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THE e-RESEARCH CENTER: TRANSFORMING A TRADITIONAL SCIENCE LIBRARY

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Abstract: At the University of New Mexico Libraries (UL) a year long process engaged faculty, students and library personnel in developing a new mission for the Centennial Science and Engineering Library (CSEL) that will re-purpose it to serve the evolving need for facilitating e-research. The authors discuss the vision of the UL for being at the center of data intensive and cyber-enabled research and the planned development of the eResearch Center (eRC). They share the planning process and ideas to revitalize a 25 year old science and engineering library into a collaborative transdisciplinary research hub**.** Plans include installing low-latency and high-availability network connections to the eRC to provide access to a fast, dedicated research network, training and resource collaboration with the campus high performance computing center, a visualization lab, collaborative environments, large-format data displays, and the provision of data life cycle management services. Finally, they share experiences and initiatives to involve the library and librarians more directly and deeply in faculty research and grant writing, and in working at a leadership level with the Office of the Vice President for Research

Keywords: data curation, data lifecycle, e-research, e-science, library revitalization, information science, informatics, cyberinfrastructure, scientific collaboration.

"E-Science, cyberinfrastructure – these ideas are at the heart of the great ambitions and promise of science in the new century.
The last several decades of network- and computer-enabled work in science have produced untold amounts of data, leading to the challenge of developing practices to manage and provide access to this data. Along with oceans of data and technology, changes in the conduct and nature of science – notably new collaborative and computational science practices – present both novel requirements and exciting opportunities to succeed in meeting this challenge" [**Anna Gold, 2007]**

The UNM University Libraries (UL) embarked on a planning process using multiple approaches in order to build our capacity to take the lead in emerging areas of data management and cyber-enabled research. Areas of UL focus are: physical spaces and connectivity within the existing Centennial Science and Engineering Library (CSEL); investments in systems designed to support collaborations within the sciences; creation of credit based disciplinary informatics courses embedded in the curriculum; and support for researchers throughout the data life cycle and capability to curate their data.

Among the key drivers for these new strategic directions are:
- Recent administrative changes in the Office of Research (OVPR) including a new Vice President who appreciates and understands the potential offered by partnering with the UL on variety of issues. In particular, enhanced support for and inclusion in grant applications and assistance with research compliance for data management plans.
- The eroding NM economic situation affecting state funded institutions requiring all units within UNM not only to find new sources of revenue, but demonstrate return on investment and alignment with the UNM research and teaching mission. We are making progress through active

participation in the granting process leading to new research overhead for the UL, as well growing our capacity to create new tuition revenue and address workforce needs through formal informatics instruction.

- The growing need to address data curation which can be uniquely met by leveraging existing UL expertise in the area of preservation and access to information to create new, highly valued, and necessary services to handle research data. Additionally, a UL faculty member serving as the PI on a large NSF grant, DataOne, adds skills, credibility and substance to this new role.
- The immense opportunities offered by cyber-enabled research to solve large scale problems opened the door for the UL to make a strong case for creating the environment for transdisciplinary collaborations by re-envisioning an aging facility and service model.

Overview

UNM is preparing to address the challenges presented by significant changes in science and engineering that are rooted in a deep merging of traditionally unconnected areas of intellectual endeavor and new ways of capturing and sharing research data. The scale of such transdisciplinary research efforts and the complex nature of the systems and problems being studied often require large collaborative inter-departmental and multi-institutional teams. Planned phases of the e-Research Center (eRC) are designed to support and provide access to core cyberinfrastructure components and to aid in the development of new skills for next-generation science and engineering research, especially aspiring student researchers participating in emerging transdisciplinary domains. As the urgency grows to respond to the loss of local data and evolving federal data retention mandates, we plan to accelerate the CSEL transformation into a collaborative transdisciplinary research hub. Low-latency and high-availability network connections to the eRC will provide access to a fast, dedicated research network, and significantly improved connectivity to the campus high-performance computing facility, the Center for Advanced Research Computing (CAR-C). The eRC will house a campus interface to CAR-C as well as a new visualization lab, technology enabled collaboration environments, data assessment and analysis services, and large-format data display walls. These critical improvements will greatly enhance research and research training capabilities as well as stimulate the expanded use of CAR-C, resulting in new research collaborations and student engagement with all aspects of the data life cycle. Finally, we are actively involved in initiatives to insert the library and librarians more directly and deeply in faculty research and grant proposals by creating consultation spaces and services within the eRC, staffed by Faculty Research Support Officers (FRSOs) and supported by the Office of the Vice President for Research.

Methodology

Our environmental scan and fact finding activities included reviews of regional and national consortia based surveys, a facilitated campus retreat which engaged over forty science and engineering faculty members and administrators, and three student focus groups, preparation of a white paper describing the need for enhanced informatics training at UNM for the Vice President for Research, and active participation in the UNM Research Collaboration Enhancement committee.

