

# Supporting the Modern Research Workflow

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## **ABSTRACT**

Libraries are uniquely positioned to support the quickly shifting landscape of modern research practice. The NCSU Libraries has paired user research approaches with iterative design practice to determine contextually relevant services to support researchers.

This poster will showcase two case studies as examples of successful avenues of support through library services, the user research and application of frameworks that supported the development of these services, and the project management methodology that applied research to practice. Each case study will outline strategies used to develop services that support modern research practice through the investigation of a complex problem space.

## **Keywords**

Open science, research data management, digital literacy, science and technology support, public access compliance support, user-centered design, user research.

## **INTRODUCTION**

Libraries have an important role in the development of a research support ecosystem that is agile and adaptable. With the increasing use of digital tools and multi-disciplinary frameworks understanding the complexity of researcher needs is vital to effective service design. Using a three part strategy, the NCSU Libraries has successfully explored and designed services to support the modern research workflow.

This poster will outline an overarching methodology for applied research and project management in the design and implementation of services to support modern research practice. It will do so by focusing on two case studies from

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the NCSU Libraries that address different approaches to determining user needs, the application of existing frameworks, and using project management concepts to support the transition between research and application. It will also discuss the final implementations of each project and how design iteration is built into implementation.

## **CASE STUDIES**

Each case study represents ongoing work at the NCSU Libraries.

### **1: Exploring and Supporting open science through the open science Initiative**

Open science is an increasingly relevant problem space that has broad implications for scientific practice. In 2015, the NCSU Libraries embarked on an open science Initiative to better understand this space, the unique context of open science in practice at NC State, and ways in which the libraries can better support ongoing work. The exploratory approach was structurally informed by schools of thought identified by the open science community (Bartling & Frieske, eds., 2014), the instructional toolkit from Foster Open Science (2015), and the OECD's 2015 policy report on "Making Open Science a Reality".

The initial investigation began with an exploratory scan that included a literature review, semi-formal interviews with information professionals familiar with the information needs of the campus community, and data analysis of information gathered from web scrapes (conducted using Perl, Kimono, and OpenRefine) compared with publication information from Web of Science and PLOS to determine pockets of activity relating to open access publications as well as other relevant keywords (eg. open data and open science).

In addition to this exploratory environmental scan, the initiative focused on creating opportunities for conversation and serendipitous collaboration. In March of 2016 we hosted an open science unconference as a venue for a community conversation on what open science means at NC State, as well as more broadly, and clarifying the path

forward in the initiative. Through this event we grew a community list of interested stakeholders who we then reached out to for interviews.

Faculty interviews were conducted using guerilla user research methods, and were informal through phone calls and in person. These conversations identified two major problem areas that researchers were facing: a growing skills gap in the use of digital technologies to engage with modern research methods, and poor incentive structures to support the investigation of open tools and methodologies.

In response to this perceived skills gap, the NCSU Libraries embarked on an interdepartmental project to create and deliver a series of workshops and informal meetups that support modern research practice through hands on skill building. This series was titled the Summer of Open Science and represents inter-departmental work within the Libraries, bringing together the Makerspace, a visualization workshop series, and the open science Initiative. Content for the workshops was informed by faculty interviews, conversations with graduate students, the Foster Open Science Toolkit for Teaching open science (2014), and existing Software Carpentry courses.



*Figure 1 The NCSU Libraries Summer of Open Science – a series of workshops and events supporting modern research practice through hands on skill building.*

Next steps in the Initiative are to explore the possibilities of using virtual environments to increase the reproducibility of research by capturing both workflow elements and output artifacts. A goal of this approach is to decrease the time investment in the set-up of a new tool or suite of tools in support of a workflow, supporting researchers who are interested in an approach but lack incentive structures or time that support exploration of new tools. A pilot virtual environment was tested in the context of a Summer of Open Science workshop.

## **2: Supporting Research Data Management**

For several years, grant funding agencies have focused on extending the impact of research they support by issuing data management and public sharing requirements for research assets. These requirements aim to ensure that the data from sponsored research are preserved for transparency, replication, and reuse to support new

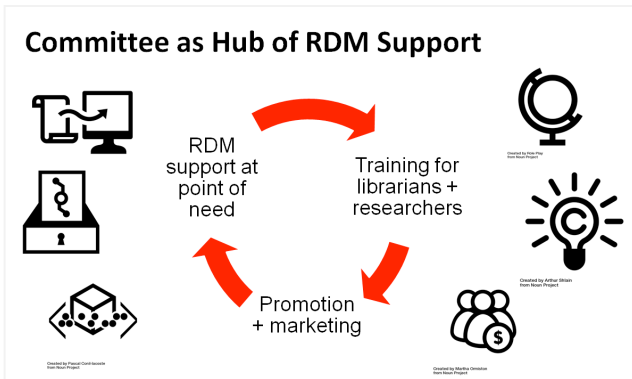
discoveries. The NCSU Libraries recognized this new context as an opportunity to strengthen and advance the role of librarians and library staff in research engagement.

