

Jun 14th, 9:35 AM - 10:50 AM

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Renaine Julian and Nicholas Ruhs, "Advancing Open Science at Florida State University Libraries."
Proceedings of the IATUL Conferences. Paper 6.
<https://docs.lib.purdue.edu/iatul/2022/clar/6>

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Abstract

Florida State University Libraries' STEM team has provided tailored library services that aim to meet the present and future research and learning needs for STEM scholars on campus and beyond since 2016. More recently, this team has been positioning themselves to enable researchers to reduce and eliminate barriers of access to information by prioritizing programs and services that advance open science and open research. This paper will discuss the structural and organizational changes that have been and continue to be implemented that enable librarians to prioritize initiatives and services related to open science and open research. This includes structural changes like title and job description updates but also strategies for balancing foundational library services with emerging needs and priorities.

This paper highlights specific efforts that advance open science, including a data fellowship initiative which aims to develop the next generation of open scientists by providing student employees opportunities to be peer educators and advocates around open science. Additional activities the STEM team is doing to advance open science at Florida State University will also be discussed, such as providing learning opportunities related to teaching with open tools, becoming an effective data steward, and data information literacy. This paper will also include a discussion around the challenges and opportunities related to transforming library services to meet the evolving needs of STEM scholars.

Introduction

The Florida State University (FSU) is a Research 1 institution according to the Carnegie Classification of Institutions of Higher Education and is located in Tallahassee, which is the state of Florida's capital city. In 2021, the Florida State University had over 45,000 students and almost 2,000 faculty (FSU FactBook 2021). The STEM team has four librarians, which includes the director, and provides specialized library services for STEM departments including: Nutrition and Integrative Physiology, Mathematics, Physics, Scientific Computing, Computer Science, Biology, Chemistry, Statistics, Geography, Earth Ocean and Atmospheric Sciences. They also provide support for the College of Nursing and the FAMU-FSU College of Engineering, which is a joint-use facility between FSU and Florida Agricultural and Mechanical University (FAMU), a historically black college and university. The STEM team also provides library support to various research centers and institutes both on and off campus, including the National High Magnetic Field Laboratory, Center for Oceanographic and Atmospheric Prediction Studies and the Center for Advanced Power Systems.

In 2017, the STEM team underwent significant structural changes in order to better meet the research and learning needs of faculty and students in STEM departments. These changes started in response to the observed changes in research and learning needs of students and faculty in STEM disciplines. Before these organizational changes, the STEM Libraries team, as

it was called, was a larger team that was also charged with the staffing and operations of FSU's Dirac Science Library and the FAMU-FSU College of Engineering Library. The changes in 2017 narrowed the portfolio of the librarians on the STEM team so that they could focus on specific needs in the classroom and the laboratory (Boff and Cardwell 2020, Chapter 11).

From 2017-2020, this team focused on building relationships and meaningful connections with faculty and staff across campus so they could better understand their library needs (Boff and Cardwell 2020, Chapter 11). During this time, new library services and programs were piloted and either scaled into larger services or sunsetted to make room and capacity for other initiatives. For example, 3D printing services were piloted as a joint effort between the STEM team and other groups at FSU Libraries. After seeing a decline in demand and new services that met the same needs launched across campus, we decided to sunset this project after a two year pilot. While focusing on engagement and spending time piloting new services, the STEM team was also eager to build an academic liaison program similar to the Social Sciences, Arts and Humanities (SSAH) team in the Libraries.

Stimulus for Change

As connections were made and relationships were formed, the STEM team better understood the needs and desires of their community. This led to more student engagement and higher interest in library events. It also meant that there was more demand on the time of the librarians on the STEM team since they were and still are a relatively small team responsible for meeting a wide range of research and learning needs for a large target audience. Eventually, challenges related to workflow and time constraints led to difficulties experimenting and trying new things. Due to these challenges, it proved to be difficult for the STEM team to position themselves to meet the evolving demands of faculty and students on campus.

By learning more about the needs and interests of faculty and students, the STEM team realized that they lacked the expertise and resources to meet many of those demands. In one instance, a new faculty member was interested in receiving guidance and consultation on research data management practices for a research laboratory they were creating on campus. This project would require partnering with the lab to assess their data management needs, create processes and procedures, as well as lead educational efforts to train members of the lab. Without a dedicated research data management specialist, there was insufficient capacity to take on such a project. There were other examples of missed opportunities which had an effect on team morale. Many of these missed opportunities were within the realm of advancing open science and open research.

