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Research Article

Evaluating an Instructional Intervention for Research Data Management Training

Alisa Beth Rod
Research Data Management Specialist
McGill University Library
Montreal, Quebec, Canada
Email: alisa.rod@mcgill.ca

Sandy Hervieux
Head Librarian
Nahum Gelber Law Library
McGill University
Montreal, Quebec, Canada
Email: sandy.hervieux@mcgill.ca

NuRee Lee
Physics and Astronomy Librarian
University of Toronto Libraries
Toronto, Ontario, Canada
Email: nu.lee@utoronto.ca

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Abstract

Objective – At a large research university in Canada, a research data management (RDM) specialist and two liaison librarians partnered to evaluate the effectiveness of an active learning component of their newly developed RDM training program. This empirical study aims to contribute a statistical analysis to evaluate an RDM instructional intervention.

Methods – This study relies on a pre- and post-test quasi-experimental intervention during introductory RDM workshops offered 12 times between February 2022 and January 2023. The intervention consists of instruction on best practices related to file-naming conventions. We developed a grading rubric differentiating levels of proficiency in naming a file according to a convention reflecting RDM best practices and international standards. We used manual content analysis to independently code each pre- and post-instruction file name according to the rubric.

Results – Comparing the overall average scores for each participant pre- and post-instruction intervention, we find that workshop participants, in general, improved in proficiency. The results of a Wilcoxon signed-rank test demonstrate that the difference between the pre- and post-test observations is statistically significant with a high effect size. In addition, a comparison of changes in pre- and post-test scores for each rubric element showed that participants grasped specific elements more easily (i.e., implementing an international standard for a date format) than others (i.e., applying information related to sequential versioning of files).

Conclusion – The results of this study indicate that developing short and targeted interventions in the context of RDM training is worthwhile. In addition, the findings demonstrate how quantitative evaluations of instructional interventions can pinpoint specific topics or activities requiring improvement or further investigation. Overall, RDM learning outcomes grounded in practical competencies may be achieved through applied exercises that demonstrate immediate improvement directly to participants.

Introduction

To meet growing demands on researchers to implement research data management (RDM) best practices, academic libraries are increasingly offering RDM training for various audiences (e.g., undergraduates, graduate students, and faculty members) and tailoring training for various disciplines and contexts (Cox et al., 2017; Hswe, 2012; Xu et al., 2022a). While graduate students and researchers may be well-versed in data analysis and research methods, they are rarely taught best practices for RDM within their own disciplines (Briney et al., 2020; Eaker, 2014; Oo et al., 2022). Over the past 15 years, academic librarians have leveraged this opportunity to develop robust RDM services, including training across and within disciplines (Ducas et al., 2020). RDM training is typically offered as part of library service models where instructional sessions are open to participants across disciplines in addition to offering course-specific workshops (Powell & Kong, 2020; Thielen & Hess, 2017; Xu et al., 2022b).

Although many academic libraries offer RDM training covering basic and advanced competencies, there are few existing studies incorporating a statistical evaluation of the effectiveness of specific RDM instructional interventions (Xu et al., 2022b; Xu et al., 2023). This study offers an in-depth analysis of one RDM training instructional intervention developed through a collaboration between an RDM specialist

and subject librarians. To assess the success of our practical approach to teaching RDM basics, we implemented a quasi-experimental pre- and post-test study design to measure participants' understanding of a core RDM competency presented in the workshops.

Literature Review

RDM Training and Competencies

RDM instructional sessions or workshops typically address best practices covering core concepts such as the FAIR principles (i.e., that data should be findable, accessible, interoperable, and re-usable), in addition to practical topics including data management plans (DMPs) and stages of the research data lifecycle, such as data storage and analysis, metadata and documentation, collaboration, data deposit or data sharing, and others (Gunderman, 2022; Xu et al., 2023). Examples of specific competencies in RDM include understanding funder requirements for DMPs, naming a file according to a convention, identifying preservation file formats (e.g., open formats such as .csv instead of proprietary formats such as .xlsx), maintaining robust documentation such as in the form of a README file, identifying discipline-specific metadata schema or controlled vocabularies, versioning files, and data preservation or depositing data in a public repository (Briney et al., 2020; Eaker, 2014; Zhou et al., 2023).

There are three recent studies that have focused on providing reviews or syntheses of the existing literature related to RDM training (Oo et al., 2022; Tang & Hu, 2019; Xu et al., 2022b). First, a recent literature review identified an increase in demand for RDM training internationally (Tang & Hu, 2019). Tang and Hu (2019) found that many institutions offer introductory RDM training and that the demand is high among both STEM and non-STEM disciplines. The mode of delivery for these types of workshops includes a range of approaches, such as asynchronous online instruction modules, conventional in-person instruction, and synchronous online instruction (Oo et al., 2022). A systematic review by Oo et al. (2022) found that most RDM training is offered by librarians via a mix of discipline-specific and general topics. In addition, Oo et al. (2022) found that RDM training is typically adjusted for audience knowledge level and discipline-specific needs. Finally, the review by Oo et al. (2022) identified two additional themes from the literature, including an emphasis on practical outcomes for participants of RDM training and relying on collaborations to develop the training with varying relevant internal stakeholders.

