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Big Data & Small Data
Manage it Better at the UCI Libraries

Data Services at the UCI Irvine Libraries
2018 Business Case Study

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Technologies and Service Innovation

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EXECUTIVE SUMMARY

Recommendation:

While the funding for a Data Curation Specialist is being determined, the UCI Libraries have a need to provide interim direction, documentation, training, and education. I recommend adding data curation as an interim assignment to a current librarian's job description. This librarian can start to develop documentation and best practices for data curation services, assist DSS with consultation, develop talking points for subject liaisons, and assist with providing training/education on data topics. *See page 4 for full recommendation.*

Why should the UCI Libraries provide Data Curation Services?

- The UCI Libraries, as a central and neutral space can provide services to all segments of the organization from faculty to students, from the arts to the sciences and can also serve as a hub to track available services and make appropriate referrals.
- It has also been noted in other reports that UC Irvine is at risk of losing current and subsequent grant funding if we cannot adequately meet funder requirements. The UCI Libraries can assist the campus community with funder compliance.
- Libraries have historically identified, selected, organized, described, preserved, and provided access to information, extending services to data curation is a natural extension to the role we already serve. Libraries are also central to the campus and are already known for providing guidance and assistance.

Process:

- Researched the current state of Data Curation Services in academic libraries, within the University of California, and at UC Irvine
- Evaluated past DSS consultations to see how they fit into the data curation lifecycle. *See page 7*
- Investigated possible case study projects to determine faculty/researcher needs. *See page 9*

Introduction:

Data curation is the management of data throughout its lifecycle, from creation, maintenance and then archived for future access and analysis. The main purpose of data curation is to ensure that data is reliably retrievable for future research purposes or reuse. At its most basic, what everyone (administrators, researchers, librarians, etc.) wants is for data to be findable, to be accessible, to be interoperable, and to be reusable.

In fact, according to NFAIS (2016), "In this new era everyone must be data literate to define problems, wrangle data, self-manage data, choose methods and tools, analyze data, communicate their findings and engage in lifelong learning." There is a long way to go before this utopia of 100% data literacy is reached. Coates (2014) stated that "many

researchers have neither the time nor the training to manage their data in ways to facilitate the reproducibility, openness, and interoperability encouraged by funding agency policies. One common thread amongst all the literature on data curation is that researchers struggle with all stages of the data lifecycle. From proposal planning and writing, project start-up, data collection, data analysis, data sharing, and the end of the project. Several studies show that researchers' need vary by discipline and that data skill levels and knowledge will also vary within that discipline. One solution to support data curation may not be sufficient.

Appendix I

A. Important Definitions:

Data - is a set of values of qualitative or quantitative variables. Data is measured, collected, reported, and analyzed, whereupon it can be visualized using graphs, images, or other analysis tools. Data as a general concept refers to the fact that some existing information or knowledge is *represented* or *coded* in some form suitable for better usage or processing.

Digital Asset Management (DAM) - consists of management tasks and decisions surrounding the ingestion, annotation, cataloguing, storage, retrieval, and distribution of digital assets. Digital photographs, animations, videos, and music exemplify the target areas of media asset management

Data Curation (Management) – management activities related to the organization and integration of data collected from various sources, annotation of data, and publication and presentation of data such that the value is maintained over time, so that the data remains available for reuse and preservation.

Data Science – an interdisciplinary field about processes and systems to extract knowledge or insights from data in various forms, either structure or unstructured. Is a continuation of some of the data analysis fields such as statistics, machine learning, data mining, and predictive analytics.

E-Science - the application of computer technology to the undertaking of modern scientific investigation, including the preparation, experimentation, data collection, results dissemination, and long-term storage and accessibility of all materials generated through the scientific process.

Researcher - someone who conducts research, i.e., an organized and systematic investigation into something. Can refer to faculty, students, and/or staff in this document.

