

Open Science Primer: Open Science Training for the Library Workforce

The Carnegie Mellon University (CMU) Libraries seeks \$241,147 for a 3-year Laura Bush 21st Century Librarian (LB21) Implementation Grant for the development of a training program and curriculum to prepare library practitioners to meet the evolving Open Science needs and expectations of the research communities they support.

PROJECT JUSTIFICATION

The proposed project is directly in line with the goals of the Institute of Museum and Library Services (IMLS) mission, including *Goal 1: Champion Lifelong Learning* and *Goal 2: Strengthen Community Engagement*. More specifically, the development of *Open Science Primer: Open Science Training for the Library Workforce*, will address LB21 Program Goal 3: “Enhance the training and professional development of the library and archival workforce to meet the needs of their communities.” with primary Objective 3.4.

[Open Science](#), or Open Research, is a movement and cultural shift centered around creating and disseminating research products that are publicly accessible, transparent, and reproducible. Open Science principles have rapidly emerged as the driving force behind changes to workflows and best practices in how research is conducted and results are shared. This is highlighted by the White House Office of Science and Technology Policy declaring 2023 the “Year of Open Science”.

As researchers navigate emerging Open Science practices and mandates, libraries are evolving to support these changes across the research communities.¹ Academic librarians have demonstrated there are many opportunities and areas where information specialists can take the lead in supporting and implementing programming in Open Science.^{2,3} They serve as important advocates and supporters of Open Science by providing guidance, tools, and resources for sharing data and making research more reproducible.

The *Open Science Primer* project aims to develop a “train the trainer” style certificate program that prepares the academic library workforce to develop skills and expertise needed to support Open Science best practices, tools, and procedures at their institutions. The *Open Science Primer* principally targets academic librarians and library staff who seek to expand or develop services, resources, or programming related to Open Science. The primer can also be used by educators for all levels and those in research support positions who teach, consult, or support best practices in Open Science, such as open data, open software, and open publishing. These audiences may include non-academic organizations and research tool vendors. In addition to the immediate benefits the training will have on participants, research communities they support will be positively impacted as the training participants apply their learning to the programs, services, and resources they provide.

Unlike most existing Open Science educational content, such as the [Open Science MOOC](#), the [FOSTER Open Science Toolkit](#), or [NASA’s Transform to Open Science](#) training programs, the *Open Science Primer* provides a “train the trainer” approach. The curriculum will align with and build-upon currently existing resources and materials, such as the [UNESCO Recommendation on Open Science](#), the National Library of Medicine & National Institutes of Health report [Developing the Librarian Workforce for Data Science and Open Science](#), and [UCLA Lessons for Librarians in Open Science](#), as well as develop new educational content to create a unique resource for the library workforce. This training will showcase approaches and techniques for teaching, communicating, and advocating for the various areas of the Open Science landscape. This includes traditional “open” topics, such as Open Access methods, copyright, and FAIR data principles, as well as topics not yet commonly discussed, like open big data, open source software, linked open data, open metrics, and Artificial Intelligence as it relates to Open Science. Educational content related to these topics will be scaffolded together to link these concepts to

¹ Tzanova Stefka. ‘Changes in Academic Libraries in the Era of Open Science’. 1 Jan. 2020 : 281 – 299.

<https://content.iiospress.com/articles/education-for-information/efi190259>.

² “Keeping Up With... Open Science”, American Library Association, February 16, 2021. http://www.ala.org/acrl/publications/keeping_up_with/open_science.

³ Bueno de la Fuente, Ge Buma. “Libraries: Roles and Opportunities on Open Science.” FOSTER, 2016, <https://www.fosteropenscience.eu/content/libraries-roles-and-opportunities-open-science>.

their application within research and showcase the flow of these practices within Open Science use cases as well as in support programming.

Open Science is a long-standing cornerstone of CMU Libraries' strategy and services: examples of infrastructure and programs include the [Open Science and Data Collaboration Program](#) and the new [Open Source Programs Office](#). The CMU Open Source Programs Office (OSPO) is one of the first such offices within universities. Even at this early stage, the CMU OSPO has established a leadership position with building awareness and capacity regarding the importance of open source software as a primary research object for open science. We intend to provide support to help others benefit from the systems we have developed at our own institution.

The project team is made up of a diverse group of CMU Libraries faculty and staff who provide Open Science related training, consultations, and resources and are active in Open Science related professional groups. These diverse perspectives will enable us to create a robust training that can be scaffolded to users with varying experience levels and roles. CMU is positioned to develop a robust curriculum that will equip library practitioners and staff across various institutions.

