



Environmental Scan 2015

By the ACRL Research Planning and Review Committee

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ACRL ENVIRONMENTAL SCAN

Introduction and Methodology

The 2015 Environmental Scan of Academic Libraries is the product of ACRL's Research Planning and Review Committee. In 2014 the committee produced the "[Top Trends in Academic Libraries](#)," published in *College and Research Libraries News* (Middleton et al. 2014). The Environmental Scan expands and broadens that document. Although broader than the "Top Trends," the environmental scan provides an overview of the current environment for academic libraries rather than an exhaustive examination. The current scan addresses topics related to higher education in general and their resulting impact on library collections and access, research data services, discovery services, library facilities, scholarly communication, and the library's influence on student success.

Higher Education Environment

In a time of growing economic inequality in the United States, there is a heightened focus on social mobility and general well-being. As educational completion correlates with income level, the affordability of higher education has become a frequent topic in the media. Rising student debt has led to increased scrutiny of higher education costs and outcomes. In December 2014, the Obama administration released the framework for a college ratings plan that would link federal funding to a number of performance metrics such as a college's average net price, its students' completion rates, the percentage of its students receiving Pell Grants, labor-market outcomes, and loan-repayment rates.

Many colleges and universities also rely on student tuition to fund most of their operating budgets at a time when net student revenues are declining. Most public institutions are experiencing large cuts in state support and more government oversight. Many community colleges find themselves unable to meet student demand for more affordable educational degree paths.

Research funding levels have decreased, leading to an increasingly competitive environment for research institutions (Bidwell 2013). At the same time, data-intensive research is necessitating new requirements for related infrastructure and data management services, and the federal government has issued open access mandates for federally funded scientific research. Federal agencies have submitted and are currently revising release plans to comply with the February 2013 White House Office of Science and Technology Policy [directive](#) (Holdren 2013).

Technology is advancing new delivery models in higher education. The for-profit sector and open education models offer convenient alternatives to traditional place-based programs. Massive Open Online Courses (MOOCs) and competency-based education

(CBE) models represent such market-based alternatives. Online learning is an attractive option for adult learners, a demographic that has been the focus of many large for-profit institutions; these students can complete degree programs and other credentials at a self-determined pace and a lower cost (Hurst 2013). Technology allows students, faculty, and staff to collaborate, teach, and learn at a level that strains existing infrastructures and service models. The current environment “offers new ways to connect things that were previously considered disparate and ‘un-connectable’: people, resources, experiences, diverse content, and communities, as well as experts and novices, formal and informal modes, mentors and advisors” (Abel, Brown, Suess 2013).

Library Collections & Acquisitions

General Overview

Libraries are reassessing their collection practices and strategies and developing a more holistic approach to collections, particularly in light of emerging diversification of the scholarly record (e.g., learning materials/objects, open access materials, freely available digital resources, etc.). To address this new diversification, Dempsey, Malpas and Lavoie (2014) offer a useful matrix based on stewardship, scarcity, and uniqueness of resources that may provide some guidance for collection managers. The authors elaborate on the consequences and implications of “outside-in” (information provided by external vendors and licensed by the library) and “inside-out” resources (locally created resources such as digitized collections, learning objects, etc.) for stewardship/preservation, infrastructure, collaboration, and internal and external workflows.

E-Books—Still in Flux

The e-book market remains in flux, with most publishers offering options directly and through aggregators, providing both subject packages and individual firm ordering through book vendors. Of particular note is the significant success of university press partnerships with well-esteemed academic portals such as Project MUSE and JSTOR. Digital rights management (DRM) continues to be a challenge for managing and using e-books (in particular for reserves and interlibrary lending/borrowing), with restrictions on printing, downloading, and re-use of content. Some of these DRM issues—as noted further below—have been eliminated through the direct delivery of content by individual publishers, or through third parties who have negotiated extensively with these publishers. Some print-on-demand services do exist from publishers such as Springer, which allows for printing entire e-books rather than just individual chapters.

Much of the discussion about e-books centers on the role of the print codex (monograph) in scholarly communication and whether or not it will retain a revered status in the academic ecosystem. As Schonfield (2013) notes in his provocative Ithaka S+R article, [Stop the Presses](#), the enhancements made possible in the digital format have not come to complete fruition or acceptance. A number of studies have shown that e-books and print

books can serve very different purposes for researchers and patrons, whether for basic searching or for actual reading (Rod-Welch et al. 2013; Staiger 2012; Li et al. 2011).

Although there continue to be predictions of bookless libraries (with books no more than aesthetic decoration), only a few high-profile examples have emerged. According to a recent [*Ithaka S+R US Library Report*](#) (Long & Schonfeld 2014), the transition to e-books has not been as smooth as earlier predicted. For example, most library directors report that large-scale acquisition of e-books has not led to large-scale de-accession of print materials. Another [*Ithaka S+R Report*](#) focused on faculty (Housewright et al 2013) provided evidence that most faculty are still wary of an e-only monograph future. Even for the sciences, only around 15% of faculty surveyed responded favorably to the statement that within the next five years “it will not be necessary to maintain library collections of hard-copy books.” Rather, faculty indicated that print titles (particularly low-use titles) were more likely to move to a storage facility. With that said, only around 20-25% of library directors still consider the acquisition of print books as a means to build research collections a high priority. Some collection managers have addressed e-book growth by establishing and expanding e-approval plans, which are no longer reserved for STEM publications. Even with e-book approvals, though, significant percentages of titles are still received in print within profiled call number ranges.

A confounding issue in e-book acquisition and management centers upon the lending of e-books across institutions. Most electronic monograph licenses remain relatively restrictive on the sharing of e-book content, thereby practically challenging the first sale doctrine upon which ILL operations rely. A new pilot between Springer Verlag, Texas Tech University, the Greater Western Library Alliance (GWLA) and the University Hawai’i at Manoa provides a new option for sharing such e-book content. A new software program/interface, Occam’s Reader, which functions as an add-on to the widely used ILLIAD lending software, is currently being tested (Anderson 2014).