Our growing portfolio of research data management (RDM) support services have been informed by a multi-faceted approach of prescribed methods by the ARL/DLF E-Science Institute as well as the Joint Task Force on Librarians' Competencies in Support of E-Research and Scholarly Communication (2014).

From July 2011 through January 2012, the NCSU Libraries took part in the ARL/DLF E-Science Institute to help frame a strategic agenda for supporting research data management and its broader e-science needs at NC State. Our internal working group conducted an environmental scan of existing services, initiatives, and plans in support of RDM at our campus followed by a self-assessment that provided context for understanding the organizational culture and the research enterprise at NC State. We interviewed key researchers and administrators to investigate the roles and requirements of faculty and students in e-science and e-research. We conducted a SWOT analysis to surface the primary internal and external influences on potential activities in support of RDM. Each of these activities led to the creation of a Strategic Agenda that helped us define a clear and concise plan for research data support.

Through the ARL/DLF E-Science Institute, we found that researchers at NC State primarily expressed a need to store data and make it accessible to the public. Researchers also expressed interest in access to computational resources and voiced a need for access to open data. In order to capitalize on the information gathered through participation in the ARL/DLF E-Science Institute, our working group proposed the formation of a Research Data Committee that was charged with actively monitoring trends, tools, and strategies in support of the discovery, access, use, and sharing of research data for and by researchers at NC State.

The Research Data Committee acts as a hub to coordinate subject liaisons and digital curation technology around consultation support to aid NC State researchers in aspects of data sharing, storage, discovery, and management. Our efforts have been focused on providing introductory data management training to both internal audiences (e.g., librarians and library staff) and external audiences (e.g., students, faculty, research staff, post-docs, and research administrators), customized guidance on individual researchers' data management plans (DMPs) through our DMP Review Service, connecting researchers with data repositories, and helping researchers understand the complex rules and expectations for making NIH-funded research open to the public.



*Figure 2 Research data management at NCSU Libraries – offering a hub of support and training ground for librarians.*

After two years of piloting services for both internal and external audiences, we conducted an audit of the training offered by the Research Data Committee and the DMP Review service in terms of the capacity to develop and enhance competencies as identified by the Joint Task Force on Librarians' Competencies in Support of E-Research and Scholarly Communication (2014). The Joint Task Force framework presents competencies in three areas: (1) Providing access to data; (2) Advocacy and support for managing data; and (3) Managing data collections. This audit led to the development of new workshops for data literacy training and to an initiative to create a series of dynamic learning activities that could be integrated into a variety of learning settings, both online and in-person as mini workshop learning activities and potentially as short video tutorials (Davis and Cross, 2015).

### LESSONS LEARNED

Supporting modern research practice is a complex problem space that requires a user centric approach to service development. While existing frameworks work to support service design, simple, low-cost, user research to localize the problem space is necessary.

Similarly, the structure of existing definitions, policy outlines, and training toolkits informed our approach to better support open science needs and user research grounded us in practical application. Creating opportunities for communication and community has given us an avenue to discover unknown pockets of interest in open science at NC State.

The modern research workflow requires a set of skills that is not always accessible due to the complexity of available tools, the abundance of options, unclear or contradictory policies, and differing practices between disciplines. NC State researchers are faced with a growing need to better

understand what working in the open means and what tools are best suited for them but are not sufficiently incentivized to invest in deep investigation of an ever changing problem space. As such, the open science initiative is taking a three pronged, iterative, approach to research support, informed by a continued exploration of local needs: skill-building support through identification of an open science skill set and development of resources to support that skill-building; community building through meetups, talks, and events; and technical support for reproducible instructional and research environments through virtual machines and tools such as Jupyter notebooks.

The ARL/DLF E-Science Institute framework has given us the context needed to implement services and training materials that support data information literacy. Learning about the research enterprise and gaps in our campus infrastructure for supporting data management and data sharing through interviews with key faculty gave us the credibility and experience to advocate on behalf of researchers.

### NEXT STEPS

For NC State researchers, there is high demand for just-in-time support. The DMP Review service has created opportunities to learn valuable skills while providing time-sensitive service to researchers. It is designed to help our researchers be more competitive in the research proposal process and to make research assets more widely available. Conducting our audit revealed areas where we have been effective at helping librarians develop skills to support researchers at the grant proposal stage. The audit also helped us identify areas for improvement. For example, we developed the Data and Visualization Institute for Librarians to better engage in the development of a community of practice for data science and data visualization.

We are building out additional internal training to ensure that all of our librarians engaged in research data management support have opportunities to handle raw data, create metadata and discovery-enabled files, assess data repositories, and develop a foundation in digital forensics. We continue to enrich partnerships with other units across campus that offer expertise and support in data security, data storage, institutional review board compliance, technology transfer, and grant proposal development.

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