Evaluating RDM Training

Oo et al. (2022) found four general categories related to measuring the impact of the RDM trainings, namely observations by the trainers related to trainee participation and engagement, an increase in future demand for or registrations for RDM training, self-reported increases in knowledge or understanding of RDM by participants, and self-reported positive feedback about the training by participants. Two other recent studies focused on quantitatively evaluating the effectiveness of RDM training in different modes and according to varying pedagogical approaches (Xu et al., 2022a; Xu et al., 2023). For example, Xu et al. (2022a) implemented an evaluation of an intervention focused on different styles of teaching or pedagogical approaches for online RDM instruction and found that interactive activities are related to higher post-training knowledge assessment scores. Xu et al. (2023) evaluated online RDM instruction for graduate student using an experimental research design, where graduate students were assigned to an intervention group receiving online RDM instruction for four hours or a control group that did not receive training. The results of this study are based on a comparison of knowledge assessment scores between both groups for pre- and post-test scores. The knowledge assessment implemented in this study

was designed based on best practices related to RDM across the research data lifecycle model. The main finding of this study is that RDM skills and knowledge depend on disciplinary training.

A recent scoping review by Xu et al. (2022b) found that there have been only four empirical intervention studies related to RDM training: two of these studies focused on RDM training for librarians, the third focused on an embedded training in an undergraduate course, and the fourth focused on a for-credit RDM training within a graduate studies program. For example, a study by Agogo and Anderson (2019), which is included in Xu et al.'s (2022b) scoping review, used a pre- and post-test design to measure the effectiveness of a physical card game-based activity in teaching core RDM competencies related to technical and business concepts to undergraduates in an information systems course. Agogo and Anderson (2019) find that students who participated in this activity experienced an increase in confidence related to understanding business and technical RDM competencies, such as parallel processing and how business biases can affect data organization, and that students performed better on knowledge assessments following the intervention. This study helps to establish that a hands-on activity can have an immediate effect on students' understanding and ease with RDM. Another study included in the same scoping review, by Matlatse et al. (2017), discusses the implementation and results of a quasi-experimental design, or a "non-randomised control group pre-test-post-test design" to increase RDM knowledge among librarians across several universities in South Africa (p. 303). In this way, there are a few existing studies that contribute proof of concept in terms of demonstrating the usefulness and validity of applying quasi-experimental designs to the evaluation of RDM instructional interventions. However, one main takeaway of the scoping review by Xu et al. (2022b) is that more intervention studies relying on statistical analyses are needed regarding understanding the effectiveness of RDM training in connection to competency-informed learning objectives.

Aims

At a large research university in Canada, an RDM specialist and two liaison librarians partnered to evaluate the effectiveness of an active learning intervention in their newly developed competency oriented RDM training. The intervention consists of an instructional exercise on best practices related to file-naming conventions. The overall learning outcome for this activity is for workshop participants to gain proficiency in naming files. File naming conventions are a core RDM competency due to their importance for establishing standardization and ensuring consistency across and within research datasets (Briney et al., 2020; Krewer & Wahl, 2018). The intervention was included in our introductory-level RDM workshops. The workshops were part of a larger effort to create the first RDM curriculum at the McGill Library (Rod et al., 2023a). The workshops were delivered online via Zoom and typically lasted between 60 and 90 minutes. We introduced the content using PowerPoint slides and included a few "hands-on" activities in each workshop to promote participants' engagement and comprehension (see Rod et al., 2023b for a list of workshops and related materials).

This study is organized around the following two research questions:

RQ1: Does the instructional intervention increase workshop participants' proficiency in naming files according to RDM best practices?

RQ2: How do different elements of the file naming activity relate to changes in workshop participants' proficiency levels?

To address these research questions, we first developed and empirically validated a novel rubric for assessing proficiency in naming files. We then applied a statistical analysis of the rubric-derived pre- and post-test measure of proficiency to investigate the effect of the file naming instructional intervention (Rod et al., 2023a).

Methodology

This study relies on a pre- and post-test quasi-experimental intervention design implemented during introductory RDM workshops offered 12 times between February 2022 and January 2023 (for an overview of this type of quantitative study design applied in an information literacy instructional context, see Fitzpatrick & Meulemans, 2011). Prior to the intervention, workshop participants are asked to view a black and white photographic image of a small white dog carrying a slipper. Workshop participants are given the following instructions: "I just showed you a photo of my dog, Chopin. How would you name this file?" (see Figure 1). Workshop participants are given one to two minutes to respond via a cloud-based McGill University enterprise licensed free polling application (such as Microsoft Forms). The data collected for this study are covered by the approved McGill University Research Ethics Board protocol file 22-01-076. The data were collected anonymously. Following their first attempt at naming the image file, we review the responses as part of a group discussion, which typically demonstrates that although all the participants are viewing the same image with the same information, their proposed file names are highly variable and lack consistency.