Streaming Media/Video

An increasing number of libraries have been subscribing to streaming video and audio services (e.g., Kanopy, Alexander Street Press, Naxos) to meet faculty and student demand for said resources. Some libraries have also adopted demand-driven acquisitions to streaming services in which number of uses (i.e., views/listens) can trigger the purchase of a streaming license for a particular work. Kanopy has been the notable model for such a service. Streaming services have definite consequences for technical services (e.g., licensing of public performance rights), systems workflows (e.g., ensuring compatibility with EZ Proxy servers), and access and discovery (e.g., availability of MARC records). DRM restrictions on re-use for teaching and research (e.g., clip-making, Reserves use), ownership of perpetual streaming rights by libraries, and increased need for bandwidth are all issues at the forefront of this streaming audio and video surge.

Implications

- Libraries should continue to work with vendors and each other to better manage the sharing and preservation of e-book content.
- Libraries will need to continue to manage a hybrid e- and print monograph world for some time to come, balancing user needs and preferences, space issues, and access.
- Streaming AV has its own set of challenges that are currently in a state of discussion and negotiation between libraries and vendors.

Demand Driven Acquisition

E-Book Data Driven Acquisition (DDA) and Patron Driven Acquisition (PDA) pilots have now reached a level of maturity and have become an integral part of collection development and acquisition workflow within many academic libraries and consortia. In light of this significant shift and adoption, NISO has recently unveiled a set of recommended practices for [DDA implementation](#) (NISO 2014b). Although focused primarily on e-books, the standards are also applicable to print DDA initiatives, which have been tried out at several academic institutions in the form of using Open Worldcat as the primary discovery layer for patrons or using print-on-demand bookmakers. Vendors such as Springer already allow for print-on-demand services, but these require purchasing specific e-book collections as a whole. DDA models have rendered many cost-savings and have been at the forefront of the strategic shift between real-time collection building and long-term collection building.

Although DDA models have had significant impacts on library collection budgets, there are indeed questions as to the sustainability of these models, particularly in light of recent increases in short-term loan price increases from various publishers (some of which have reached an increase of over 100%). Some publishers, such as Wiley and Palgrave, have been marketing a new model known as “evidence-based collections” in which subscribers pay an agreed-upon, upfront fee to access all e-titles in the publisher’s collection (or a subset thereof) for a year. The library can then choose which titles to add to its permanent collection, but must purchase an agreed-upon minimum threshold. A key implication of these new publisher models is that they act more as subscriptions, whereas DDA models follow a more traditional monograph acquisition model and do not require an upfront fee or purchase threshold (except for record loading). The potential benefit of these publisher-directed models is the less stringent (or absent) DRM. Potential issues, however, center on assessment of collection use. In other words, how many uses lead to an addition to the catalog? Is a PDF download of one chapter or a simple browse on the landing page enough to merit inclusion?

Implications

- Libraries should evaluate their ongoing, established DDA programs carefully and ask for detailed usage statistics to perform such assessments.

- New publisher models of patron-based acquisition such as evidence-based models are still relatively new, and need to be carefully assessed.

Textbook/Course-Adopted Readings and Libraries

Textbook affordability and course reading support continue to be substantial areas of discussion among librarians (Demas 2014), with numerous initiatives being piloted. Several states have addressed textbook costs through legislation, as has the federal government, requiring students to have access to title lists prior to class enrollment. The role of libraries in textbook support and acquisition continues to be in flux. Libraries have begun promoting open educational resources (OERs) through direct grants as a means to address rising costs. Other institutions have begun to focus on course-adopted readings, rather than traditional textbooks, and promote e-collections as a means to better meet patron demands for these high-use materials (e.g., University of North Carolina-Greensboro pilot). Another approach has been to purchase textbooks for certain fields and place them on reserve—using either existing collection dollars or special funds.

Implication

- Libraries can play an important role in providing more access to textbook and course-adopted texts (particularly with e-books), but need to take heed of and collaborate with the many internal university players in the textbook and course readings ecosystem.

Curating Collective Collections/Collaborative Print Management

Shared print repositories continue to be of great interest to academic libraries as a means to more efficiently manage and sustain legacy print collections, expand access, and create or repurpose existing physical space in individual libraries. A 2013 OCLC Report, “Understanding the Collective Collection” (Dempsey et al. 2013), accentuates the “shift from local provisioning of library collections and services to increased reliance on cooperative infrastructure, collective collections, shared technology platforms, and ‘above-the-institution’ management strategies” (OCLC 2013).

Memoranda of Understanding (MOUs) are becoming more common as a means to govern and structure decision making around shared/collective print collections, including guidelines on retention and last copies (Demas 2014, which builds upon Malpas 2009). Per a recent [ARL SPEC survey](#) (Crist and Stambaugh 2014), these collaborative relationships focus much more on shared management of retrospective collections than on prospective collaborative collection development or management. Although most participants in these collective arrangements are public or state universities, there is a move to more public-private partnerships (e.g., Emory and Georgia Tech; see Payne 2014). Relatively new consulting services such as Sustainable Collection Services (SCS) have also appeared to assist individual academic libraries with a data-driven methodology for de-selection.

Two new ARL Spec Kits [#337](#) (Britton and Renaud 2013) and the afore-mentioned [#345](#) (Crist and Stambaugh 2014), focus on print retention policies and shared and collaborative print initiatives across numerous institutions and consortia. They provide significant guidance in establishing infrastructure and addressing potential issues in print resource management, including communication strategies with relevant stakeholders. The ARL Spec Kit #337 on Print Retention Decision-Making “examines research libraries’ print retention decision making strategies related to storage of materials in three different types of facilities or circumstances: on-site, staff-only shelving; remote shelving; and collaborative retention agreements.” Spec Kit #345 on Shared Print Programs “explores the extent of ARL member libraries’ participation in shared print programs, the type and scope of programs in which they choose to participate, the rationale for participation, the value and benefits the programs provide to ARL and other libraries, and the roles different libraries are playing in them.” A particularly interesting section of the Shared Print Programs study focuses on shared print monographs and “future” services, i.e., potential leveraging of these retrospective collections in light of e-books and digitization. New possible services considered include coordinated digitization of shared collections, scan-on-demand services, metadata crosswalks between shared print and digital copies, and enhanced interlibrary lending networks.

