignment too long. Students reported that this length of time between components made them feel disconnected from the program, and that they struggled to recall the work they had done on their DMP two months prior; faculty agreed that a shorter timeline would have better sustained the program's momentum and helped them track their students' progress. In future iterations we anticipate shortening this time period to one month and assessing participants' response to the change.

Student Perceptions of RDM: Implications for Practice

Responses from the reflection assignment highlighted multiple shared experiences that illustrate the impacts of the program and bear implications for future RDM supports and services, including training.

Sixteen of 19 respondents saw data sharing and reuse where appropriate as a positive outcome of developing a DMP. Students spoke thoughtfully about the value of data sharing and appeared to grasp its benefits. However, although data sharing and reuse were highlighted strongly in the reflections, in the DMPs reviewed by librarians, responses related to data sharing, licensing, repositories, and metadata were often sparsely populated or left blank, and in a few cases indicated explicitly that the student did not know how to answer the prompts. This may suggest that there is a gap between student interest in data sharing and the knowledge required to describe it, and that more robust training in data sharing may be required to help researchers feel comfortable with this aspect of RDM.

Nearly half of respondents commented on the lack of flexibility in the default Portage Template within the DMP Assistant tool and the challenges they faced trying to respond to its prompts in the context of their research projects. During this phase of the program, librarians also received seven emails from students reporting difficulties completing the DMP for this reason. This issue highlights known challenges within RDM support communities (e.g., Digital Research Alliance of Canada) around creating DMP templates that are both general enough to be flexible and specific enough to be relevant to unique research contexts. For RDM training purposes, if a general template is used it may be valuable to incorporate additional discipline-specific support, such as the involvement of liaison librarians, as suggested in the Challenges and Lessons Learned section. The use of discipline- and methodology-specific templates available within the DMP Assistant could also be considered.

The student reflections left us with the overwhelming impression that students engaged thoughtfully with RDM, retained key concepts from training sessions, and understood the benefits of incorporating data management planning and sound RDM practices in their research process. Because RDM can place a significant burden on researcher

time, as many students indicated, we feel that sharing the "why" of data management is equally important as teaching practical tools and skills. We believe this program offers a viable model for introducing RDM to students and faculty in a way that does both.

Conclusion

The SURE RDM Summer Program demonstrates one way that academic librarians can partner with their institutions' research offices to offer active and engaging RDM support to students and faculty. Through workshops, practical engagement, and reflection within the context of real-world research, the program supported participants in learning about RDM and creating a DMP, and it provided insights for academic librarians who wish to refine or develop training in their local contexts. Sustained and creative efforts of this kind will be prerequisites for success as researchers navigate emerging expectations from funders and publishers in Canada and worldwide.

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Appendix A

Summer Research Data Management Program Recruitment Document

SURE Summer Student Research Data Management (RDM) Program:

Learning RDM Best Practices and Building a Data Management Plan

TIMEFRAME

Summer Projects 2022

PROGRAM OVERVIEW

Imminent policy from the Tri-agency will require grant applications to include a research data management (RDM) plan. A data management plan is a formal document describing how research data will be managed and documented throughout a research project, as well as the subsequent deposit of the data in a data repository for long-term management and preservation [CASRAI].

We have partnered with SURE: Student Undergraduate Research Experience program to offer a research data management training program for undergraduate students and supervisors. The SURE Summer RDM Program presents a unique opportunity to upskill students in the early stages of their research careers, helping them learn about and adopt RDM best practices and comply with the new Tri-agency policy. This program will also benefit supervisors by familiarizing them with Tri-agency RDM policy which may apply to their future grant applications. Students who participate in this program will receive Co-curricular credit.

By participating in this program, faculty supervisors commit to requiring that students participate in the activities described under “Program Components”, below. Throughout the program, supervisors and students who participate will be supported by the librarians administering the program to ensure that each student can be successful.

PROGRAM COMPONENTS

1) RDM Education

Students who participate in the program will attend two separate educational sessions (online/in person pending) to learn about and apply RDM best practices. Faculty supervisors are invited and encouraged to attend both educational sessions (not required).

How to Manage your Research Data (May 10th 10:30am, 2022)

- Length: 1.5 hours
- Format: Lecture and activities

- Takeaway activity: Students use the DMP Assistant template to consult with their supervisors about current data management practices in their research group

How to Create a Data Management Plan: A Workshop (May 25th 1-3 pm, 2022)

- Length: 2 hours
- Format: Hands-on workshop
- Topics covered:
    - Building a data management plan using the DMP Assistant tool
    - Hands on time building each phase of a data management plan

2) Development and submission of DMP to supervisor and librarian(s) (Due early/mid June)

After taking the introductory session, consulting with their supervisor, and participating in the workshop, students will finalize their data management plan and submit it to their supervisor and the librarians for review and feedback.

3) Student/supervisor reflection (Due week of Aug 15)

Students write a reflection of their experience learning about and building a data management plan.

Student reflection:

- Length: =<500 words
- Reflection on one's personal experience learning about RDM and building a data management plan.

Supervisor feedback (optional):

- Written comments describing whether the creation of a DMP made any impact on the students' work or the work of their larger research team over the course of the summer.

Analysis of student reflections

For research purposes, the program team will ask students to consent to having their reflection assignments analyzed to identify common themes related to learning about and practicing RDM. Participation in this the research portion of this program is entirely optional.

PROGRAM TIME COMMITMENT

Stakeholder	Task	Time commitment
Student	Attend introductory RDM training session	1.5 hours
Student	Attend data management plan workshop	2 hours
Student	Complete data management plan	3 hours
Student	Student reflection	1.5 hours
Student	Total:	8 hours
Supervisor	Attend introductory RDM training session (optional)	1.5 hours
Supervisor	Attend data management plan workshop (optional)	2 hours
Supervisor	Answer student's questions related to building their data management plan	2 hours
Supervisor	Feedback to project team	30 minutes
Supervisor	Total (required):	2.5 hours

Appendix B

Student Reflection Themes and Codebook

See file s2_sure_analysis_codebook_2023.xlsx