B. Background

A rising conversation at the University of California, Irvine is the state of data, infrastructure, and researcher support. While UCI has made strides since 2013 to improve Research Cyberinfrastructure (RCI) on campus it still remains a weakness. The *Vision for Research Cyberinfrastructure at UCI* stated that, "Campus support for the increasing load of data and digital asset management is currently distributed, loosely coordinated, and not staffed to the level of peer institutions." One of their many recommendations was to hire a library data curation specialist to develop tools and workflows for data management. The report compared the UCI Libraries' Digital Scholarship Services staffing to both Purdue and the University of Oregon and UCI had significantly fewer. Not only that but in my comparison of all ten UC campuses of the current and planned data services, UCI Libraries would rank quite low. Most other UC campuses have a significantly higher number of staff dedicated to Data Curation services and have significant web presences. This report recommended funding a "Library Data Curation Specialists to support funder compliance, manage collections of campus produced data, work with the Office of Research to implement data management training programs, and promote open access."

According to Gold (2010) there is a "…conceptual shift away from viewing libraries as primarily collections-oriented repositories of information towards viewing them as service providers that actively support the exchange of ideas and knowledge across the disciplines." In addition, Luce (2008) stated that "…libraries work across academic and organizational boundaries; data management and curation is not scalable in siloed environments." In 2010 the Ligue Des Bibliotheques Europeennes de Recherche (LIBER) created an e-science working group to investigate libraries and their roles in the field of e-science. Focusing on Research data as the most urgent element the group developed the top ten recommendations for libraries to get started with research data management:

1. Offer research data management support, including data management plans for grant applications, intellectual property rights advice and information material.
2. Engage in the development of metadata and data standards and provide metadata services for research data.

3. Create data librarian posts and develop professional staff skills for data librarianship.
4. Actively participate in institutional research data policy development, including e-resource plans.
5. Liaise and partner with researchers, research groups, data archives and data centers to foster an interoperable infrastructure for data access, discovery, and data sharing.
6. Support the lifecycle for research data by providing services for storage, discover and permanent access.
7. Promote research data citation by applying persistent identifiers to research data.
8. Provide an institutional data catalogue or data repository, depending on available infrastructure.
9. Get involved in subject specific data management practice.
10. Offer or mediate secure storage for dynamic and static research data in co-operation with institutional IT units and/or seek exploitation of appropriate cloud services.

With the retirement of the librarian who previously handled Social Science Data the UCI Libraries has the opportunity to strategically hire or to assign the role to improve services to the campus in the area of data curation. The UCI Libraries also developed a new strategic plan; Pillar 1 focused on expanding the libraries capacity to improve lives by:

- Enhancing the global visibility, reproducibility, and societal impact of UCI's research by providing leadership in the creation and implementation of enabling technologies and services that facilitate effective management, sharing, discoverability, and preservation of research output.
- Contribute to the development of UCI's research cyberinfrastructure and embedding librarians throughout the research lifecycle.

C. RECOMMENDATION

With the rise of international, national, and local open access policies extending to data, UCI researchers are being asked to manage and share their data more than ever before. Data curation is considered to be very messy at all stages of the data life cycle and researchers need expert support and guidance in how to manage their data throughout the process. At the same time the field is facing a deficit of people trained in how to handle big data – in how to aggregate and filter data, present data, analyze data to gain insights, and manage data for long term preservation. In tandem with the Data Curation Services business case, recommendations for hiring a Data Curation Librarian have been made in "A Vision for Research Cyberinfrastructure at UCI."

Option 1: Add Data Curation to a current Librarian's duties

The UCI Libraries can move forward with data curation services at varying levels depending on what duties the librarian chosen already supports, what percentage of time they can devote to data services, and what their skill levels are with dealing with data. Depending on the skills of the chosen librarian the libraries might want to consider ensuring that training opportunities like the following are available:

- UCI Data Science Certificate Program: http://ce.uci.edu/areas/it/data_science/

- Data Scientist Training for Librarians: http://altbibl.io/dst4l/

Note: Data Curation Services cannot happen with only one person, it will take the commitment of subject liaisons to learn about data curation and to serve as the point of first contact, helping researchers when they can and referring when needed. To do this will require the creation of a training program for subject liaisons, clear documentation about who handles what at UCI for referral processes, and the creation of outward facing guides that could hopefully help answer simple questions for researchers.