Access to and discoverability of these shared collections is another issue that should be considered. How are users able to locate these collections in a seamless fashion? Several consortia and regional institutions are implementing or have already implemented joint/shared ILS to manage these shared holdings in both print and electronic formats.

Implication

- There should be a continued review of the collaborative and coordinated management and use of retrospective print collections and how to enhance services associated with these collections and their digital counterparts.

Collections Assessment

Collecting metrics on library collections has long been a source for evaluating the usage of the collections and their relevance to the academic programs they support. Metrics have also been used to reflect the size, ranking, and prestige of institutions. The current trend continues to focus on how collections help support the library’s alignment with the campus vision/mission/goals, and to what degree they contribute to research, student success, and other criteria.

Traditionally these metrics have focused on collections owned and managed by the library. As the library's curation role expands to e-research, data, open access scholarship, born-digital resources, and open education resources, the potential for tracking and assessing what is held in institutional repositories has raised some practical issues on what to measure and the need for standards for cross-institutional and global comparisons. In addition, further studies are being undertaken to assess how the increased

dissemination of scholarship might help advance research and increase institutional standing (Webometrics n.d.).

The development of altmetrics that measure the impact of new modes of scholarly communication (such as blogs, social media, institutional repositories, etc.) has led to new approaches in evaluating the importance of individual authors' works and has influenced the way library collections are both developed and evaluated. The new measures have also opened up opportunities for library staff to engage with researchers in the ongoing dialogue of how scholarly impact is measured and to participate with other stakeholders in developing standards ([NISO Altmetrics Initiative 2014](#)).

Implications

- Libraries will need to continue to track and assess the value of collections beyond the traditional boundaries to include new modes of scholarship.
- Libraries will need to engage with researchers on the impact of new modes of scholarship and new ways to measure this impact and its implications for collection development, management, and data curation.

Research Data Services

Responses to US Government and Funding Agencies' Policies

In 2013, the US Office of Science and Technology Policy (OSTP) released a memo for all its heads of executive departments and agencies with the subject heading of "[Increasing Access to the Results of Federally Funded Scientific Research](#)" (Holdren 2013). This policy required that the direct results of federally funded scientific research, including both peer-reviewed publications and scientific data in digital formats, be made available and useful to the public, industries, and scientific communities. Currently, all federal funding agencies with an annual budget of over \$100 million need to develop plans for sharing their funded research results, including providing public access to the data. Higher education and research communities as well as publishers are all working toward developing suitable dissemination platforms for these agencies to share future scientific results, but they are pursuing different paths. Academic libraries are participating in the [SHared Access Research Ecosystem](#) (SHARE) project (2014), while more than 100 publishers collectively supported the [Clearinghouse for the Open Research of the United States](#) (CHORUS) project (2014). It is still unknown which of these two possible solutions will ultimately serve federal agencies better, but the issue of data linkage will likely be a key differentiator.

The new OSTP policy recognizes the need to protect confidentiality and personal privacy while maximizing public access to digital research data. However, balancing the needs of privacy protection and scientific research autonomy will not be an easy task. For example, the US Department of Health and Human Services developed the Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule in 1996, which attempted to standardize procedures for protecting the privacy of personal health information while allowing for health data sharing and reuse. But according to an

Institute of Medicine study, the interpretation and implementation of HIPAA policy has been costly and has caused unintended negative impacts on health research in many ways (Nass, Levit, and Gostin 2009). The study calls for a new legal and regulatory framework to better protect privacy and facilitate responsible health research through such approaches as requiring the data provider to establish stronger security safeguards and implement legal sanctions to prohibit unauthorized re-identification of information after it has been de-identified. No matter how the new OSPT policy will handle similar technical, legal, and ethical issues of public data access, academic librarians, serving both the data creators and data users, will have more opportunities to provide valuable services beyond data management plan consultation (Goben and Salo 2013).

Implications

- The future of research data services of academic libraries will continue to be driven by larger academic factors and government policies, as well as even broader national development priorities and international competition and collaborations.
- Academic libraries need to pull together their human and intelligent resources and collaborate on developing state-of-the-art, cross-institutional digital platforms for disseminating scholarly projects in multiple formats.
- Academic libraries can leverage their expertise and experience in curation, preservation, and data management to support, educate, and facilitate government agencies that now need to make their data and information more publicly usable and accessible.

Understanding Researchers' Data Sharing and Management Practices

Broader and institutional-level policies and requirements that regulate and potentially change researchers' behaviors affect the everyday tangible practices of research data sharing, management, and preservation. Also important are research communities' norms, their awareness of available resources, and individual researchers' motivation to increase their researchers' visibility (Kim and Stanton 2012). Increasing numbers of scientists are beginning to reflect on their own data sharing abilities and challenges. Institutions are trying to identify researchers' real data needs and develop more targeted programs for research data services. Meanwhile, academic librarians have also conducted more survey and interview studies on large and small groups to identify researchers' current strategies of dealing with data.

Based on an international survey of over 1,000 scientists, one study found that, although most researchers realize the importance of data sharing and preservation, they are usually limited by time, budget, and information about currently available support and tools (Tenopir et al. 2011). Another international study of over 2,000 scientists, conducted by the publisher Wiley (Ferguson 2014), revealed the national and disciplinary differences in research data sharing and found that researchers are more willing to share if they can get full credit for sharing data and thus increase their overall impact within research communities.

From the scientists' perspectives (Marx 2012; Budin-Ljøsne et al. 2014), extensive technical challenges still arise when sharing data in a broader range of communities. Even sharing across consortia within the same disciplines is difficult, especially when reuse of data requires detailed information on research methods and software tools. Faced by these challenges, scientists are not motivated enough to invest in better solutions partly because not enough forms of recognition or ethical standards of sharing data have been developed.