PROJECT WORK PLAN

The proposed *Open Science Primer* project has various components and steps involved in curriculum development, implementation, delivery, and dissemination. The project team is highly interdisciplinary with a broad range of expertise. Each project staff is essential for uniting campus and external partners or stakeholders to successfully implement the proposed project plan. The Project Director, Emily Bongiovanni, will oversee the project, budget management, and timeline of activities outlined below. The CMU project group will work closely as a team to complete the proposed project activities.

As outlined throughout the project phases below, the proposed project is highly collaborative to ensure the outputs are widely applicable and impactful. The external partners listed throughout the work plan have already expressed interest in supporting this project and have provided letters of support. If funded, we intend to solicit additional external collaborators.

Phase 1: Needs Assessment and Hiring (August 2023 - November 2023)

A *needs assessment* will be conducted to capture the Open Science practices that library professionals need to understand in order to serve their research communities. The needs assessment will include a systematized literature review, scan of job postings in this area, and review of selected library websites to identify curriculum needs.

First, we aim to broadly understand the current state of the Open Science field and its gaps. To do so, we will conduct a systematized literature review to understand the following: current Open Science principles and practices; the differences between European and American views and practices related to Open Science; how libraries and other organizations support Open Science; and the focus and gaps of current training materials such as the [Open Science MOOC](#), [Open Research Toolkit \(ORT\)](#), [Foster Open Science](#), and [UCLA Library's Open Science for Librarians](#). We will apply evidence synthesis methods to our search to make it more systematic and comprehensive than a traditional review.

Second, we will look for job ads and library websites related to Open Science to understand the broader landscape within academic libraries as well as the required skills needed to support Open Science in this context. We will use two approaches for harvesting job postings in the Open Science, research data, scholarly communications, and data literacy areas of academic libraries: (1) scan job ads on common library industry websites such as the ALA JobList and HigherEdJobs and the job aggregator Indeed.com and (2) use variations of the following search string in Google: ""open science"|reproducible|data AROUND(3) job|hiring|position AROUND(3) library|libraries|librarian".

Third, we will also do an environmental scan of existing Open Science programs, units, or services within academic libraries. While many academic libraries support Open Access, examples of

dedicated units or programs supporting Open Science in libraries are rare.⁴ This scan will help us surface these programs and stand-alone support services for Open Science in libraries. We will start the environmental scan by searching the websites of our peer institutions for “open science,” “open research,” and “open scholarship.” Our peer institutions are research-intensive private universities, including those with a focus on science, engineering, and technology. We also want to take an unbiased approach by evaluating needs at a wide variety of institutions, in terms of size, research activity, disciplinary-breadth, and diversity. To that aim, we will systematically scan the internet for related websites with the following search string: “open|reproducible|reproducibility AROUND(3) research|science|scholarship AROUND(3) library|center|program”site:.edu. We will review results until no relevant results are returned on 5 consecutive pages.

Fourth, in addition to these structured activities, we will capture themes and topics that emerge during informal discussions among colleagues, researchers, and library professional communities to learn more broadly about what conversations are happening around Open Science at other academic institutions. We will take advantage of the connections we have from existing relationships and communities we belong to, to scope the attitudes, needs, and feelings of preparation in various Open Science topics.

One benefit of the needs assessment is that it will allow us to take a data-driven approach to our curriculum development. At the end of our needs assessment, we will have data from four sources: (1) our systematized literature review, (2) informal discussions, (3) job ads, and (4) library websites. We will do open qualitative coding using open source software to analyze these data and identify a set of skills that are related to supporting Open Science at academic institutions. The identified skills will drive the design of our curriculum learning objectives and lessons outlined in *Phase 2*.

During *Phase 1*, the project team will also hire and onboard a Library and Information Science graduate student assistant. The assistant will work collaboratively with the project team to support the project tasks, including the needs assessment and facilitating the learner cohorts (see Budget and Budget Justification for associated costs). This role will support the professional development of the student in the areas of open science, teaching and learning, and program management.

Phase 2: Program Development (December 2023 - April 2024)

The project team will use the results from the needs assessment findings to identify curriculum coverage and priorities. Components of curriculum development will be divided among the project team members according to their specialties. The project team will connect with their professional networks outside CMU for curriculum review and feedback, and welcome contributions.

This “train the trainer” style certificate program seeks to prepare the academic library faculty and staff across various types of institutions to support the Open Science demands of their communities, including Open Access publishing, Open Data, Open Educational Resources, Open Peer Review, and Open Source Software. The *Open Science Primer* primarily targets academic librarians and staff who support researchers across all stages of the research lifecycle.