Figure 1
RDM workshop file naming activity image.

In the next part of the workshop, we review best practices related to file naming. Specifically, we discuss the ISO 8601 date format (i.e., YYYY-MM-DD) as an internationally accepted best practice for maximizing machine-readability and interoperability across various systems and software. We also note that, in the context of research data, the initials of the file creator, a project acronym, a topic or subject of the file, and versioning information are all important elements in uniquely identifying the individual file. We discuss the purpose of following best practices for file naming, including project management for researchers who may not remember the contents of specific files five or ten years into the future. In addition, to improve the reproducibility or re-use of research data, it is necessary for files to have descriptive names so that other researchers may understand or identify the contents without opening the file itself. Importantly, during this discussion, participants often explicitly acknowledge that naming a file requires several minimum key pieces of information. This is one desired learning outcome of the exercise – for workshop participants to think critically about managing research data and to then apply their knowledge of file naming best practices.

The post-test for this activity involves viewing the same image of Chopin the dog with the following additional instructions: "How would you name the photo according to the information I give you? This photo of my dog Chopin was taken on August 5th, 2018. It is a polaroid photo. The photo is in black and white and was taken at my parent's home in Toronto." For the post-test activity, more detailed information about the image of Chopin is provided to workshop participants to reinforce the importance of using conventions. The provision of additional information related to the image is part of the design of the instructional intervention.

At this point, we ask workshop participants to submit a potential file name for this image again. During this section of the workshop, we discuss the observed differences with workshop participants, noting that although their second attempts at file names incorporate elements related to best practices and are typically improved in terms of interoperability or machine-readability, there remains many unique or inconsistent file names. It is important for the learning outcome of this intervention that participants observe that having additional information about the image file is not enough to obtain a standardized result (i.e., consistent file names across workshop participants) aligning with best practices.

To evaluate the effect of the intervention on participants' proficiency, we developed a grading rubric differentiating levels of proficiency. Proficiency in this case is operationalized as the extent to which a participant demonstrates the ability to apply best practices for naming files according to a standards-based convention, which encompasses at least four file naming elements. Rubrics are a "reliable and objective method for analysis and comparison" and have been used consistently by librarians in the past decades to evaluate information literacy instruction outcomes (Knight, 2006, p. 43). We mapped the workshop learning objective related to file naming to four components of the workshop activity (i.e., including a date, topic, and version in a well-formatted file name) to help us measure users' levels of proficiency before and after the intervention. We established a three-point measurement scale (poor, average, and excellent) with average serving as the basic threshold of understanding, or proficiency, for naming a file according to a standards-based convention (see Table 1 for the grading rubric).

Table 1
Grading Rubric: Creating a File Naming Convention

Criteria	Poor (1)	Average (2)	Excellent (3)
Date	No date is included in the naming convention.	Some date information, including a placeholder such as [date], is included; it may not follow a machine-readable scheme.	A complete date is included in the ISO 8601 machine-readable format (yyyymmdd) or (yyyy-mm-dd).
Name	The file is not given a descriptive name (e.g., no topic or subject). One naming element may be used.	A somewhat descriptive name is used; it could be too generic for unique identification. Two naming elements are used to identify the file.	A unique and descriptive name is used. At least three naming elements are used (excluding date and version).
Version information	No version information is included.	Version information is provided but incomplete: the version number or the initials of the contributors could be missing.	Complete version information is provided and includes initials for collaborators on the file.
Formatting	The file name does not abide by basic formatting rules for files (e.g., includes special characters that are not machine-readable or spaces).	The file name makes use of some formatting rules. It is not completely machine-readable. Includes a maximum of one element that's not machine-readable, such as special characters and spaces.	The file name abides by formatting rules and uses underscores or hyphens or CamelCase where appropriate. The file name is machine readable.

For example, for the date component of the file name, we evaluated if participants not only included a date, but also whether it reflected the ISO 8601 date format. If a participant did not include a date in their submitted file name, their file name date element submission was coded as poor. If a participant only included a placeholder for a date (e.g., "[date]") or did not use the international standard for dates in their submitted file name, their file name date element submission was coded as average. Our pedagogical perspective is that participants who included a date or date placeholder in their initial file name submission, regardless of whether their submission was formatted correctly or not, understood the importance of including this element. If a participant used the ISO 8601 date format in their file name submission, their file name date element submission was coded as excellent.