Smaller scale studies of scientists or research communities have developed deeper dialogues between librarians and researchers and provided opportunities for librarians to introduce newly created data services to their users (Diekema et al. 2014; Williams 2013a). Librarians have learned that most researchers are not aware of libraries' various support services throughout the research data life cycle, and librarians have had to educate researchers about their expertise and knowledge in the relevant fields of research data.

Obvious gaps exist between the available resources and information and the researchers who need data management and shared support services. Therefore, libraries must still develop outreach and education efforts with an eye to innovation, and then implement new services, programs, or research projects. Detailed strategies might include, for example, a bibliographic study of academic publications to identify researchers to target with data curation services (Williams 2013b) or plans to take advantage of the end dates of funding life cycles, when researchers need to implement their data archiving plans (Nilsen et al. 2013). These ideas have been suggested to maximize buy-in for library data services.

Implications

- Disciplinary and methodology differences influence researchers' data collecting, analyzing, and sharing behaviors and thus require data services librarians to develop a deeper understanding of research processes, in order to provide suitable assistance within each research field.
- Increasing numbers of data management and curation services will be developed based on an evaluation of specific research programs' needs and practices.
- Innovative outreach strategies are needed for academic libraries to market their existing data services to users who are usually unaware of librarians' expertise and the available tools and resources.

Advances in Data Curation Services

As the [Data Curation Policy Working Group of OCLC](#) (Erway 2013) has pointed out, although academic libraries are still the main stewards of research data who care about the long-term preservation of this special asset, collaboration between campuses and even institutions is key to services' success. Collaboration with other campuses or institutional units, such as research and research compliance offices and, especially, research departments, could even enable a smaller and less research-intensive university to

successfully engage with faculty in data management education and curating research data for long-term preservation (Shorish 2012).

Academic library data curation services have developed beyond simple extensions of institutional repositories into more customized features while librarians work closely with researchers (Olendorf and Koch 2012; Miller et al. 2014). This can include collaborating with disciplinary repositories to maximize the visibility of otherwise hidden data held by individual researchers (Akers and Green 2014). Data curation quality control is currently a major challenge, and even institutional data repositories are inadequately performing the steps to evaluate deposited data, according to a comprehensive review article on the commitment to data quality among different types of data curators (Peer et al 2014). However, a clearly identifiable trend toward quality control is emerging. Workflow models and examples are being presented and shared within the data curation community to make data preservation more streamlined and accountable (Giarlo 2013; Hense and Quadt 2011; Johnston 2014a).

Research data curation requires broad, cross-disciplinary expertise as well as specific content knowledge in science, engineering, and data management (Mayernik et al. 2014). In support of this growing need, the Harvard-Smithsonian Center for Astrophysics John G. Wolbach Library and the Harvard Library have developed Data Scientist Training for Librarians or DST4L (alibibl.io/dst4l/), an experimental course to train and retool librarians to respond to the growing data needs of their communities.

A recent study analyzing placement rates revealed that applicable knowledge and hands-on experience strongly influence whether graduates from curation programs are able to get jobs in either libraries or industries. Continuing education programs allow data curators to update and further develop their skills while working in their current positions, given the new challenges facing them within the changing landscape of data curation (Palmer et al. 2014).

Implications

- Data curation and preservation will require more collaborative efforts between multiple campuses and institutional units, and academic libraries could be the initiators and coordinators of policy development and program design.
- Customizing features according to specific research communities' needs and implementing reliable measures for data quality review and control will need a further understanding of research processes and deeper engagement with researchers.
- Preparation of the data curation workforce requires both formal library school training and continuing education programs, and the skills and knowledge taught need to be practical and to cover science, engineering, and data management domains.

Data Information Literacy: National and Regional Projects

Data services librarians have been advocating data literacy as an essential aspect of information literacy for a long time. This was recently synthesized on a theoretical level

into a detailed list of core content and competencies for articulated data literacy instruction, including additional newly identified competencies in data management (Prado and Marzal 2013). Data librarians in academic libraries are exhibiting more collaborative and collective efforts for instruction on data information literacy: gathering user information, engaging in conversations across institutions and disciplines, and developing and sharing instructional materials, pedagogical strategies, and practical experiences.

The Institute of Museum and Library Services funded a successful multi-institutional data information literacy project in 2013. The project counted on the participation of data services librarians and subject specialists in different research departments and laboratories from multiple institutions, including Purdue University, University of Minnesota, University of Oregon, and Cornell University. Faculty and graduate students' needs were assessed using a standardized measurement instrument, and different instruction delivery approaches were shared in timely publications (Carlson et al. 2013; Carlson et al. 2014) and at a symposium (Data Information Literacy 2013a, b) where academic librarians from across the nation gathered together to learn about each other's experiences and to discuss further steps.

Another noteworthy multi-institutional data information literacy program is the New England Collaborative Data Management Curriculum (NECDMC) project (2015), with participants currently from Countway Library of Medicine, University of Massachusetts Medical School, and Tufts University's Marine Biological Laboratory and Woods Hole Oceanographic Institution Library. This project has developed a series of instructional modules for teaching best practices in data management based on the *Frameworks for a Data Management Curriculum* (Martin et al 2012), which can be adopted and customized for different contexts. The project's participants are also collecting actual cases in research data management from many different disciplines to be used for instruction.

Implications

- Data information literacy has been recognized as an important component of general information literacy competencies for higher education. Data librarians need to join more actively in dialogues about information literacy, learn from newly developed pedagogical strategies, and contribute based on their special perspectives as well.
- Data librarians or subject librarians who are assigned to, or interested in, data information literacy instruction or data management practices training could benefit from existing collaborative national and regional data services program models and curriculum materials, to customize their own efforts within local contexts.

Data Management Services: New Specialties for Subject Librarians

Newly hired data services librarians need to work with subject specialists to provide subject-specific data management services. Many times, academic libraries merely add additional data management responsibilities to existing subject librarians' duties, rather than hiring new data specialists. In either case, subject librarians or liaisons with schools

and departments are facing this new challenge and opportunity to acquire new skills and knowledge related to data management.