Two versions of the training will be developed: one to be delivered online and almost entirely asynchronously over a two-week period, and one to be offered synchronously in-person over a two-day period. Both the online version and components of the in-person version, such as ancillary materials, will be hosted on the CMU learning management system Canvas. Guest CMU Canvas accounts will be created for participants from outside of CMU at no cost.

The project team will seek feedback before, during, and after the curriculum development to ensure the training is useful and widely adaptable. Before designing the curriculum and delivery, the project team will consult with the [CMU Eberly Center for Teaching Excellence & Educational Innovation](#) on best practices to apply learning objectives, active learning, and assessment to the training to ensure the curriculum design effectively meets the outline program outcomes. In addition to working with CMU support units, the curriculum will be reviewed by external subject matter experts in Open Science for

⁴ Wang H, Gainey M, Campbell P et al. Implementation and assessment of an end-to-end Open Science & Data Collaborations program [version 2; peer review: 2 approved]. F1000Research 2022, 11:501 (<https://doi.org/10.12688/f1000research.110355.2>)

feedback and guidance on the curriculum scope, learning outcomes, and design. These external collaborators include Ye Li at Massachusetts Institute of Technology and Ali Krston at Auburn University, who are both supporting Open Science practices at their institutions, as well as Ana Van Gulick, who supports open data and publicly available research products at Figshare, and Huajin Wang, who leads the Center for Open Science's efforts to advance programmatic services with partner stakeholders (see Supporting Documents 1, 2, 3, and 4). Curriculum will also be tested with CMU colleagues to gather additional feedback.

The *Open Science Primer* curriculum will take a unique approach in providing participants with techniques and perspectives for offering Open Science support, services, and resources at their institutions, rather than focusing on Open Science topics as the primary subject matter. In this "train the trainer" model, the intention is to prepare the library workforce to effectively discuss, advocate, and teach on these principles and practices. Unlike most of the existing resources in this area that aim to teach on Open Science topics and practices directly, the intention of this training is to educate on the terminology, approaches, workflows, and resources in this area as it relates to library services and supporting research communities. The *Open Science Primer* will build on existing materials to ensure it is aligned with other work in this area. This training will also complement educational resources on Open Science, such as the [UCLA Lessons for Librarians in Open Science](#), as a next step for learners to take in understanding how to successfully build Open Science supports at their institutions.

The *Open Science Primer* training will offer a concrete set of outcomes to all participants. We anticipate that participants will:

1. Clearly describe core principles and values of Open Science, including transparency and reproducibility
2. Articulate enthusiasm for promoting Open Science practices
3. Identify opportunities to support Open Science practices
4. Practice strategies for Open Science support
5. Find up-to-date information about emerging or evolving concepts and practices in Open Science
6. Be confident in their ability to support local research communities
7. Recognize a larger community of individuals at diverse institutions who are pursuing similar efforts
8. Create the foundation for participation in a community of practice, including core initial membership, shared understandings and practices, and an intention to continue working together into the future.

The training curriculum will address the program outcomes through the following draft outline:

Part 1: Understanding the Open Science Ecosystem: Core Principles and Practices

Part 1 of the curriculum aims to introduce the training program and ensure participants have a general understanding of Open Science principles and practices. Topics covered in this section include an introduction to the Open Science landscape, definitions for Open Science terms, and how Open Science relates Diversity, Equity, Inclusion, and Access (DEIA) and the United Nations Sustainable Development Goals (SDGs).

Part 1 Learning Outcomes:

- Be familiar with current issues in Open Science
- Identify key elements of the Open Science landscape
- Describe areas in which participants are already engaging with and supporting Open Science

Part 2: Supporting Open Science: Organizational Contexts and Constraints

Part 2 of the training aims to demonstrate approaches to growing Open Science programs within institutions' constraints and contexts. Participants will be provided with examples of how institutions are providing Open Science support at different levels and activities to identify opportunities for program growth at their institution. This section will also discuss approaches to seeking funding, including grant opportunities.

Part 2 Learning Outcomes:

- Recognize diverse approaches to supporting Open Science practices
- Identify strategic partners and local champions in an institutional context
- Develop strategies to create programs that support Open Science practices
- Locate grants and other external funding opportunities

Part 3: Supporting Open Science Across Disciplines and Across the Research Lifecycle

Part 3 addresses different approaches to supporting the different areas of Open Science across a variety of disciplines. Topics covered in this part of the curriculum will include Open Science practices, tools, methods used across disciplines and Open Science practices that support DEIA and SGDs. This segment will also highlight existing literature and reports discussing the differences in strategies for promoting Open Science in different subject areas.