We used manual content analysis to independently code each pre- and post-instruction file name according to the rubric, which served functionally as a codebook. Content analysis is a method of reviewing qualitative data, such as text, to categorize observations (Bernard et al., 2016; Krippendorff, 2018; Stemler, 2000). Content analysis is an iterative process in which it may be necessary for coders to re-code the data or a sample of the data to calibrate themselves to the categorization criteria. To ensure rigor, at least two coders must independently analyze the data according to a standardized codebook or rubric. To refine and provide examples for the initial rubric, two of the authors coded a sample of pre- and post-test file names. After adding clarifying information to the rubric, the two coders re-coded the same

sample to ensure agreement. The three authors each coded two-thirds of the full dataset, meaning that all file names were coded two times independently (Rod et al., 2023a). Following two rounds of coding, we reached a high level of inter-rater reliability (percent agreement > 90% or $\kappa > .70$) for all items (Krippendorff, 2004; Kurasaki, 2000; Lombard et al., 2002). See Table 2 below for inter-rater reliability analysis results.

Table 2
Inter-Rater Reliability Analysis Results

Variable code/shorthand	Percent agreement	Cohen's kappa (κ)
Pre-test Date	94.4%	0.912
Pre-test Name	94.4%	0.919
Pre-test Version	96.3%	0.856
Pre-test Formatting	91.9%	0.865
Post-test Date	91.9%	0.853
Post-test Name	98.8%	0.975
Post-test Version	90.1%	0.844
Post-test Formatting	93.2%	0.882

The inter-rater reliability outcomes, including percent agreement and Cohen's kappa for each variable, were produced using SPSS, a statistical analysis software program. All data are publicly available at the McGill University Dataverse collection: https://doi.org/10.5683/SP3/V8JG3G. Following the analysis of inter-rater reliability, two of the authors reconciled all remaining disagreements by re-coding inter-rater discrepancies. In most cases, disagreements arose due to subjective interpretations of phrasing related to the name category of the rubric. For example, we debated whether adjectives or verbs should count as an independent naming element or as part of a single element (e.g., "happy dog" or "white dog".). Ultimately, we decided to consistently rate these types of phrases as single naming elements. Overall, there were relatively few disagreements, and those disagreements were the results of consistently applied subjective interpretations that could be reconciled by comparing them against the rubric.

Results

One key purpose of this study is to determine whether workshop participants in an introductory RDM training improve in proficiency following a newly designed practical instructional activity involving a standards-based file naming convention. The evaluation rubric is designed such that a score of 2 for any element of the file name is the threshold for proficiency, with a 1 corresponding with a lack of proficiency and a 3 corresponding with a high level of proficiency (see Table 3 for examples of participant-submitted file names before and after the instructional intervention). To address RQ1 and determine whether workshop participants gained proficiency, we compare the average scores for each participant pre- and post-instruction intervention (n = 127, after dropping 34 observations for which either the pre- or post-response was missing). Only complete data encompassing both a pre- and post-response from the same individual are included in this analysis.

Table 3
Selected Exemplars of Pre- and Post-Intervention File Names

Pre-intervention	Post-intervention
Chopin_Baguette_1June2021	20180805_Dog_Chopin_MS_Toronto_v2
happy dog	20180805_FP_Chopin_PolaroidBW
Shoe eater	20180805_chopin_Toronto

The average score of the four file naming elements for the pre-test observations is 1.72 (σ = 0.326), which is below proficiency according to the rubric. The average score of the four file naming elements for the post-test observations is 2.35 (σ = 0.391), which is above the threshold for proficiency according to the rubric. Since the participants were not randomly selected and since the measurement scale is ordinal, we conducted a Wilcoxon signed-rank test to determine if the difference in medians between the pre- and post-test observations is statistically significant. A Wilcoxon signed-rank test is the non-parametric equivalent to a paired t-test when one of the underlying assumptions of the paired t-test, such as normality, random selection, or a continuous dependent variable, is violated. The results of the Wilcoxon signed-rank test show a statistically significant gain in proficiency ($Z = -9.198$, $p < 0.001$). The common language (CL) effect size statistic, calculated by dividing the positive ranks value (n = 114) by the total after removing ties (n = 117), is 0.97, which means that if a participant was randomly selected from our dataset, there is a 97% probability that their post-test score exceeds their pre-test score (Wuensch, 2020).

To address RQ2, in addition to analyzing aggregate shifts in proficiency of the combined scores, we also analyzed shifts in scores for each of the four file naming elements to investigate whether specific elements of a file naming convention are more easily grasped (Rod et al., 2023a). We observed an increase in mean scores above the threshold for proficiency across all individual file name elements except for the version element of the file name (see Table 4).