This year long process engaging faculty, students and library personnel led to the development of a new mission and program plan for the Centennial Science and Engineering Library (CSEL) that will profoundly re-purpose it to serve the critical need for facilitating and supporting the key aspects of e-research described previously. The proposal and plan is now a working document moving steadily upward on the priority list for UNM capital projects.

The Alliance for Information Science & Technology Innovation Summit informed our broader perspectives [van Reenen, et al, 2008]. Common themes emerged from the question posed to a sophisticated group of digital data experts and leaders "what keeps you up at night":
- Reinventing librarians and libraries to meet the challenge (people)

- Data ownership
- The size of the challenge of managing digital data/information
- The urgency of the challenge
- The mechanics of curation: identifying, tracking, warehousing and preserving data over the long-term.

Common themes coming from the question "What excites you?" were:
- The great promise of cyber infrastructure-based research
- The opportunities for building partnerships
- The opportunities to curate digital information that support new science
- The challenges of change presented by asking the question if we are inventing a library today, what would the model be?

The Greater Western Library Association's (GWLA) Institutional Repository Taskforce survey asked questions regarding members data curation plans revealing the state described below.
"The role of academic libraries in data management is not clear and should be explored and acted on before other intermediaries claim this field. The survey results indicated that 32% of responding libraries are involved with data warehousing and/or curation at the level of gathering information and building understanding, 25% are at the planning stage, and 14% reported involvement at the regional or national level. 50% reported that their organization had policies for data warehousing. It is unclear what this means as only four reported the campus IT and two the Office of Research as being responsible for such policies, the rest did not know who was. Only one organization of the six reporting knowledge of such policies could identify who monitors compliance and reporting processes. The same organization reported on a university-wide information management plan (in which the library is a stakeholder and that included data management) that is under development. We conclude from the above that data curation and warehousing is not clearly defined and understood, nor are significant efforts underway at individual responding organizations to involve the library as a leader in e-science on campus." [GWLA Institutional Repository Taskforce, 2008].

Essentially, only one of 32 GWLA universities had a data management plan in 2008. On further questioning it was clear that "policies for data warehousing" referred to enterprise data not research data. Clearly, we need to respond quickly and decisively to the challenges posed above before others do it for or to us or demand it from us.

Through our focus groups and retreats students, faculty, and staff on the leading edge of these changes both technically and culturally identified a series of specific physical measures that would bring the CSEL more in line with the needs of today and the future. These include:
- An area that brings together all the digital tools they use in their studies
- Updating of the building interior which, after many years, has become "dismal" and "dated"
- The creation of facilities to make possible the hosting of interdisciplinary programs
- Opportunities to showcase leading edge technology including gaming, trade shows, large scale visualization
- Renovations undertaken using energy efficient and "green" materials leading to a sustainable facility
No such venue currently exists for UNM's science and engineering faculty and students.

A facility as envisioned above would not only support the academic and institutional mission but would also provide a useful tool for recruitment and retention of undergraduates, graduates and faculty. More specific suggestions included:
- Venues for small to large group presentations
- Spaces that open for "walk-up" participation
- Flexible and easily reconfigurable furnishings and spaces
- An environment that provides opportunities for serendipitous discovery, interactions, and learning

Planning Outcomes

Spaces

Informed by our environmental scanning, survey reviews, and local focused idea generation processes it was evident that there have been major changes in science and engineering technology and related methods of research and teaching. This is seen most dramatically in the shift to the production, storage and dissemination of data and digital media. Further, the transdisciplinary nature of modern science and engineering research and teaching require a natural nexus for the collection, manipulation and dissemination of this data. We believe a re-focused and transformed science and engineering library should be this nexus at UNM as it provides "neutral ground" where multiple disciplines can be brought together in a collaborative manner to answer the challenge of complex research ideas and engage students in exploratory projects.

One approach we have incorporated into our planning document is based on the concept of public spaces as "street theatre". This is a form of theatrical performance and presentation in public spaces without a specific paying audience. These spaces can be anywhere. They are especially seen in spaces where large numbers of people congregate. One of the most interesting points about modern street theatre is its unique sociopolitical place. People who might not have ever been to, or been able to afford to go to, the "legitimate" theatre can watch a street show. By virtue of where the shows take place, their audience is made up of anyone and everyone who wants to watch. Suggestions along these lines made their way into the plan in that some activities can be encouraged to take place in the public spaces; others are facilitated by creating a sense of community by providing visual access through glass walls. Additional areas will invite voluntary participation such as seating facing a large scale data display/visualization wall.

The concept stimulates curiosity by offering easy access to a wide variety of science and engineering disciplines in a concentrated area and supported by a flexible and renewable-by-design technological backbone. It is a place for focused effort as well as a place to browse a wide variety of ideas and tools. Electronic collaboration as well as physical collaboration systems and spaces are under development.