In many disciplinary fields, such as science, business, and health, librarians are paying attention to this new professional demand and publishing studies on the meaning and relevance of data management in their specific fields. Digital humanities also provide an area where libraries can offer support through data management services. Adams and Gunn (2013) note that data services departments “are appearing at many academic libraries as more administrators, researchers and librarians see the possibilities for data use in the humanities as well as in the sciences.” This includes the resources to equip themselves with necessary skills so that they can quickly adapt to change (Elmore and Jefferson 2014; Creamer et al 2014; Tenopir et al. 2013).

Researchers have surveyed academic librarians’ perceptions and attitudes toward this currently emerging role and discovered some important differences between librarians and academic library administrators (Tenopir et al. 2013; Tenopir et al. 2014). As librarians are expected to take on a growing number of new responsibilities, such as support for research data management, they recognize gaps in their current store of skills and knowledge. Although administrators believe that they are providing sufficient training opportunities to bridge these gaps, librarians do not perceive this level of support from their institutions.

Implications

- New roles in supporting research—especially research data services—are emerging as new services within academic libraries. These growing opportunities to become further engaged in research processes are inspiring visionary library administrators to reprioritize library functions and even reorganize their libraries’ structure to align with these new needs and potential areas of innovation.
- More collaboration among different units of academic libraries will become increasingly common and important in carrying out complicated research support projects, for example, those that involve data discovery, collection, documentation, management, and curation. Innovative on-site professional development opportunities, such as cross-departmental dialogues, observations, and demonstrations, will be valuable in developing new collaborative networks and relationships among librarians from different units.
- Professional development opportunities need to be created for all librarians, which are not limited to support for attending conferences and short, one-time knowledge updates. These also should include providing release time and financial support for librarians to enroll in continuing education programs and to obtain certificates in new specializations.

Discovery Services

Many libraries have implemented discovery layer services designed to deliver unified results across resource and collection types. The configuration and local enhancement/customization of a discovery service enhances the user experience and encompasses the library's print, media, electronic resource, library services, library staff and expertise, and resource guides. Enhanced discovery requires library staff with systems thinking and web development skill sets.

Shared integrated Library Systems (ILS)/Resource Management Systems (RMS)

Academic libraries continue to explore ways to provide access to information in the broadest way possible through discovery services. There is also increased interest in shared integrated library systems (ILS) and resource management systems (RMS) that provide behind-the-scenes infrastructure to coordinate the holdings of large consortia or multi-campus systems (e.g. Orbis-Cascade, Illinois Heartland Library System) (Breeding 2015).

To meet user expectations and preferences, interface design is increasingly modeled after the discovery interfaces in the commercial sector. For example, Google's search engine has become so popular that many of these systems provide a similar search-box interface (with options for more advanced search features), and "recommender" systems and relevance rankings similar to Amazon. "Cloud systems" are increasingly replacing the traditional technical and storage infrastructure to run these systems.

Implications

- Advances in discovery systems and shared ILS/RMS systems are enabling multiple institutions to provide broad user access to library collections and to provide the back-end infrastructure that supports these partnerships.
- Libraries should continue to consider users expectations and information-seeking behaviors in developing or selecting discovery systems.

Collaborations

Large, multi-institutional collaborations focused on digital collections or technology infrastructure have also changed the face of discovery services. Projects such as the Digital Project Library of America join the ranks of other large portal sites like Europeana to provide users with access to diverse research holdings from numerous institutions. The partnership between Library of Congress and Twitter to archive and provide access to the world's tweets is one of the large-scale projects addressing the preservation of and access to new modes of communication. The Committee on

Coherence at Scale sponsored by CLIR and Vanderbilt University has been formed to analyze national-scale digital projects that help transform higher education.

What sets many initiatives apart from the previous generation of library projects is the focus on designing platforms to support the sharing of code and the creation of added-value services by the community, such as APIs that support development of apps and other tools (Experian 2013).

As the number of self-contained portals, repositories, and online catalogs continues to grow, libraries want to create seamless discovery environments and service layers to help researchers search across all these information-rich silos. New developments include open source discovery applications that enable users to search across catalogs, repositories, and digital libraries and view a range of materials and formats (books, manuscripts, images, ETDs, e-journals, etc.) without the disparate information silos having to merge their infrastructures behind the scenes.

Implication

- Libraries will continue to address users' needs by providing broad access to collections via portals, exploring the benefits of large-scale collaborations for digitization, and adding service layers that facilitate searching, discovery, and manipulation of the content they find.

User-driven Research: Linked Data, Data Mining, & Analytical Tools

Linked data is about making connections between related data using the semantic web. As libraries increasingly use Resource Description Framework (RDF), Uniform Resource Identifiers (URI), World Wide Web Consortium (W3C) standards, and other best practices in the management of data, researchers benefit from the ability to more easily discover data. What makes this so exciting is that it empowers researchers to make new connections between related data and facilitates the creation of new knowledge (Lampert and Southwick 2014; Krafft and Corson-Rikert 2014).

User-driven research is also being supported through platforms that support data mining. For example, the HathiTrust Research Center provides computational access to researchers for non-profit and educational use of the HT corpus of works in the HathiTrust Digital Library. Libraries frequently support text and data mining via vendor-digitized collections.

Additionally, various analytical tools have been developed—such as the Google Books N-Gram Viewer, Voyant Tools, and Raw—to help researchers perform textual analysis and create visualizations of data in ways that contribute to new insights (Kerr 2014; Varner 2014).

Implications

- Libraries have the opportunity to empower users by providing rich and deep content platforms with tools that facilitate discovery and analysis, which ultimately enables

them to make information connections that contribute to the creation of new knowledge.

- In support of non-consumptive scholarly research, libraries, in collaboration with content vendors, should explore options for providing data mining functionality in aggregated databases.

Library Facilities

The Ithaka S&R US Library Survey 2013, mentioned earlier in this report, also highlights the recognition of the library as a place important to the university and to student success. In this survey of library directors, “providing a space for student collaboration” (Long & Schonfeld 33) was a high priority for nearly 90% of baccalaureate, master’s and doctoral level institutions. Current discussions of library facilities focus heavily on student success services and the library as an academic or learning commons. Holmgren and Spencer (2014) present the results of discussions of Chief Information Officers’s workshop sponsored by the Council on Library and Information Resources (CLIR). They conclude that “by 2024, many library buildings will have been transformed into an academic commons whose primary role is to host academic support services while also providing space for what remains of the library’s physical collection”.