Table 4
Changes in Mean Scores Across Four File Name Elements [a]

	Pre-test mean	Pre-test σ	Post-test mean	Post-test σ
Date	1.54	0.71	2.67	0.51
Name	2.02	0.70	2.70	0.61
Version	1.05	0.25	1.57	0.79
Formatting	2.29	0.92	2.48	0.78

[a] Note: n = 127.

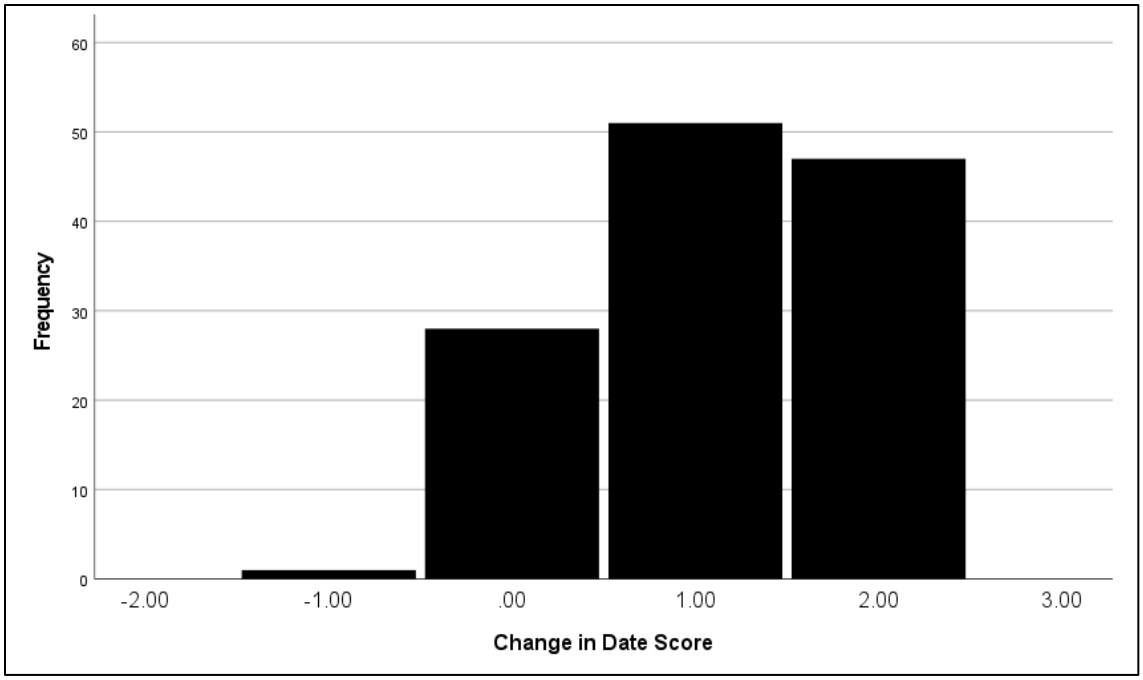

Figure 2
Distribution of date element score change.

Regarding the date file naming element, 98 of 127 workshop participants gained 1 or 2 level(s) of proficiency in applying a standard file naming convention format (see Figure 2). We observed a decrease in the percentage of workshop participants receiving a 1 for the date element (59% in pre-intervention to 2% in post-intervention) and an increase in the percentage of workshop participants receiving a 3 for the date element (13% in pre-intervention to 69% in post-intervention).