If Data Curation Services are added to a current librarian's portfolio the UCI Libraries may need to make tough decisions on the level of support that can be provided to the campus community. The services provided by a part-time data curation librarian would by necessity be smaller than those provided by a 100%-time librarian focused solely on data curation. A 100%-time librarian for data curation would be able to handle the items in Mandatory preparation and core service and depending on their background some of the items in the Outside of Core Services section. A librarian spending part of their time on data curation would be able to tackle significantly less because of other responsibilities and duties.

Mandatory Preparation:
- Evaluate and possibly improve web presence (research guides, DSS page) about data curation, finding data, and data visualization
- If possible, have the guide point to other campus contacts for data related tasks outside the realm of data curation.
- Develop internal data training for subject liaisons on data curation

Core Services:
- Data Management Support
- Best Practices for Managing Data
- Archiving and Sharing Data
- Data Workshops
- Refer researchers to appropriate campus contacts for data related services outside of the scope of data curation.

Outside of Core Services (could be included or separate depending on staffing):
- Metadata and standards support
- Purchasing, Acquisitions, and Licensing of data
- Institutional repositories (IR)
- GIS and spatial analysis support

Option 2: Hire a Librarian for Data Curation

If funding for a Data Curation Librarian is not made available through Research Cyberinfrastructure the library should further consider funding the position. More applicable to the needs of the UCI Libraries would be a librarian who either has educational experience in informatics or previous experience in managing data curation services. This librarian could:

- Provide Data Curation services to researchers in all disciplines.
- Building demand for Data Curation services.
- Understand and unpack data management requirements.
- Participate in the conversation about data curation on a local and national level.
- Develop training and teaching opportunities for the UCI community and UCI Library staff.
- Be a liaison to Data Science Initiative and the Office of Research
- Promote Data Curation services to the campus community

It is important to note that Data Curation in institutions require a high level of participation on the part of administration and requires new, sustained funding and differently trained staff. Planning for data curation services is not a static event but needs to be a continuous process to ensure long term success. Overall, in data there is an urgent need for standards, tools and best practice models for both file formats and disciplines. To stay current the UCI Libraries will need someone to stay current of advances in this area. Implementing data curation services can be considered a resource drain, decisions at some point might need to be made on what the UCI Libraries should discontinue doing to pursue providing data curation services.

D. DATA CURATION SERVICES

Since researchers need help throughout the data lifecycle, I recommend building consulting services and marketing that touches on each the areas below: creating, processing, analyzing, preserving, access, and re-use. Implementing consultation services on multiple topics can be difficult and time consuming, especially if the responsibility for Data Curation is added to a librarian's current duties. They may need time to research and learn about some of the areas in the data lifecycle. To try to narrow down which areas the UCI Libraries should focus on first the Faculty Interactions Database was mined for data related interactions and requests. Most of the requests fell into the area of creating data, data preservation, and access of data, I would recommend that these three topics be the initial focus when building the data curation consultation service.

Creating data

- Design research
- Plan data management (formats, storage etc.)
- Plan consent for sharing
- Locate existing data
- Collect data (experiment, observe, measure, simulate)
- Capture and create metadata

Processing data

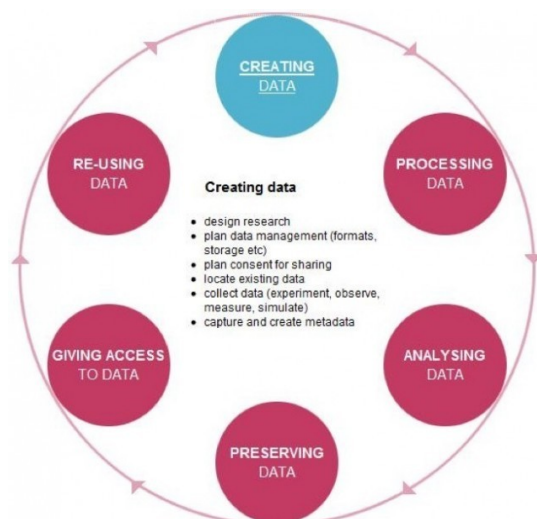- Enter data, digitize, transcribe, translate