Part 3 Learning Outcomes:

- Connect Open Science practices to DEIA and SDGs
- Be familiar with the impact of disciplinary differences in Open Science
- Identify strategies for adapting Open Science supports across disciplines
- Identify strategies for applying Open Science supports throughout the research lifecycle

Part 4: Current Issues in Open Science

Part 4 explores current discussions and issues in Open Science. Topics discussed in this section include new opportunities for library support in Open Science, such as Open Source Software. The aim of this section is to demonstrate how these topics are evolving and the specific areas that are quickly growing.

Part 4 Learning Outcomes:

- Describe current issues in Open Science
- Identify areas of Open Science that are changing or developing

Part 5: Modeling open science practices

Part 5 of the curriculum provides participants with the opportunity to learn and explore Open Science strategies. This section discusses best practices in teaching and consulting on Open Science, including pedagogical practices and draft workflows for consultations.

Part 5 Learning Outcomes:

- Develop core skills to design instruction around Open Science principles
- Compare pedagogical practices and instructional content related to Open Science
- Draft workflows to support consultations in Open Science

Part 6: Plans for staying on top of the field

Part 6 wraps up the training by providing participants with resources they can use in the future to stay connected with these topics and continue to explore Open Science. Participants will come away with a toolkit of resources, tools, and ideas for supporting Open Science practices, which can be curated for their communities specific needs. Resources shared in the section also include

educational materials to learn more on various Open Science topics, like [The Open Science Training Handbook](#) and [UCLA Lessons for Librarians in Open Science](#).

Part 6 Learning Outcomes:

- Be able to find the information to support continued learning

In addition to the teaching of the topics listed above, participants will come away with various take-away resources they can utilize as they apply what they learned to their work. These resources include a glossary of Open Science tools, terms, and practices, and an overview of resources and communities for supporting or working in this space. Through this training, a community of practice will also be fostered among participants. As outlined in *Phase 3: Program delivery* below, the training will be followed up with facilitated conversations and structured activities to keep participants engaged in discussions in these areas and utilizing each other as resources.

Phase 3: Program Delivery (May 2024 - August 2025)

The project team will facilitate 4 online and 6 in-person sessions. The project team has begun to seek partners at institutions across the country to support the hosting of in-person training sessions. Partner institutions will include those in a variety of geographical locations and classification (R1, small private, etc). In addition to CMU-hosted in-person training, other institutions that have already expressed interest in and support for co-hosting a training session. These include the Colorado School of Mines, University of Oregon, and Florida State University (see Supporting Documents 5, 6, and 7). Both the online and in-person training will have a maximum 60 participants per cohort, or a total of estimated 600 participants. The project team will assess demand and explore offering a 5th online session if warranted. As outlined in *Phase 4: Evaluation and Dissemination* below, the course material will be made freely available online and will have the potential to impact an unlimited number of learners.

Both the online and in-person training options will be free to participants and 12 total travel stipends will be offered for those seeking in-person training (see Budget and Budget Justification). Travel stipends are intended for participants from traditionally underrepresented groups in academia or who work at institutions that primarily serve underrepresented groups. To receive funds recipients would also have to demonstrate a need to fly or drive over two hours to attend the in-person training. The project team will seek guidance from CMU's Diversity, Equity, and Inclusion office and admissions office, as well as other experts in developing a stipend and stipend criteria for underrepresented groups. Participants seeking an in-person training travel stipend will need to complete a short application. Stipend applications will be reviewed based on total estimated travel costs to attend training, if they have professional development funds available through their institution, and status of Open Science programmatic support at their institution.

All participants at online and in-person trainings, including hosts, trainers, and learners, will be expected to adhere to a code of conduct to ensure a welcoming and inclusive environment for everyone. The code of conduct will include an anonymous form for reporting violations, as well as the repercussions for violations. This code of conduct will be developed following commonly used examples and guidance, such as the [Chatham House Rule](#).

The online trainings will be delivered over a two week period. Online training will be delivered asynchronously on Canvas, with two optional synchronous cohort "coffee and conversation" sessions hosted on Zoom. Guest CMU Canvas accounts will be made for each participant, at no cost to them. This asynchronous, online option will incorporate a variety of activities and discussion board prompts to engage the participants.

The in-person trainings will take place over two days. Registration will be on a first-come, first-served basis. We will reserve 10 registration spots for the co-host institution. Meals and materials needed during the in-person trainings will also be covered and free for participants (see Budget and Budget Justification).