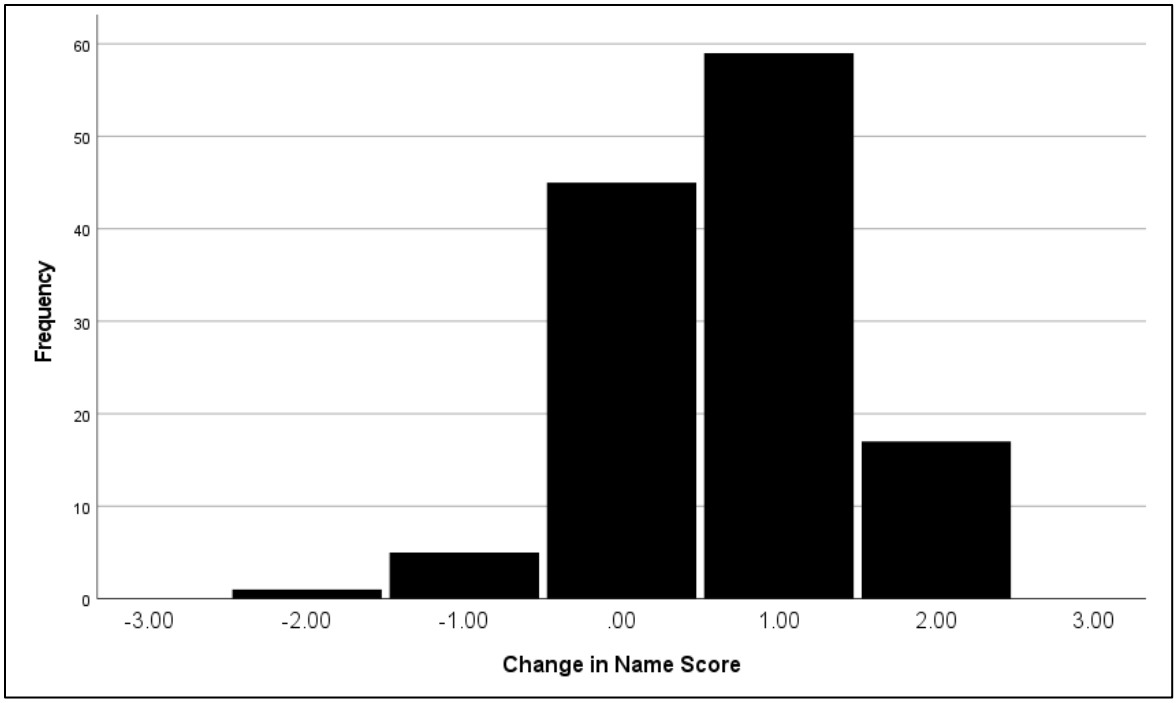

Figure 3
Distribution of name (i.e., topic of file contents) element score change.

Regarding the topic file naming element (coded as "name" in the rubric and referring to the topic of the contents of the file itself), 76 workshop participants gained 1 or 2 level(s) of proficiency in applying a standard file naming convention for the topic of the file (see Figure 3). We observed a decrease in the percentage of workshop participants receiving a 1 for the name element (23% in pre-intervention to 1% in post-intervention) and an increase in the percentage of workshop participants receiving a 3 for the name element (25% in pre-intervention to 78% in post-intervention).

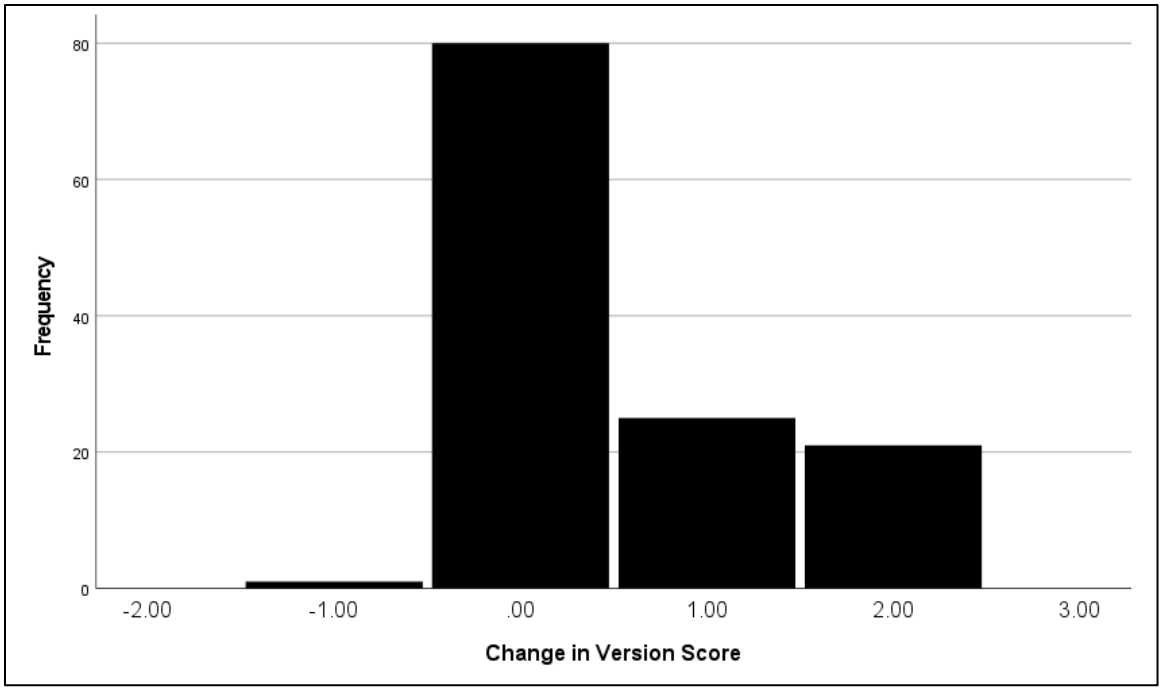

Figure 4
Distribution of versioning element score change.

Regarding the versioning file naming element, 46 workshop participants gained 1 or 2 level(s) of proficiency in applying a standard file naming convention for versioning a file (see Figure 4). Out of 127 participants, 80 participants' scores remained unchanged between the pre- and post-intervention for the versioning element. We observed a decrease in the percentage of workshop participants receiving a 1 for the versioning element (96% in pre-intervention to 62% in post-intervention) and an increase in the percentage of workshop participants receiving a 3 for the versioning element (1% in pre-intervention to 19% in post-intervention).