Another challenge, which also proved to be an opportunity, was a deep desire by individuals on the STEM team to contribute and work in ways that were in alignment with their values and also in alignment with our library's strategic plan. Specifically, they wanted to focus more time and energy doing work that was in alignment with the library's strategic goals of ensuring equitable access to information as well as enhancing research and scholarship for the FSU community ([FSU Libraries 2020-2023 Strategic Plan](#)). This meant spending more time on emerging research services provided by STEM librarians at peer universities, such as research data

management and GIS support (Tchangalova et al. 2021). It also meant finding ways to enable open science on FSU's campus and beyond in an effort to reduce barriers of access to information.

Creating space for Open Science

These challenges created a desire and stimulus for change that would enable the STEM team to pursue new projects and initiatives in an effort to meet the evolving needs of STEM scholars. Through team and individual discussions, the team agreed to explore ways to create capacity in their portfolios and time in their work day. This involved identifying services and programs to spend less time on so that they could focus on work that requires their expertise. Many of the requests received by the STEM team could be answered via our virtual reference service and some of the training needs could be met with resources created by vendors. For example, in many instances, embedding YouTube videos from database vendors can achieve the same learning objectives as in person instruction sessions that only feature academic database activities. Citation management is another area where the STEM team spends a bit less time teaching. Given the advancement of citation management tools and the availability of resources online, this is another example of where creating asynchronous learning objects or embedding existing ones into learning management systems saves librarians time.

One example includes using an internal tool that was repurposed to help divide up some of the consultations and requests associated with being an academic liaison. Request Tracker (RT) is a tool that is used to track IT, website, and facility issues in the FSU Libraries. Some departments were also using this tool to manage student and faculty requests. The STEM team decided to use this tool for this reason so that graduate assistants, staff, and others who did not have formal academic liaison assignments could field questions that they were equipped to answer. While this is a recent change, there is hope that it will alleviate some of the inequitable workload associated with having a high number of academic liaison assignments. Sometimes, one or two academic departments can account for a large number of requests based on specific assignments for classes or requirements. In these cases, the STEM team hopes that using RT can empower others who have the time and capacity to take on these requests.

Job titles and roles were also reconsidered in the effort to enable increased focus and capacity towards advancing open science. In general, at FSU Libraries, whenever vacancies occur, hiring managers and others examine the role and the job description to make changes that better reflect the needs and direction of the organization. In the STEM team, multiple job title changes were made to signal their expertise and value to the campus community. These job title changes also reflect the actual work that they focus on which is in alignment with their passions and career goals. These specific role changes and job title changes will be detailed in other sections of this paper.

Open Science has been described as an umbrella term that involves the various movements trying to remove the barriers for sharing any kind of output, resources, methods or tools, at all stages of the research process (FOSTER n.d). The Organisation for Economic Co-operation and Development describes open science as encompassing “unhindered access to scientific

articles, access to data from public research, and collaborative research enabled by...tools and incentives” (OECD 2020). Within this context, and the context of the FSU Libraries strategic plan, which was discussed in previous sections, the STEM team has been working to pilot and assess new programs and services that they believe advance open science at their institution and beyond. Currently, the STEM team is attempting to advance open research and open science by:

- Supporting effective data stewardship through data management education and advocacy
- Prioritizing the teaching and learning of free and open source tools whenever possible
- Piloting and assessing new library services and programs that advance open science

That being said, not all efforts towards open science are pilot programs. For example, supporting effective data stewardship through data management education and advocacy builds on existing research data management services that the STEM team has offered since 2016. By investing more time and resources into research data management services, the STEM team is acknowledging the success of previous efforts and the current demands from researchers in this area. The STEM Data and Research Librarian was the librarian primarily responsible for providing research data management services, in addition to other roles and responsibilities. The title of STEM Data and Research Librarian was considered by the team to be a dated description because of the evolving nature of the position and the movement of new personnel into the role. Other members of the STEM team and FSU Libraries are also contributing towards data services. This librarian and the Director of STEM Libraries collaborated to change the title of this position to Research Data Management Librarian. Since this title change, there have been noticeable increases in the number of requests for research data management consultations and instruction sessions. While this librarian has roles and responsibilities outside of research data management, such as their academic liaison responsibilities, this new title enables researchers on campus to better understand the expertise and value this librarian provides.

One strategy the STEM team has been exploring for advancing open research is to modify and make adjustments to current teaching efforts. This involves prioritizing the use of free and open source tools whenever possible. This means teaching students how to use tools and resources that they will have access to after graduation. Fortunately, many of the tools and programs that are in demand in today’s job market are free and open source, including tools like Python and R-Studio. That being said, the STEM team still chooses to teach workshops and provide consultation on data analysis tools that are proprietary, especially when they are the industry standard. This includes tools such as Microsoft Excel and MATLAB. This balance enables the STEM team to advance open research while still providing opportunities for students and others to learn relevant skills that will be needed in a data intensive workforce.