Figure 1: Data Lifecycle from https://www.bu.edu/datamanagement/background/data-life-cycle/

- Check, validate, clean data
- Anonymize data where necessary
- Describe data
- Manage and store data

Analyzing data

- Interpret data
- Derive data
- Produce research outputs
- Author publications
- Prepare data for preservation

Giving access to data

- Distribute data
- Share data
- Control access
- Establish copyright
- Promote data

Preserving data

- Migrate data to best format
- Migrate data to suitable medium
- Back-up and store data
- Create metadata and documentation
- Archive data

Re-using data

- Follow-up research
- New research
- Undertake research reviews
- Scrutinize findings
- Teach and learn

Source: UK Data Archive

The UCI Library's Data Curation service can assist and provide training to researchers in following best practices in writing effective and compelling data management plans. The library can also provide support in describing and depositing data to ensure data is easily findable and citable by placing it in the proper repository. The UCI Libraries Data Curation service could also help to ensure that data can be sustainably accessed in the future.

E. Data Related Interactions in Faculty Interactions Database

Previous Requests	Part of the data lifecycle	Possible Consultation Service/Referral that could have assisted with request
Creation/revision of Data Management Plan (DMP)	Creating Data	Consultation with Data Curation Librarian about DMP's – referral to DMP Tool and other resources.
Request to gain access to the Databrary system	Creating Data	Referral

Loading data into DASH • Data repositories and open access • General questions on UCI Dash and Orange County Data Portal.	Preserving, access, and re-use of data	Consultation with Data Curation Librarian re: DASH tool
Potential Dash/OC Data Portal Data donor agency NROC		Consultation with Data Curation Librarian re: DASH tool
Data mining	Creating Data	Consultation with Data Curation Librarian – getting data out of library databases
Hosting and sharing of 60 GB of experimental data	Preserving, access, and re-use of data	Consultation with Data Curation Librarian re: DASH tool
Read an old data encoding format (i.e. EBCPAK)	Re-using data	Referral
Data backup and storage	Preserving and access to data	Consultation with Data Curation Librarian about repositories.
Reassure outside entities that UCI can *securely* store *sensitive data*.	Preserving and access to data	Referral
Data management and how to create a personal database.	Processing Data	Consultation with Data Curation Librarian about best practices of data management.
Use Atlas TI to do open coding and memoing on interview and forum data. I would also like consultation on the most effective manner of making scraped .json files into human-readable data, if possible.	Creating, processing, analyzing data	Initial consultation with Data Curation Librarian for discussion on possible software tools and needs. Then referral to metadata person about scraping .json files
• Visualize and map data • generate a meta database	Creating, processing, analyzing, and access	Initial consultation with Data Curation Librarian & possible referral. First step would be creation of a data

aggregating the content • Best way to organize the data • Create exploratory maps that would visual data. The interface should overlay historical city maps against the contemporary landscape of Los Angeles.		management plan (DMP)

F. Example of Faculty support

A faculty member requested assistance with the organization, formation, and versioning of a multi-year research project. When discussing the situation, it became apparent that assumptions were made about the skills and knowledge of graduate students hired to help organize and input data. The professor ended up with multiple spreadsheets all formatted differently that they currently cannot compare across. This requires them to go back and create a master spreadsheet, resolve old labeling and header issues, and verify older data in preparation for visualization and mapping for inclusion in a future monograph. Services that could have helped are:

- Training in creating a data management plan
- Training for graduate students in data management and data best practices
- Versioning and file naming
- Best practices for data management

Appendix II

G. UCI Libraries

The UCI Libraries has a history of creating teams for both data and GIS:

Data Team: The Data Team (multiple team charges in 2010 & 2011) was responsible for monitoring data-related developments both on campus and at CDL, to implement ways to inform library staff about how disciplines utilize research data, to educate staff on data resources and services, and address data literacy for users. For a time, focus was placed on data related sources and tools but in recent years more focus has been placed on library purchased data sets and resources.