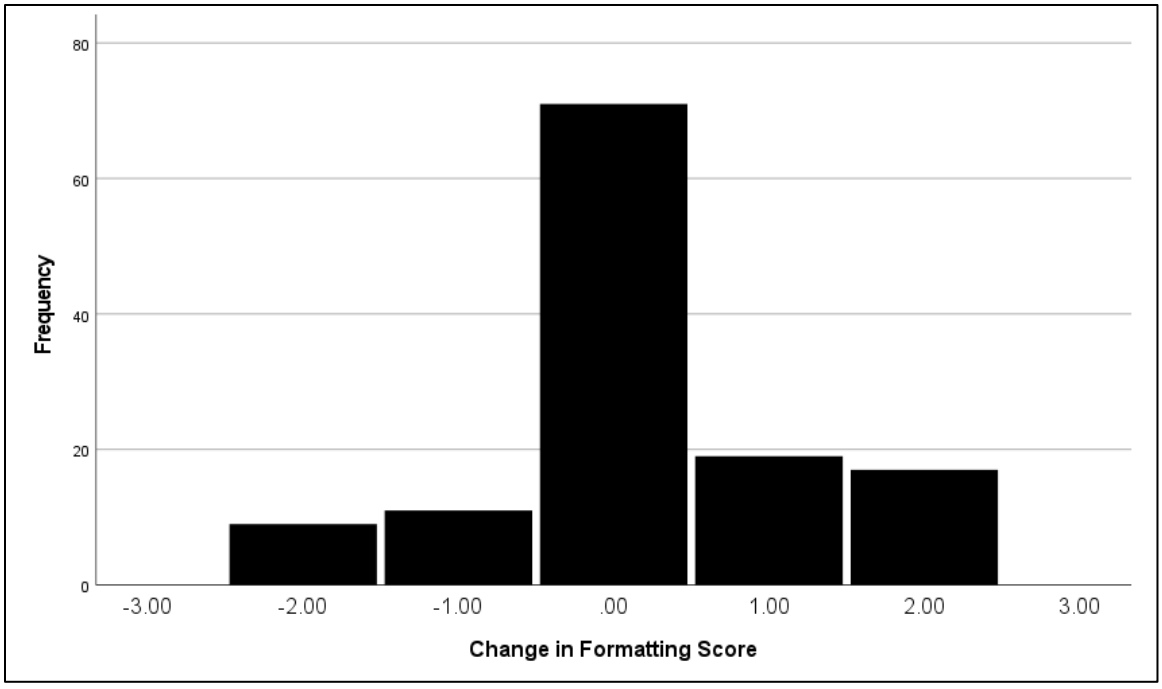

Figure 5
Distribution of formatting element score change.

Regarding the overall formatting of the file name (e.g., avoiding special characters or spaces in the file name), only 36 workshop participants gained 1 or 2 level(s) of proficiency in applying a standard format for a file naming convention (see Figure 5). Out of 127 participants, 71 participants' scores remained unchanged between the pre- and post-intervention for the formatting element. In addition, 20 participants' scores decreased by 1 or 2 level(s), meaning their proficiency dropped. We observed a decrease in the percentage of workshop participants receiving a 1 for the formatting element (32% in pre-intervention to 17% in post-intervention) and only a slight increase in the percentage of workshop participants receiving a 3 for the formatting element (61% in pre-intervention to 65% in post-intervention).

Discussion

The results of this study indicate that our instructional intervention successfully increases the proficiency of RDM workshop participants regarding file naming best practices. In general, prior to an interactive instructional activity, participants across a range of contexts and disciplines scored below proficiency for naming an image file according to RDM best practices. Following an intervention in which workshop instructors discuss the benefits and justifications for using file naming conventions (e.g., to improve the organization of files and information, to ensure discoverability and interoperability in the future) and present specific standards to implement when naming files (e.g., ISO 8601 for dates), participants are asked to complete a similar exercise, but with additional information about the file. The results of this study demonstrated that the score for workshop participants following the intervention shifts above the threshold for proficiency. Notably, this shift is statistically significant.

Although the introduction of additional information about the image file used in the intervention may appear to present a confounding factor in this analysis, we argue that this is addressed by mapping rubric

levels to specific best practices in file naming rather than the information provided about the image file. For example, for the post-test we include information about the date when the image was taken in a human-readable format (i.e., August 5th, 2018). The rubric criterion for a rating of excellent for the date file naming element requires that "a complete date is included in the ISO 8601 machine-readable format (yyyymmdd) or (yyyy-mm-dd)." Notably, participants could have used any date in the file name so long as it was in the correct machine-readable international standard format. The additional information provides neither the answer nor a mechanism for achieving the rating of excellent for this element in the post-test. For additional context, 25% of participants received a rating of excellent for their file name for their first attempt in the pre-test.