One STEM librarian, who had been with the organization since 2016, had been working toward their master’s degree in Geographic Information Science (GIS). At the same time, the Libraries received requests for help with finding and using spatial, creating maps, and other GIS related

requests. With this expertise and experience, the STEM librarian began taking on GIS requests and even promoting their GIS knowledge and expertise as part of their academic liaison duties. While this librarian's role extended well beyond GIS and environmental sciences, which they also have a background in, the decision was made to change their title from STEM Research and Learning Librarian, to GIS and Environmental Sciences Librarian, to better reflect their expertise and focus. In alignment with the team's desire to teach with free and open tools, the GIS librarian has been prioritizing teaching with QGIS and Google Earth, both of which are free tools.

As previously mentioned, the STEM team and FSU Libraries have selectively piloted specific initiatives so that they can create use cases for future services and programs. In some cases, a workshop series will be an avenue to try something new. For example, the GIS and Environmental Sciences Librarian is piloting a new workshop series on QGIS, which is a free and open-source geographic information system that can perform data analysis and create maps similar to its counterpart, ArcGIS. The research data management librarian leverages the existing and popular Data @ Your Desk workshop series to teach new tools or provide a lesson for the first time. Creating these workshops, marketing them, and seeing who shows up is one strategy for getting data on potential demand for a new service or program. Surveying students who attend these workshops create opportunities to gather data on how learners are engaging with this new material.

FSU Libraries recently hired an Open Science Librarian, who is piloting and testing use cases for the Open Science Framework (osf.io), which is a collaborative project management tool that collects and supports research tools and workflows. FSU's Office of Research purchased an institutional license so that the Libraries could explore opportunities and uses for this tool. The Open Science Librarian role was created from a vacated STEM librarian position. The position has similarities with its previous iteration, such as a significant role in academic liaison support for certain STEM disciplines. In this case, the director assumed additional liaison responsibilities so that there was capacity to include a focus on providing library services related to supporting open science to the portfolio.

The next section of this paper will detail a pilot program where the STEM team has put a significant amount of time, energy and resources toward. It is the data fellows program, which is led by the Research Data Management Librarian.

Data Fellows Program Pilot

Program creation

Academic libraries have been at the forefront of advocating for the principles of good data stewardship. To date, these efforts have largely focused on faculty and graduate students, with less focus on undergraduate students. However, employers increasingly expect new graduates to possess foundational skills in data analysis, data visualization, and data literacy. In fact, job growth in data-related fields is estimated to grow approximately 28% through 2026 [U.S. Bureau

of Labor Statistics, 2018.] In order to meet the needs of an increasingly digital workforce and prepare students for post-graduation success, libraries need to invest in efforts to provide opportunities around data education and training that will help develop the next generation of data scholars and ambassadors.

In 2020, the Florida State University (FSU) Libraries released the current version of its strategic plan. This plan outlined the library's mission, vision, values, and goals for the time period between 2020-2023 [Florida State University Libraries, 2020.] Within it, there were five goals outlined:

1. Ensure equitable access to information
2. Establish the library as a center of intellectual community
3. Enhance Research & Scholarship
4. Invest in People
5. Promote Critical Thinking

As part of the plan, a process was established wherein library faculty and staff were invited to submit strategic initiatives that would help achieve some or all of these goals.

Seeing an opportunity to invest in our students and enhance their data skills, in addition to advancing the library's ongoing data services program, the Research Data Management Librarian submitted a strategic initiative proposal titled "Building a Community of STEM Data Scholars" [Florida State University Libraries, n.d.] The main component of the initiative was the creation of a STEM Data Fellowship program focusing on the development of a peer-to-peer teaching, research support, and outreach model for data support. The fellows would have the opportunity to teach their peers and advocate for principles related to data information literacy, open science, and open data. The fellows would also have the opportunity to advance their own professional development and obtain knowledge and skills in specific areas to help them prepare for their future careers.

First-year Highlights

In September 2021, two students were hired as part of the initial cohort of STEM Data Fellows. The fellows, both undergraduate students at FSU, brought unique disciplinary experiences and backgrounds to the program. One fellow was a senior Chemical Engineering major at the FSU-FAMU College of Engineering, while the second fellow was seeking a B.S. in Statistics from FSU. Together, they brought to the fellowship experience in areas such as scientific research, survey data analysis, and knowledge of data analysis software such as MATLAB, R, and SAS. The data fellows were involved with multiple projects and the establishment of new services throughout the 2021-2022 academic year. The rest of this section will highlight selected projects and services.