A pre-test and post-test survey will be administered to the participants before and after the

training. The results of these surveys will be used to identify areas where the curriculum is teaching topics effectively and areas for improvement. These surveys will also ask participants to reflect on areas they would like to learn more about to indicate opportunities for additional topics in future trainings.

One component of the in-person training will focus on community-building activities. Upon completion of the training, trainees will be well-positioned to stay in touch with one another. Our initial cohort will form the core members of a community of practice, and subsequent cohorts of trainees will join this community. The community will share communication channels such as email distribution list and access to a repository of resources, and will meet remotely twice a year for networking, collaboration, and professional development. Subsequent cohorts will be integrated with the ongoing discussions and mutual support centered in the community of practice and a requirement of participation in the training will be attendance at the next upcoming community event. This will enable participants across the various cohorts to interact with each other and exchange ideas, projects, and feedback. The community of practice will be supported through an online discussion group, hosted on [Google Groups](#). This Google Group, called Open Science Community, will serve as an informal discussion group of librarians and other information professionals who support Open Science at their institutions, as well as those interested in approaches to support Open Science initiatives. The group will allow members to share opportunities for collaboration, collectively brainstorm or troubleshoot, discuss ideas, share projects, celebrate successes, and support one another through struggles related to supporting Open Science. A code of conduct will be developed for the discussion group in an effort to maintain a safe, inclusive environment for all participants.

Phase 3 also includes the development of an assessment framework that academic libraries can use to assess the gaps in skills and understanding of Open Science principles, tools, and practice. This assessment framework will be developed with information collected through the needs assessment and the curriculum development. The assessment will take the form of a self-guided survey. The respondent will be asked to evaluate their own understanding of Open Science principles, as well as standard skills associated with the practices of open research. Based on their answers respondents will be guided towards resources scaffolded towards areas needing improvement, such as expressing a lack of understanding of various open licenses and being turned toward educational materials on accessible data and publishing. Similarly, their answers to open-ended response questions will be matched against pre-prescribed responses that outline best practices in Open Science. Respondents will also be asked to walk through hypothetical Open Science related research consultations, offering guidance on the practice of training others in these principles as well. The team will review Initial responses to this self-assessment to judge effectiveness of the pre-built guidance. Later iterations will have asynchronous responses, enabling a large upscaling in the number of people who can engage with and learn from the assessment. The assessment framework can help libraries identify gaps or areas for growth across their Open Science activities, so librarians can best allocate their resources, time, and professional development. This framework can also be used for individual assessment.

During *Phase 3* the project team will also explore methods for sustaining and growing the training program and Open Science Community online forum after grant completion. This exploration will include identifying potential organizations as partners and seeking external-funding.

Phase 4: Evaluation and Dissemination (September 2025 - July 2026)

Training materials will be developed and shared following Open Educational Resources (OER) best practices and accessibility standards. Materials will be accessible on stable repositories and platforms, such as Canvas Commons and Open Science Framework, under the guidelines of open licenses. Open Science Framework, a platform commonly used by library professionals and that supports Open Science, will be used to host a centralized, living, and continuously updated collection of materials, similar to the way that learning and training materials are disseminated by [The Carpentries](#) or [The Turing Way](#). After the training, we will encourage learners to upload Open Science-related workshops or course materials that they develop to the Open Science Framework repository to support a community of practice. Sharing in this manner will facilitate asynchronous, self-paced learning, and promote community

engagement, by allowing constructive feedback and improvement of material by peers. Finally, a stable version of record of the curriculum will be deposited on KiltHub, the CMU institutional repository, where it will be assigned a DOI and be citable.

We will evaluate the training using surveys designed according to best practices.⁵ We will collect feedback at the end of each day to ask learners for one positive thing about the training and one thing that could be improved which will allow us to evaluate the training and make small improvements during the 2-day session and to future iterations of the training. We will also use pre-and-post surveys for the in-person and online trainings to determine (1) baseline knowledge and experience with Open Science entering the training, (2) which concepts or modules were of most interest or use, (3) and whether the curriculum has led to professional development opportunities at various time points post-training. The facilitated discussions post-training will not only help foster a community of practice among learners but will also lend insight into their professional development and the success of the training. The longitudinal survey and facilitated discussion sessions together will allow us to understand the longer-term impact of our training.

Findings from the needs assessment will be disseminated via Open Access publications and conference presentations (see Budget Summary for associated costs). Conferences will include those specific to academic libraries, such as [ALA](#) & [ACRL](#), information science and related disciplines, such as Coalition for Networked Information (CNI), and other disciplines with library or related tracks, such as the [Engineering Libraries Division of the American Society of Engineering Education](#). In addition to sharing the results of the needs assessment, we will find opportunities to present and publish on the challenges, successes, and lessons learned in developing the curricula.