As library spaces are re-envisioned for this new role, characteristics such as state of the art technology access and support, flexibility of the infrastructure and furnishings to meet current as well as future demands, accessibility for a wide variety of users, and environmental “friendliness” are essential in enabling the space to meet institutional goals. Library construction or remodeling project planning processes necessary in this environment require consultations and collaborations with stakeholders across the university. In his discussion of ways academic libraries are adapting for the future, Brad Lukanic (2014) identifies four key areas libraries must pay attention to: responding to strategic campus and business needs, providing technology in every aspect of service, embracing flexibility to meet current and future needs, and providing places for engagement.

Libraries are reaching across campus divisions to collaborate with student affairs and campus life personnel to develop integrated approaches and programming that foster holistic student success. Academic support services are co-locating with libraries to provide seamless services. Recently, new library buildings have been designed specifically for these purposes. For example, libraries at Seattle University and Grand Valley State University (Seattle University, n.d.; GVSU Libraries 2013-2015) include dedicated space for additional student success services like tutoring and writing centers and a variety of physical spaces and media production facilities. In addition to providing collaboration spaces, the GVSU library also made provision for quiet study spaces (GVSU Libraries 2013-2015). New library buildings and furnishings are designed with flexibility for the future in mind.

Pedagogical and curricular changes are leading library planners to include technology-enhanced learning spaces in both reconfigurations and newly built facilities. Spaces are being designed to allow users to engage with a range of technologies that support

multiple modes of teaching and learning, including collaborative and individual work in support of emerging high-impact practices. Many libraries offer multimedia production facilities and lend technology tools that support media-enriched content creation.

Digital scholarship centers as described by Lippincott, Hemmasi and Lewis (June 2014) are increasingly found in academic institutions of all types and involve a variety of disciplines with the goal of co-locating expensive equipment, expertise, and services such as assistance with planning research projects, use of software, metadata, intellectual property issues and preservation. As the authors note, “[Digital scholarship] centers in their early stages are experimenting with various services and staffing models as they develop partnerships and engage with various researchers; even well-established centers frequently adjust their priorities and services as the nature of digital scholarship and those engaged with such work on campus evolves.” As a central location on campuses, libraries are an obvious place to house such centers.

Planning for and assessment of the outcomes and benefits of these new spaces is increasingly important. As services and collections in libraries evolve, a clear understanding of the institutional environment for teaching, learning and scholarship is necessary to ensure that library facilities continue to meet user expectations and priorities.

Implications

- As libraries are increasingly required to share their spaces with other campus offices, creativity will be required to envision ways to open up space for these constituencies while still providing the spaces needed for more traditional library services.
- Libraries at institutions where new buildings or major remodeling efforts are not possible will need to consider other ways to build these connections. Options include finding ways to decrease collection footprints in order to accommodate additional offices and spaces for new initiatives/technologies or to partner outside of the library facility.
- Expertise for support of these new dimensions and services will necessitate new roles for staff. Support for services not traditionally provided by the library require new skills such as training and support for increasingly sophisticated technologies: 3-D printers, visualization labs, or multimedia production.

3D Services, Makerspaces, and Technology Services

Another development influencing academic library buildings and facilities is the opportunity to provide a hub for cutting edge technologies that allow students to experience and make use of new technologies such as 3D printing and scanning, advanced multimedia production, and visualization facilities. Typically, these services are located in a specially designated area and may offer a variety of options or just one.

Mobile application development rooms offer students the opportunity to develop new mobile apps and test their product on a variety of devices. New libraries such as the Hunt Library (completed in 2013) at North Carolina State University (NCSU Libraries, no date) provide access to large-scale visualization techniques, a game lab, decision theaters, video and audio studios as well as a makerspace with a laser cutter and 3D printer.

“Makerspace” is a general term and can include a host of concepts ranging from hands-on arts to building a robot. These are fun and exciting times for libraries to be able to add value from a campus perspective. Students enjoy working collaboratively and testing out new technologies for free or a nominal fee, faculty embrace the new technologies offered at the library and imagine ways of incorporating library services into classroom curricula, and library administration can report on the increase use of the space, services and circulation. These new technology services place the library in the center of campus and increase its visibility and therefore its value. As more libraries explore these spaces, resources such as the LibraryMakerspace-L@lists.ufl.edu will become available for libraries wanting to initiate 3D services or to create a makerspace environment, tapping into the expertise and knowledge of library colleagues who are already offering such services.

Libraries are increasingly called upon to offer students the opportunity to be creative and innovative in a high tech environment. Libraries may provide technologies in the building or make them available for circulation. To make the best use of these services, internal library procedures and policies related to use, theft, or damage need to be created prior to beginning the service. Providing a 3D printer requires additional policies, guidelines, space considerations, staff workflows and training (Garcia et al.; Gonzalez and Bennett 2014; Moorefield-Lang 2014; Colegrove 2012).

These opportunities serve students but also pique the interest of faculty and researchers who then can develop course curricula and use the lab for assignments. Libraries may want to further develop these campus partnerships and be included on grants and other funding initiatives for the maintenance and purchase of new technologies.

Implication

- Establishment of technology-related services requires planning for continuous support and infrastructure, including: training for users, availability of staff with the requisite skill sets to support the services, availability of physical facilities with sufficient space and power, ongoing availability of resources to keep the services up-to-date as well as establishment of appropriate policies and guidelines.
- Additional expertise related to library and instructional technologies, media production, and other emerging technologies must link with institutional assessment and space planning in order to ensure library facilities meet user expectations into the future.