To date, the renovation plan has moved forward by significantly weeding print collections, combining the reference and circulation service points, updating some furniture, creating the consultation spaces and services within the eRC, staffed with new positions and supported by the Office of the Vice President Research, and providing the on-campus front door for the CAR-C. The visualization lab and data wall are still under development with a significant fundraising effort underway.

Connectivity

The eRC proposes to achieve full-scale connectivity for eResearch labs in CSEL to serve as the central hub for services and access to a dedicated high speed research network. Our fundraising will accelerate its revitalization as a technologically-advanced collaborative transdisciplinary research hub*,* by extending low-latency and high-availability network connections to the eRC, providing access to a fast, dedicated research network and significantly improved connectivity to CAR-C and implementing infrastructure upgrades in support of the eRC and CAR-C's advanced visualization equipment, collaborative environments, and large-format data displays.
The Library submitted several collaborative grants in support of the eRC efforts:
- NSF ARI-R²: Academic Research Infrastructure Improvements for the Centennial Science and Engineering Library that will create a direct connection to the Albuquerque GigaPop and be the basis for a dedicated research network
- NSF: Stimulating innovation in cross-disciplinary women studies research through cyber-enabled data management and informatics research systems.
- NSF: Karst Wikinomics: Communicating Science from Subterranean investigations through Image Data Mining
- A proposal for joint development of a visualization system and data wall to an international high tech supplier with local offices.

Collaborations and support

The UL has taken active steps to challenge a culture that constrains librarians to information delivery roles. Newly defined faculty librarians with new skills and toolkits will:
- Prepare scientists for long term openness in regards to their unpublished data
- Achieve good working relationships with shared values that encourage scholarship, grant writing and collaboration between librarians and scientists
- Challenge ourselves to move out of the library into the research process
- Educate scientists to think of librarians in an expanded role as informationists
- Create neutral electronic collaborative spaces where scholars can make connections between disciplines and view librarians as part of the team

Activities to date include participation in developing a white paper "Informatics at UNM", leading a committee on "Research Collaboration Enhancement", serving on Limited Grant Competition Review committees, co-developing a research expertise system to meet the needs of the OVPR and the Library (ScholarGuides), creating a partnership with the Center for Advanced Research Computing, active participation in e-science related grant writing, developing an e-research lecture series, hiring a Director for e-Science for the UL, and creating a staffing plan that will bring new skill sets and attitudes to the eRC. We are also strengthening our already close connections and joint projects with the Earth Data Analysis Center and the Long-term Ecological Research Network both with headquarters at UNM.
Informatics teaching and research data support:

"When making the case for preservation, make the case for use." [Berman and Lavoie, 2010].

The Office of the VP for Research, in collaboration with the UL and others throughout the country, successfully competed for a NSF DataNet grant, called DataOne. William Michener is the PI and recently named the Director for e-Science at the UL. To realize the service model envisioned for the eRC and UL, an aggressive recruitment is underway for five new librarians who will bring skills in data management and informatics training to UNM. They will work in the following areas: data visualization, spatial data management; and Geographic Information Systems; data intensive research support systems; data life cycle management; and outreach with emphasis on data support within the humanities and social sciences. They will work in tandem with the five Faculty Research Support Officers (FRSOs) hired by the Office of Research to immerse the group into research outreach and enhance laboratory and research processes of various sorts and, hopefully, increased grant writing and success.

In the area of teaching we are working on two initiatives:
- An e-Research Lecture Series to make the case for data management and research informed by informatics tools and resources. Speakers thus far have been Malcolm Atkinson and David de Roure during their visit to the US, Herbert van de Sompel on Memento, and Rajan Gupta on the Global Energy Observatory.
- Approval to offer credit courses with an overall plan to start teaching foundation courses in discipline based informatics, create new certificate programs, and offer a Summer School in Environmental Informatics in 2011.

In support of data life cycle management, the UL has made arrangements for our new librarians to spend a week each in four lab environments (nano-chemistry lab, geomicrobiology and karst studies lab, physics and astronomy data lab, and a neuropsychology lab). The findings from the combined three months of lab observation as well as their increased understanding of the existing data management systems and challenges, will inform the first phase of a UL led data life cycle support system. Additionally, the UL has taken the lead in creating a UNM Research Data Storage Consortium with partners whose large data creation and consumption activities will bring together existing storage and practices to realize efficiencies and create momentum for a more focused development of UNM's research data storage capacity.

Our initial focus will be on smaller datasets and data from local interactive collaborative research environments.

Conclusion

The need to renovate an aging Science and Engineering Library, coupled with exciting new opportunities to address needs in the areas of data management, support for e-research, and provide informatics training have culminated in a reinvigorated role for the University Libraries. The challenges of transforming the physical spaces as well as the skills and roles of UL faculty and staff as described in this paper are both underway and evolving. The approach taken, involving stakeholders early in the planning process while simultaneously building our capacity to deliver services by collaborating to create completely new positions, has provided the energy and enthusiasm needed to evolve this new model of service.

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