Phase 4 also includes the implementation and testing of the assessment framework outlined in *Phase 3*. We will first test the developed framework with colleagues within the CMU Libraries and our external collaborators. We will also request feedback from the training participants. After implementing changes from the feedback we will share this assessment tool across various channels, including the Open Science Community online discussion forum.

DIVERSITY PLAN

Diversity, equity, inclusion, and access (DEIA) are at the heart of CMU Libraries and our Open Science efforts. The CMU Libraries play a significant role on campus in making higher education and science more equitable and accessible through Open Access, Open Educational Resources, and Open Science initiatives. Open Science practices that support DEIA include removing financial barriers to access and publish research, promoting interoperability and reusability of data, promoting collaboration across disciplines and geographic regions, and transparency in data collection methods. At CMU, our DEIA efforts are closely related and aligned with several of the University Nations Sustainable Development Goals (SDGs), including SDG #10: Reduced Inequalities.

Our project DEIA plan will ensure the *Open Science Primer* is built on a foundation of diverse perspectives, follows accessibility guidelines, and is aligned with DEIA best practices and CMU's commitment to diversity, equity and inclusion.

1. *Diverse Perspectives*: To ensure our project is inclusive and relevant to all, we plan to engage with and recruit multiple perspectives from library and information practitioners across various institutions and in intersectional and multidisciplinary domains. We will also seek guidance from experts in the area of DEIA, including CMU's Diversity, Equity, and Inclusion group.
2. *Respect for Participants*: As we conduct trainings and build a community of practice, our project team will ensure we provide an inclusive environment for all participants. To ensure all participants are treated with respect, compassion, and patience we will provide a code of conduct for the Open Science Community online discussion group and as part of the training introduction. We will use commonly used guidelines and examples to support the code of conduct, such as the [Chatham House Rule](#) or the [Contributor Covenant](#).

⁵ Sufi S, Nenadic A, Silva R, Duckles B, Simera I, de Beyer JA, et al. (2018) Ten simple rules for measuring the impact of workshops. PLoS Comput Biol 14(8): e1006191. <https://doi.org/10.1371/journal.pcbi.1006191>

3. *Equitable Access*: All project products, including the full training curriculum will be shared in an open and accessible format. The curriculum will be developed following the Americans with Disabilities Act Standards for Accessible Design (ADA) and be made openly available on Open Science Framework and our institutional repository, KiltHub. Both the online and in-person facilitated training will be free to participants and a total of 12 travel stipends for in-person training will be available for participants from traditionally underrepresented groups in academia or who work at institutions that primarily serve underrepresented groups. The in-person trainings will be hosted in spaces that are ADA compliant.
4. *Open Science Intersections with DEIA and SDGs*: As part of the curriculum, the training will highlight intersections of Open Science, DEIA, and SDGs. This will help participants use Open Science practices to support their communities DEIA and sustainability related goals.

PROJECT RESULTS

The proposed program will facilitate the proliferation and effectiveness of experts and advocates for Open Science across a variety of library communities.

Core deliverables of the *Open Science Primer* include:

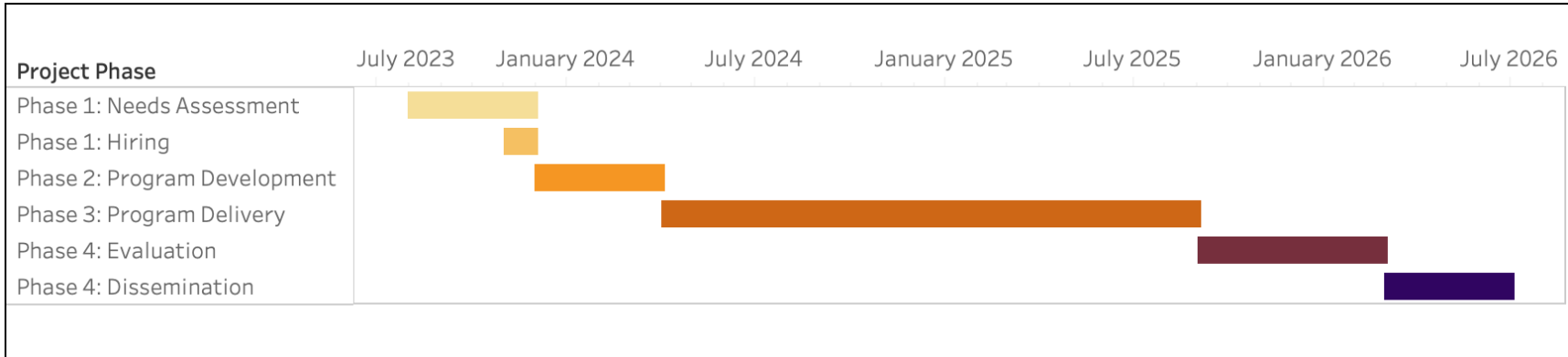
1. Creation of an openly accessible, free curriculum to train librarians and library staff in Open Science instruction and support
2. Publish and broadly disseminate results from a comprehensive needs assessment which will inform the teaching of Open Science principles
3. Development and fostering a community of practice for practitioners supporting Open Science
4. Development and dissemination of an assessment framework which can be used by academic libraries and individuals to assess understanding of Open Science principles
5. Publications which detail the process, challenges, successes, and lessons learned in developing a train-the-trainer Open Science curriculum