Scholarly Communication

Academic Library as Publisher

Publishing by academic libraries has steadily increased in the past few years. Hahn (2008) reports the results of a 2007 survey of ARL libraries. At the time of the survey, “44% of the 80 responding ARL member libraries reported they were delivering publishing services and another 21% were in the process of planning publishing service development.” A similar survey in late 2010 found interest had grown, with “approximately half (55%) of respondents indicated having, or being interested in, offering library publishing services …, with over three-quarters of ARLs being interested” (Mullins et al. 2012). The Library Publishing Coalition launched in 2014 as a member-supported institution devoted to research and support for library publishing. Its *Library Publishing Directory* (Lippincott 2015) reports on the publishing activity of 124 different academic libraries. Library publishing varies, from scholarly journals to monographs and technical reports, but journals lead the list. Hahn (2008) reported that ARL libraries were publishing 265 journals; Lippincott (2015) found that the 124 libraries in the Directory were publishing 432 campus-based journals and a further 195 journals for other institutions. Ninety-seven percent of the campus-based journals were open access. ACRL has just published an extensive guide to why, how, and what academic libraries publish: *Getting the Word Out: Academic Libraries as Scholarly Publishers* (Bonn & Furlough 2015).

Implications

- Libraries can support open access scholarship through publishing efforts.
- Libraries can build relationships with campus scholars and other campus units by acting as publishers.

Copyright Issues and Fair Use

As academic technology and scholarly communication practices continue to evolve, existing copyright law does not always reflect the new paradigm. In this environment, academic libraries rely on a set of best practices to guide the use of materials in a manner permissible under the fair use doctrine guidelines, including those specifically granted to educators. In support of standardizing practice and articulating current consensus on this subject, the Association of Research Libraries, the Center for Media and Social Impact (CMSI) at the American University School of Communication, and the Program on Information Justice and Intellectual Property published a “Code of Best Practices in Fair Use for Academic and Research Libraries” (Adler et al. 2012). CMSI has also released a “Statement of Best Practices in Fair Use of Orphan Works for Libraries and Archives” (Aufderheide et al. 2014). Many research libraries have staff with expertise in fair use, authors’ rights, and copyright laws.

Implication

- Rights management is a complex landscape in which to maneuver. Librarians can advise on best practices and the development of institutional policies.

Altmetrics

As scholarly communication increasingly takes place online, alternative metrics are emerging as a methodology to measure social media visibility and research impact via online engagement around scholarly output. An Altmetric score is based on the number of individuals mentioning the research, where the mentions occur, and how often the author of the mention references the research. This alternate view is an addition to the existing filters such as citation counting, the Impact Factor, and peer-review. In 2013, the Alfred P. Sloan Foundation awarded the National Information Standards Organization (NISO) a grant to explore, identify, and advance standards and/or best practices related these new assessment methods. NISO's [Alternative Assessment Metrics Initiative](#) will also explore potential assessment criteria for non-traditional research outputs such as data sets, visualizations, software, and other applications. Leading scholarly publishers are also working with altmetrics. In 2013, Wiley partnered with Altmetric to pilot alternative metrics across a number of its subscription and open access journals. A high percentage of the journals included in the trial received scores that demonstrated they were receiving attention and having an immediate impact. During the pilot, Wiley also polled website visitors: 65% felt the metrics were useful, 77% agreed that altmetrics enhanced the value of the journal article, and 50% agreed or strongly agreed that they were more likely to submit a paper to a journal that supports altmetrics (Warne 2014). As a result, Wiley now makes altmetrics available for their fully open access journals. Other scholarly publishers such as Elsevier and Sage also offer altmetrics information at the article level, including comments and shares made by readers via social media channels, blogs, newspapers, etc., in addition to its Altmetric Score and demographic data of these users.

Implications

- As the role and importance of repositories increases, academic librarians should develop workflows and consultation services to support the depositing of research in institutional, discipline, and agency repositories.
- As compliance requirements continue to evolve, academic librarians should take the lead in developing educational initiatives around open access and author rights.
- To enhance the discoverability of Open Access content, librarians should collaborate with major publishers to index Open Access journals.
- The increasing availability of open access journal content will impact local collection subscription decisions, as libraries continue to consider delivery/access vs. ownership/retention.
- Researchers will increasingly share their research via social media that best serve their network and include altmetric data in documenting the impact of this research.

Library Impact on Student Success

Academic libraries exist in a time of increased accountability as performance-based budgeting becomes a more common approach in higher education. The [Value of Academic Libraries](#) report (Oakleaf 2010) and a [report](#) detailing two widespread summits around the topic (Brown and Malenfant 2012) underscore the ongoing need to articulate and document libraries' impact on student learning and success. Recommendations from the summit report highlight the need for librarians to fully understand the importance of the library on multiple dimensions of student learning as well as to articulate and promote assessment competencies to document and communicate library impact. The study also recommends increased professional development for librarians in the design and implementation of strategically focused assessment activities, development of broader partnerships with higher education groups, and better use of existing ACRL resources on assessment.

Assessment in Action

To address these issues and recommendations, ACRL's [Assessment in Action](#) program, (conducted in partnership with the Association of Institutional Research and the Association of Public Land-grant Universities and with funding from the U.S. Institute of Museum and Library Services) is engaged in a multi-year project that fosters the development of effective approaches demonstrating the academic library's value to student learning and success (Association of College & Research Libraries 2014). ACRL recently released a [report](#) synthesizing project results from over 70 higher education institutions that participated in the first project cohort (Brown and Malenfant, 2015). The projects discussed in the report document positive relationships between the library and overall student learning and success. Studies investigated the effectiveness of a range of library services including library instruction, research and study spaces, use of instructional games, library use of social media, and instruction and services conducted in collaboration with other campus units.

The AiA teams employed a variety of assessment methodologies and tools, including surveys, rubrics, pre- and post-tests, interviews, and focus groups. The experiences of the AiA teams demonstrate that library assessment is most effective when it involves collaboration with other campus units, aligns with institutional goals, employs a mixed-methods approach, and when assessment is assigned to one or more librarians as part of their position responsibilities. In building a community of practice around assessment, the project reports serve as templates that can be adapted for use by academic libraries of all sizes.

Implication

- Given current trends in funding models and calls for accountability in higher education, librarians must develop the expertise to articulate and document the impact of libraries on student learning and success. Programs such as AiA provide resources and expertise for libraries of all types to explore methods for collaboration and assessment across the institution.