Geographic Information Systems (GIS) Implementation Team: Formed in 1997 the GIS team was created to "focus on planning and developing GIS services in the library." The team made advances in GIS software and documentation, GIS web page development, promotion, GIS liaison and collection development, and instructional and support services. A team was again charged in 2008 to re-vision the previous GIS program by reviewing the program and recommending changes. The final report stated that the UCI Libraries effectively refers and/or can respond to questions regarding platforms or data. The second point was that there was no "expert" on staff that could provide assistance with ArcGIS. The final report also mentioned that historically the Libraries have not needed to recruit someone with a substantive GIS background. A meeting was scheduled with our current librarian responsible for GIS at the UCI Libraries, during this meeting we discussed the current state of GIS and found that it is much the same as it was historically. The biggest issues are that library users don't know how to use the tools, that data is inherently difficult to deal with, and that they would like access to more tools. The tasks that are the most labor intensive are big census related questions which can take 3-5 hours of research and the process of identifying data sets and/or getting data for secondary analysis for library users.

Subject Liaison Interviews:

1. Engineering

   - Engineering is not overwhelmed with questions about Data Curation, mostly the requests are for data sets.
   - Need for how to get data ready, how to manage it, how to anonymize and set it up.
   - GIS could be bigger
   - Quarter doesn't allow for big projects
   - Not using the data from the database
   - Responsive to no demand versus building demand
   - How to integrate data into classroom teaching
   - Data management problem
   - No UCI data management policy

2. Business

   - Primarily questions about purchasing data sets

3. Social sciences data

   - Purchasing data sets
   - Pulling data from library databases
   - Assisting with data management plans and referring to data repositories
   - DASH, DMP tool, Merritt, etc.

4. Medicine

   - Primarily need support with compliance to the NIH Public Access Policy
   - Very few data requests beyond NIH

H. UCI Data Related Services:

Office of Information Technology (OIT)

- Data Center
- System Administration
- Backups
- OIT Data Center Co-location Services
- Computing Resources:
  - GIS
- Computing Hardware
- Clusters:
  - HPC
  - Virtual Servers
- UCI Lightpath Network
- Research Software
- Research Computing Support

UCI Center for Statistical Consulting

The Center works on a recharge basis per hour of support, they provide support in the following areas:

- Study design and power analysis for experiments, surveys and observational studies
- Choice of statistical methods and their proper application
- Interpretation of results, including their limitations
- Grant preparation and the preparation and review of manuscripts

I. UC Libraries Data Curation Services

UC Berkeley – The Data Lab: http://www.lib.berkeley.edu/libraries/data-lab		
The lab offers consultations to current UC Berkeley students, staff and faculty on research involving numeric data, including finding and recommending data sources and advising on technical data issues such as file format conversion, web scraping, and basic statistical software use. The Lab also provides workstations with analytical software such as ArcGIS, Stata, SAS, SPSS, Stata, R, and Python. The Data Lab also provides assistance with: • Research Data Management • Data Acquisition and Access Program (funding for data)	Services Provided: • Research assistance in locating, recommending, and acquiring numeric data. • Statistical software support for such packages as R, Stata, SPSS, SAS, and Python. • Instructional support for courses with a data analysis component. • Workstations and laptops loaded with commonly used data analysis software. • Space for individual and group work.	Staff: 4 members • Librarian for Economics, Political Economy, and International Government Information • Librarian for Federal and State Government Information, Political Science, Public Policy and Legal Studies • Data Librarian • Research Data Management Service Design Analyst
UC Davis – Digital Scholarship: https://www.lib.ucdavis.edu/dept/digitalscholarship/		

	Services Provided:	Staff: Based in IT, 4 total w/3 vacant
• Data Design and Sustainability • Data Analysis and Visualization	• Support with designing and implementing a sustainable data storage strategy. • Analyzing and visualizing data to advance research activities, and for publication and presentation.	• Data Sys Supv II • Vacant; Data Sys Anl 3 [GIS Data Curator/Specialist] • Vacant; Data Curator, TBD • Vacant; Data Curator,