As outlined in the Digital Products document, project products, including the results of our needs assessment, our assessment framework, a comprehensive training curriculum and ancillary materials, will be made openly available for others to adopt, modify, and share. Specifically, our needs assessment and resulting assessment framework will be packaged and widely disseminated to advance knowledge and understanding of the Open Science landscape. In particular, this toolkit will help librarians and library staff access and effectively make use of the resources, practices, and communities required to effectively promote and support Open Science. Through the *Open Science Primer* activities outlined in this proposal, we aim to prepare the academic library workforce in supporting Open Science at their institutions. The development of the training materials will incorporate a wide range of perspectives and collaborators to ensure the curriculum will be applicable across institution types and sizes. Resulting curricular materials will be widely disseminated, and cohorts of participants will form the basis of enduring communities of practice. A community of practice and online discussion group, Open Science Community, will continue beyond the duration of the *Open Science Primer* project and represent a durable suite of benefits for Open Science and the library community. Research communities will benefit from increasingly prepared and connected libraries which more extensively and effectively interact in the Open Science ecosystem. Educational communities will benefit from ready information, resources, pedagogical strategies, and library educators who are well-positioned to support and promote Open Science practices within their communities. Librarians and library staff will benefit from these repositories of information as well as an assessment framework that can be used to identify gaps in resources and services. They will become part of a community of practice that can facilitate continuous improvement of Open Science supports, enable Librarians and library staff to remain up-to-date in a complex and ever-changing landscape of Open Science tools and practices, and facilitate interdisciplinary and inter-segmental collaboration among library professionals invested in promoting Open Science.

SCHEDULE OF COMPLETION

Carnegie Mellon University

Open Science Primer: Open Science Training for the Library Workforce



DIGITAL PRODUCTS PLAN

Type

The *Open Science Primer* project will generate digital content, resources, and assets. These will be a combination of digitized and born-digital products created by individuals, project teams, and community efforts.

Digital products will fall into four categories: 1. Results of project research; 2. Open educational resources (OER); 3. Community of practice infrastructure; and 4. Assessment framework materials.

1. Results of project research will include evaluation and needs assessment protocols, analytical materials such as survey instruments and a qualitative codebook, and findings. Results of research will take the form of conference presentations, publications; metadata; and documentation.
2. Open educational resources (OER) will include a stable version of curricular materials and pedagogical artifacts, a collection of ancillary curricular and pedagogical materials, and documentation of these OER. OER will include teacher resources, evaluation protocols, workflows, assessment instruments, and documentation.
3. Community of practice infrastructure will include a Google Group called Open Science Community and associated documentation detailing expectations, norms, and guidelines for community development and sustainment. Community infrastructure will include a Google Group, email distribution list, repository of resources, and code of conduct.
4. Assessment framework will include an instrument and associated protocol to help libraries identify gaps or areas for growth across their Open Science activities, so they can best allocate their resources, time, and professional development. This framework can also be used for individual assessment. Assessment framework products will include documentation, instruments, and workflows.

Availability

1. Results of project research will be disseminated via Open Access publications and conference presentations. Conferences will include those specific to academic libraries, such as ALA & ACRL, information science and related disciplines, such as Coalition for Networked Information (CNI), and other disciplines with library or related tracks, such as the Engineering Libraries Division of the American Society of Engineering Education. In addition to sharing the results of research, we will find opportunities to present and publish on the challenges, successes, and lessons learned in conducting our needs assessment, developing curricula, instantiating a community of practice, and developing, refining, and using the assessment framework.
2. Training experiences will be delivered both online and asynchronously. Both versions and related artifacts such as ancillary materials will be hosted on Canvas, the CMU learning management system. Guest CMU Canvas accounts will be created for participants from outside of CMU at no cost. Training materials will be developed and shared following Open Educational Resources (OER) best practices and accessibility standards. Materials will be accessible on stable repositories and platforms, such as Canvas Commons and Open Science Framework, under the guidelines of open licenses. Open Science Framework, a platform commonly used by library professionals and that supports Open Science, will be used to host a centralized, living, and continuously updated collection of materials.
3. Our community of practice will be supported by collective development of an Open Science Framework repository. We will encourage learners to upload Open Science-related workshops or course materials that they develop to the repository to facilitate asynchronous, self-paced learning, and promote community engagement, by allowing constructive feedback and improvement of material by peers.