Teaching and Learning

Librarians are partnering with faculty development personnel to take advantage of acknowledged educational high impact practices. Collaborations involve more than one-time instruction, instead focusing on course redesign and application of active learning in research skill development. They also continue to experiment with alternative service models to support and enhance rapidly evolving user needs and preferences. Models include tiered services targeting distinct needs of undergraduate students, graduate students, faculty members, and researchers. Where resources allow, “personal” librarians are designated for first-year students to create initial connections and foster service awareness. Liaison librarians are assigned to academic departments, programs, and other initiatives to develop resources and services targeted to those specific audiences. Academic support services are co-locating within library facilities to provide seamless services, placing libraries at the heart of student learning. As the range of libraries’ services increases, the range of skills required becomes broader than those taught in traditional library degree programs. Libraries are beginning to utilize non-librarians whose skill sets match current opportunities and programmatic needs. These specialists may be instructional designers, assessment specialists, or scholars from other fields, all of whom participate in the provision of online instruction, website development, or specialized collection development and research services.

Housewright et al point out that, while librarians continue to see information literacy instruction as primarily their responsibility, “faculty members have a more mixed view of where this principal responsibility may reside.” (Housewright et al 2013). The [*ACRL Framework for Information Literacy for Higher Education*](#) (Association of College & Research Libraries 2015) asserts that “Librarians have a greater responsibility in identifying core ideas within their own knowledge domain that can extend learning for students, in creating a new cohesive curriculum for information literacy, and in collaborating more extensively with faculty.” The *Framework* expands the scope of skills and concepts necessary for students in the current information environment, including visual media, data, and social media. Because it is based on a cluster of interconnected core concepts, with flexible options for implementation, rather than on a set of standards, learning outcomes, or any prescriptive enumeration of skills, it provides opportunities for deeper collaborations with faculty. Librarians are actively embedded in academic courses, in-person or online, in order to gain insight into student and faculty needs, as well as partnering with faculty to develop innovative assignments that engage students in new ways. These collaborations inform the development of new services and resources in addition to highlighting the ways in which libraries contribute to the success of learning and teaching.

As more instructional content is housed in course management systems (CMS), librarians are included in class rosters, forum discussions, and chat sessions. Online course guides are also linked in CMS course sites, highlighting library resources and services that are relevant to the course and assignments. These guides are supplemented with video and interactive tutorials that supply just-in-time instructional practice, support, and student feedback. Some libraries are creating positions for information literacy design specialists and instructional technologies librarians who are responsible for developing

comprehensive suites of online learning tools and environments. As assessment of library websites and online course content continues to expand, the need for special skills in these areas grows.

Implications

- Pedagogical innovations such as flipped classrooms, gamification, or high impact educational practices provide librarians opportunities to engage with curriculum development and collaborate with faculty in new and productive ways.
- User experience (UX) and usability testing that informs the development of library resources will continue to be a growth area for academic librarians.

Competency-Based Education

Calls for access to higher education, reduced costs for degree completion, and options for students to demonstrate learning gained outside of the traditional degree path are leading to increased examination of competency-based education. In these models, credit is given for demonstrated mastery of content rather than accumulation of credit hours. A variety of models are being used to document students' learning; some link the competencies with credit hours, while others involve direct assessment of student learning independent of credit hours or other traditional metrics (Fain 2014). Competency-based assessment is also growing as institutions try to institute credit for prior learning for courses outside the scope of those traditionally given credit by examination or advanced placement.

Examples of institutions exploring the direct assessment approach to competency-based education include the University of Wisconsin system and College for America, a competency-based education program within Southern New Hampshire University. College for America, which was recognized by President Obama for its innovation, (Southern New Hampshire University, 2013) includes "digital fluency and information literacy" as one of nine key competency areas (College for America 2014 for an Associate of Arts in General Studies degree. The University of Wisconsin Flexible Option program (University of Wisconsin 2014) offers four degrees—one Associate of Arts and Sciences and three Bachelor of Science degrees—as well as three certificate programs (University of Wisconsin 2015).

Implications

- As institutions review curricula with competency-based education and credit for prior learning in mind, the library has an opportunity to address the need for information literacy skills as well as offer options for assessing these skills on behalf of the program.
- With higher education under increased scrutiny to demonstrate the value of a post-secondary degree, it is incumbent upon academic libraries and librarians to communicate the Library's value in relation to student and faculty recruitment, retention, and teaching and learning success.

Conclusion

The trends and issues outlined in this document highlight the rapidly changing environment in which libraries provide resources and services as well as the evolving roles for library staff. With higher education under increased scrutiny to demonstrate the value of a post-secondary degree, it is incumbent upon academic libraries and librarians to document and communicate the Library's value in supporting the core mission of the institution. Libraries increasingly have the opportunity to play a significant role in overall student success through collaborations across campus and in the assessment of student learning. The shifting landscape of scholarly communication, fluctuating publishing models, and focus on data management presents new opportunities for librarians to engage with researchers and publishers alike. Advances in technologies and a continued focus on the user experience present new expectations for the development, discovery and delivery of content and services in the virtual environment and in the library's physical spaces. While this environment can be viewed as challenging, it also presents opportunities for academic libraries to strategically support the core missions of colleges and universities.

Appendix A: ACRL Research Planning and Review Committee 2014-2015

Jeanne Davidson (Chair)

Head of Public Services

South Dakota State University

Wayne Bivens-Tatum

Philosophy and Religion Librarian

Princeton University

Marianne Buehler

Special Projects Librarian

University of Nevada Las Vegas

Ellen Carey

Librarian and Instructor

Santa Barbara City College

Lisabeth Chabot (Vice-chair)
College Librarian
Ithaca College

Michelle Leonard
Associate University Librarian
University of Florida

Chris Palazzolo, PhD
Head of Collections (Woodruff Library)
Emory University

Lorelei Tanji
University Librarian
University of California, Irvine

Minglu Wang
Data Services Librarian
Rutgers University - Newark

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