UC Irvine - Digital Scholarship Services: http://www.lib.uci.edu/dss

Write grant winning Data Management Plans. Deposit data into repositories for access and preservation. Increase reproducibility.	We can help you with all stages of data management required by funding agencies • DMPTool • Dash • EZID	Staff: • None specifically for Data

UCLA – Data management & Curation Services: http://www.library.ucla.edu/support/publishing-data-management/scholarly-communication-services/data-management-curation-services

As part of the UCLA Library's efforts to support scholarly communication and the university's research mission, it assists students, staff, faculty, and researchers with data management across the full life cycle of research projects. Librarians and staff from the campus libraries can provide subject-specific guidance tailored to individual researchers' data needs. Planning ahead about how to manage research data ultimately saves time, ensures that data is properly documented and reproducible, and creates opportunities for collaboration.	Services Provided: • General data management • Data discovery • Data management plans • Copyright and licensing data • DOIs • REDCap • Geospatial data	Staff: In the Digital Initiatives and Information Technology Division (2 staff): • Data Archive • Data Management

Additionally, many funding agencies require that grant proposals include a plan for how research data will be managed and shared.		
UC Merced – Research Data Curation: http://library.ucmerced.edu/research/researchers/research-data-curation		
The library can assist faculty and researchers with the many-faceted steps of research data curation—from preparing research data management plans (which are required for many funding agencies), through file management best practices and metadata creation, to data sharing and data archiving.	Services Provided: • Data Management Plans • Best Practices for Managing Data • Archiving and Sharing Data • Research Data Management Glossary • Research Management Toolkit • What is a Data Dictionary	Staff: • 1 Data Services Librarian (also a subject liaison) • Library Liaisons also provide direct support for the following:
UC Riverside – Managing Your Data: https://library.ucr.edu/research-services/managing-your-data		

Managing your data is critical to the success of your research, grant-seeking, and publication efforts. Before starting a new research project, it is critical to develop a data management plan (DMP), which outlines your practices for collecting, organizing, backing up, and storing the data your research generates.	Services Provided: • Data Management Plans • Depositing Data • Help plan what happens to research data before, during, and after research project • Provide workshops and instructional materials on working with data • Identify and provide access to major data sets	Staff: • No org chart and no staff listed…requests go to dataconsult-lib@ucr.edu
UC San Diego – Research Data Curation Program: http://libraries.ucsd.edu/services/data-curation/		
Research Data Curation Program The UC San Diego Library's Research Data Curation Program supports the core data needs of our campus community.	Services Provided: • Data Management: Follow best practices. Write an effective data management plan. • Sharing and Discovery: Describe data and deposit it in a repository. Make data citable. • Digital Preservation: Ensure sustainability by putting data in a digital archive.	Staff: • Program Director • Technical Analyst • Metadata Specialist • Research Data Strategist • Liaison Librarian • Data Curation Specialist and Faculty Liaison Librarian • Digital Preservation Analyst • Library Data Librarian
UC San Francisco – Data Sharing & Data Management: http://guides.ucsf.edu/datamgmt		

Not sure how to organize your data? Need help sharing your data to meet publisher requirements? Looking for UCSF-specific data management tools?	Services Provided: • Make a Data Management Plan • Find Data • Organize Data • Store Data • Secure Date • Visualize Data • Follow Data Sharing Policies • Share Data • UCSF Research Development Office (RDO) Templates	Staff: • 1 data management Librarian • 1 liaison librarian
UC Santa Barbara		
Launched July 1 – no website yet	Services Provided:	Staff: • Director • Geospatial Data Curator • Humanities Data Curator • Assistance from other librarians
UC Santa Cruz – Research Data Management: http://guides.library.ucsc.edu/datamanagement/		
We assist UCSC faculty, staff, researchers and graduate students with strategies and tools for organizing, managing and preserving research data throughout the research data life cycle.	Services Provided: • Create a Data Management Plan • Manage Data • Publish, Preserve and Back Up • Find Data for Reuse	Staff: • 9 librarians from 3 departments.

SUPPLEMENTAL READINGS

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