4. The assessment framework will be disseminated across various channels, including conference presentations, peer reviewed publications, and the Open Science Community online discussion forum.

Access

Results of research presented or published in open access journals will be available according to the dissemination guidelines associated with individual publication venues. All resources and products developed through this grant will be made freely available online and shared under the Creative Commons license [CC-BY 4.0](https://creativecommons.org/licenses/by/4.0/).

Sustainability

Most artifacts and resources developed as part of this project will be available through existing, stable repositories. Our novel community of practice will rely on long-standing platforms and distributed across social and technological contexts to ensure content stability. We anticipate that the digital products created for this project will be adapted, adopted, and used across multiple contexts and will therefore enjoy a broad, diffuse set of use cases. Additionally, a stable version of record of the curriculum and other digital products will be deposited on KiltHub, the CMU institutional repository, where it will be assigned a DOI and be citable.

ORGANIZATIONAL PROFILE

Carnegie Mellon University

Carnegie Mellon University (CMU) is a four-year private, globally-recognized research-intensive university in Pittsburgh, Pennsylvania. CMU offers a transformative educational experience for students that cultivates an inclusive, diverse and collaborative environment open to the free exchange of ideas, where research, creativity, innovation, transdisciplinary scholarship, and entrepreneurship flourish. CMU currently serves over 13,000 students and consists of seven colleges and degree-granting campuses nationally and internationally.

University Libraries

The mission of Carnegie Mellon University Libraries (CMU Libraries) is to create a 21st century library that serves as a cornerstone of world class research and scholarship. This mission is outlined in CMU's Strategic Plan 2025 which was approved by the president, academic and administrative leadership, and the Board of Trustees of CMU in 2015. One area in which CMU Libraries is recognized as a leader is our innovation around Open Science. The CMU Libraries Open Science & Data Collaborations (OSDC) Program was created in 2018 to propel the integration of many Open Science elements into the research landscape of our community. Our many services, such as Carpentries workshops, data and research consultations, an institutional repository and related services for sharing data, give students, faculty, and staff the tools and training needed to meet the requirements of evolving academic expectations. CMU's Open Source Program Office (OSPO) was established in the fall of 2022 with support from the Sloan Foundation. The OSPO is positioned in CMU Libraries to deliver centralized support for open-source activities across campus, and the efforts of the federally funded Software Engineering Institute, which develops secure and stable software to support government and industry organizations. In 2021, CMU became the first academic partner for the Emerald Cloud Lab (ECL), a remote-controlled and automated science lab. Together, OSDC and the OSPO are creating guidance and infrastructure for data sharing for researchers using the cloud lab. Like the OSPO, the Carnegie Mellon Sustainability Initiative is established and has a dedicated space, the Sustainability Studio, in CMU Libraries. The Sustainability Initiative supports efforts to achieve the Global Goals, like social equity, economic justice, and environmental protection, and brings programming to students, faculty, and staff to talk about their work and its applicability to sustainability. The rapidly changing academic landscape requires continuous innovation, and CMU Libraries serves as both an academic hub and a community center to meet the growing needs of the campus community.

University Service Areas

Carnegie Mellon is distinct from peer institutions as it provides multidisciplinary services to meet the specialized needs of our diverse and multidimensional academic units on campus. CMU Libraries maintains partnerships with these service centers to continuously improve approaches to deliver support that aligns with educational and research goals across the university. For instance, evidence-based educational experiences are available to educators and students on campus through collaborations with the Eberly Center for Teaching Excellence and Educational Innovation and the Student Academic Success Center. The Eberly Center supports faculty, graduate students, and other educators that aim to design courses and curricula that put students at the center of the teaching process. Services include consultations, workshops, and an array of tools and resources motivated by research and data and guide the design and implementation of more effective courses. The Student Academic Success Center facilitates student learning by providing academic coaching, subject-specific tutoring, effective communication strategies, accommodations for students with disabilities, and language support for multilingual learners. They also engage with faculty and staff to improve the coordination and professional development of academic advisors.