One of the goals of the data fellows program was to have the fellows provide direct, in-time support to their peers working on data-related assignments or projects. However, one challenge that was faced in Fall 2021 was ongoing changes and guidance with relation to COVID-19, which made scheduling in-person walk-up or office hours untenable. Thus, we launched a

virtual reference channel specifically for data questions. This channel, which was integrated into our library-wide “Ask a Librarian” chat service, was designed specifically to allow students an avenue to come and ask data related reference questions, such as how to find a dataset, how to use our library’s data resources, and so on. Chat widgets unique to the data virtual reference channel were implemented on the research data services webpage and data management research guide. Overall, this new channel was received positively by the FSU Libraries administration and the FSU community. There are plans to expand the reach of this channel and offer in-person office hours as the effects of the pandemic ease.

During the first year of the fellowship program, the fellows were also embedded into our ongoing data instruction efforts. As this was the first year of the program, both fellows spent a significant amount of time shadowing and assisting workshop instructors. The fellows also served as helpers and Zoom moderators for several existing data analysis and visualization tools workshops. One of the fellows had the opportunity to serve as a co-instructor for an Introduction to MATLAB workshop during the Spring 2022 semester.

Furthermore, both data fellows contributed to the development of introductory, asynchronous Canvas modules on selected data analysis software. These modules were designed to allow students to learn at their own pace and to be utilized as supplementary material for student projects or full-semester courses. For example, one fellow developed an introductory module on MATLAB, primarily for first and second year Engineering majors. This module covered concepts that students are expected to learn or know in foundational Engineering courses, such as how to set up functions, develop scripts, and perform rudimentary data analysis. There was interest from a faculty member at the College of Engineering who was willing to integrate this module into their Chemical Engineering Laboratory course. A module on R is also in development by one of the data fellows.

A key component of any research data services program is outreach and engagement with the campus community. It was believed that the data fellows could play an important role towards these efforts, particularly with students. During the fall 2021 semester, the fellows conducted an email campaign to FSU Registered Student Organizations (RSOs), focusing on organizations with a STEM focus. This campaign provided the fellows with the opportunity to interact directly with their peers and promote our library’s research data services in a way that was relatable to undergraduate students. Additionally, the fellows co-wrote blog posts on various topics, such as big data and data analysis software [Bustamante & Clark, 2021, 2022.] These posts were targeted at undergraduate and graduate students at all levels of their data education. These articles, which were published on the library blog site, have to date generated over 300 views. The fellows also played a role in our 2022 Love Data Week outreach activities, which included collaborating on social media content and providing written perspectives on their experiences as data fellows for the library blog.

As part of this initiative, there were deliberate efforts to provide the data fellows with opportunities to equip themselves with the knowledge and skills to succeed in data-focused careers and academic endeavors. By doing so, the goal was to instill in them a passion for data literacy and effective data stewardship. At the beginning of the fellowship program, fellows were asked to schedule one-on-one sessions with FSU librarians, particularly those with data-related job portfolios. By meeting and conversing with library data experts, the fellows were able to get a sense for the variety of ways in which data is utilized and in which we assist our scholars. Another strategy we used was holding weekly group discussion sessions and demonstrations on data-related topics. Several of these sessions featured guest moderators from FSU Libraries. Topics covered included open data and open science, government data, data in special collections, and health data. They also partnered with campus offices and departments, such as the FSU Career Center, to connect the fellows with available campus resources that provide assistance for seeking long-term employment opportunities after graduation.

Program next steps

During the first year of the STEM data fellowship program, a framework for a peer-to-peer teaching, research support, and outreach model focused on library research data services was created. New services were initiated to meet the needs of FSU scholars, such as virtual data reference hours. This first year has also highlighted areas in which we can improve student engagement around data services, particularly with regards to our Libraries' data instruction program. Moving forward, there will be more opportunities created for the fellows to co-teach and develop workshops, while also involving them more into our efforts to provide synchronous and asynchronous data instruction. Finally, there is a desire to implement a peer-to-peer mentorship model within the fellowship program, where experienced fellows are able to mentor new fellows that join the program.

Thinking towards the future

Over the past few years, the STEM team at Florida State University Libraries has been able to find ways to provide support for the evolving needs of STEM scholars. They have been able to do this with limited resources and personnel. Through experimentation and pilots, they have tried new things, which will need to be evaluated moving forward. Funding pilot initiatives that could become permanent programs, such as the Data Fellows Initiative, will be a priority moving forward. Finding ways to increase capacity and to build the required expertise to provide advanced data service offerings will also remain a priority. As changes are ideated and proposed to the overall academic liaison program at FSU Libraries, the STEM team will need to respond in a way that is in alignment with the organization's broader directions while still providing tailored library services for STEM scholars on campus and beyond.

Acknowledgement

The authors would like to thank the Florida State University Libraries for providing funding to support the STEM Data Fellowship program.

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