Tellingly, we have never experienced any workshop participant asking for additional information prior to their first attempt at naming the file. In this way, the file image information provided as part of the intervention is critical for demonstrating and reinforcing a key learning objective and is thus an essential component of the overall intervention. This is included in our discussion during the workshop when presenting best practices for file naming – that domain knowledge about a research dataset or files is required to develop a meaningful convention. We argue that it is not enough to provide instruction on best practices divorced from context. Rather, instruction on RDM should incorporate examples of how context is an equally crucial ingredient for applying competencies in practice.

When evaluating specific aspects of the file naming activity outcomes, participants demonstrated clear improvement in proficiency regarding naming and dating their files. The instructors used an international standard, ISO 8601, to illustrate a machine-readable format for dates. In addition, the instructors emphasized the importance of unique file names in identifying the contents and context of a file. Regarding the formatting aspect of the file naming activity, participants exhibited a minor degree of overall improvement, which may be explained by relatively higher levels of recorded proficiency in this topic prior to the intervention. Thus, we are aiming to revise the workshop to provide more advanced training and examples in machine-readable formatting of file names. Finally, participants did not exhibit a shift above the minimum threshold of proficiency regarding the versioning aspect of naming a file. In this way, we identified a specific aspect of file naming conventions that is perhaps poorly understood or that is poorly covered within the context of our RDM training. Because of this finding, we aim to update our introductory workshop to include more discussion around the rationale for versioning and more examples or interactive activities for versioning file names. This demonstrates how quantitative evaluations of instructional interventions can pinpoint specific topics or activities requiring improvement or further investigation (e.g., Xu et al, 2022a).

Overall, the results of this study indicate that it is worthwhile to develop short and targeted interventions in the context of RDM training. In other words, learning outcomes grounded in practical competencies may be achieved through applied exercises that demonstrate immediate improvement directly to participants. These findings align with Oo et al.'s (2022) key conclusion that practical outcomes and collaboration are the key components of successful RDM training.

Given that several studies have reported on the success of instructional activities for RDM training, RDM librarians should consider engaging in quantitative evaluations to demonstrate the impact of their teaching (Oo et al., 2022; Xu et al, 2022b). Previous studies have mostly focused on describing the learning interventions or self-reported improvements with very few empirical studies (Xu et al., 2022b). Thus, RDM specialists and librarians who engage in RDM instruction should leverage quantitatively assessable

instructional activities to demonstrate the value-add of librarian initiatives and the impact of modular-style instructional activities.

Future research could build on this work by focusing on measuring outcomes at repeated intervals over time with the same participants. Similarly, future studies could focus on the design and quantitative evaluation of other RDM-related competencies to determine if this style of interactive activity leads to a better understanding of RDM. While Xu et al. (2022b) report on the results of pre- and post-assessments following a workshop, few studies have been conducted on the practical knowledge that is required in RDM. Another path for future research building on this study could be to incorporate mixed methods (e.g., interviews and/or surveys) in addition to a quasi-experimental or experimental design to investigate whether individual characteristics (e.g., demographics) affect outcomes of this or related RDM instructional activities and to what extent.

Limitations

The limitation of an immediate post-test of an instructional intervention is that long-term effects cannot be evaluated. Thus, it remains unclear whether this instructional intervention may contribute to long-term retention of proficiency in naming files according to best practices. In addition, we did not collect demographic or background information that would allow us to assess whether prior discipline-specific training, status (e.g., student, professor, or other), or other individual characteristics influence proficiency in naming files according to RDM best practices.

Conclusion

Navigating complex and interconnected technological, policy, and legal frameworks regarding RDM is presenting an increasing challenge for academic researchers. To help overcome this challenge, an RDM specialist and two liaison librarians at McGill University created a curriculum to help researchers learn RDM best practices. This study contributes to the literature on RDM training in academic libraries by developing and statistically evaluating the effect of a targeted RDM instructional intervention rooted in current best practices. Empirical findings of this study indicate that researchers and students benefit from even a single RDM training session. Through a simple and quick instructional exercise, we were able to see significant progress in the use of file naming conventions, an important component of RDM in practice. However, additional research is needed to investigate discipline-specific needs in this context and whether novices are more likely to achieve gains in proficiency compared with participants with pre-existing knowledge or experience in this domain.

Author Contributions

Alisa Beth Rod: Conceptualization (supporting), Data curation, Formal analysis, Investigation (lead), Methodology, Project administration, Validation, Visualization, Writing – original draft (equal), Writing – review & editing (equal) **Sandy Hervieux:** Conceptualization (supporting), Investigation (supporting), Writing – original draft (equal), Writing – review & editing (equal) **NuRee Lee:** Conceptualization (lead), Investigation (supporting), Writing – original draft (equal)

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