A Splendid Torch:
Learning and Teaching in Today's Academic Libraries

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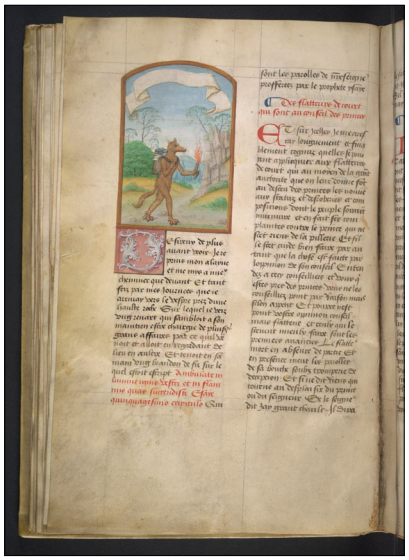
September 2017

Council on Library and Information Resources

ISBN 978-1-932326-58-1
CLIR Publication No. 174
Published by:

Council on Library and Information Resources
1707 L Street NW, Suite 650
Washington, DC 20036
Web site at http://www.clir.org



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Digitized through Digitizing Hidden Special Collections and Archives, a CLIR program generously supported by The Andrew W. Mellon Foundation.

Project: "Bibliotheca Philadelphiensis: Toward a Comprehensive Online Library of Medieval and Early Modern Manuscripts in PACSCL Libraries in Eastern Pennsylvania and Delaware"

Participants: Lehigh University, Linderman Library; Free Library of Philadelphia; University of Pennsylvania Libraries; Bryn Mawr College; College of Physicians of Philadelphia; Haverford College; Library Company of Philadelphia; Rosenbach Museum and Library; Swarthmore College; Temple University; University of Delaware; Chemical Heritage Foundation; Franklin & Marshall College; Villanova University; Philadelphia Museum of Art

For more images from the project, see #bibliophilly on Twitter.

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Foreword

Field Guide to a Revolution

The essays in this remarkable collection describe and exemplify some of the most important and vital contemporary reformations of our traditional concept of higher education: they cogently articulate the benefits, with specific case studies, of unwinding and redefining inherited social hierarchies, disciplinary boundaries, methods of knowledge organization, and the procedures of discovery in academia. The library becomes the instrument fomenting, abetting, and facilitating these changes, and in this role is profoundly enlivened. No longer a settled place for the curation and circulation of information, this library is now an extension of our cognitive processes, encompassing the creation, augmentation, and practical application of knowledge in teaching, learning, and research. These essays thus posit collectively a compelling introduction to twenty-first century interrelationships between matter and mind, and the complex conversations that reciprocity entails.

A major theme is the coordination and intermixing of the physical and the digital. This occurs in redesigning concrete spaces to better foster advanced learning and ways of knowing, and is obviously salient for the new methodologies of digital humanities. Information literacy and geo-spatial literacy are similarly enhanced through digital resources and tools. Intriguingly, this volume begins with architectural re-visioning of previous century library rooms to accommodate a more sophisticated cognition of acquiring knowledge and understanding through thought, experience, and the senses; the final essay describes a kind of apotheosis by reversing the typical sequence from analog to digital, examining pedagogical enrichment using 3D printing of objects from digital files. We come thematically full circle, with the materials described in these essays assuming a metaphorical significance that further underscores the power of transposition.

Core to these advances is the profound re-imagining of the traditional fences, professional roles, and general organizational principles that have informed our institutes of higher learning for centuries—persistent demarcations that slowly have become ghostlier. In these essays terms such as *collaboration*, *conversation*, *huddle*, *contact*, *customize*, and *choose* sit comfortably with *un-centered*, *informal*, *clarity*, *adaptability*, and *visibility*. Old disciplinary borders would make the discovery of a new antibiotic impossible; for that microbiologists, parasitologists, data scientists, historians, medievalists, and medicinal chemists are necessary to translate and reconstruct a 1,000-year-old

recipe for a salve. Teaching information and spatial literacy requires a collegial, level working field for librarians, faculty, and students. Machines become the extension of respected traditions of reading and interpreting books and maps, but only with the concerted contributions of librarians, data specialists, faculty, and those they are mentoring.

These projects and programs represent the fluorescence of communities of practice that unbox, refocus, and newly weave extraordinary talent that is mission driven and collectively strategic. Is this not a more welcoming academy and its poignant library, gracefully reflecting the potential and marvel of an open mind, a more sublime orchestration of instrument and voice in pursuit of understanding?

Charles Henry

About This Publication

John C. Maclachlan, Jodi Reeves Eyre, and Christa Williford

In the winter of 2015, a handful of current and former CLIR postdoctoral fellows gathered at a small restaurant in Washington, D.C., to celebrate publication of *The Process of Discovery: The CLIR Postdoctoral Fellowship Program and the Future of the Academy*. In typical CLIR fellowship alumni fashion, it took about an hour of relaxation before we began to look at one another and ask, "Now what?" Over fried pickles, barbecue brisket, and vegan spare ribs, we decided to recreate the Collaborative Writing Group (CWG) experience that fostered the collection of essays about what we had learned from our work in academic libraries.[1] The CWG process brings together individuals with unique backgrounds and ideas to explore a single theme.[2] Similarly, the CLIR Postdoctoral Fellowship Program brings together individuals with varied disciplinary backgrounds and points of view relating to research, teaching, and higher education to imagine an increasingly coherent and effective future for the libraries that nurture this work. With current and former fellows sharing the perspectives they have gained from working across the United States and Canada in a multitude of positions, the potential for crafting, improving, and challenging new ways of thinking about libraries and the academy is rich.[3]

With the methodology in place, the next logical question was, "What topic should we explore?" A common thread of inquiry was necessary to tie our unique identities together. The answer came rather quickly: teaching and learning.

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[1] For details, see Maclachlan, Waraksa, and Williford 2015, 1–3.

[2] For other examples of collaborative writing projects, see Healey, Marquis, and Vajoczki 2013; Maclachlan and Lee 2017.

[3] For statistics related to the positions fellows occupied from the program's inception through 2014, see Brodeur, Maclachlan, and Parrott 2015.

The definition of *the scholarship of teaching and learning* (SoTL) has been continually evolving since Boyer (1990) formalized the term *scholarship of teaching;* over time, it has incorporated learning with increasing frequency to describe more fully the interactivity inherent in formalized education (Simmons and Marquis 2017). Potter and Kustra have described SoTL as

> the systematic study of teaching and learning, using established or validated criteria of scholarship, to understand how teaching (beliefs, behaviours, attitudes, and values) can maximize learning, and/or develop a more accurate understanding of learning, resulting in products that are publicly shared for critique and use by an appropriate community. (2011, 2)

For this project, we sought to explore the contributions that today's academic libraries—as providers of resources, professional support, and space—are making to learning and teaching. While our scope might stretch the limits of what has traditionally been considered SoTL, the perspective our authors have gained from their work in academic libraries suggests that the real-time interaction between teachers and students, while vital to formal education, is just one part of a broader picture and that preparation, support, and suitable environments are equally essential to the success of both learners and teachers. CLIR fellows often find their careers situated at the nexus of teaching and learning, as the nature of the CLIR fellowship is often a hybrid role in which the fellow is expected to use disciplinary and pedagogical expertise to help improve the experiences of all users of academic libraries, students, and teachers alike (Waraksa 2015). An interdisciplinary fellowship cohort sharpens fellows' understanding of similarities and differences across diverse fields of study, making them increasingly aware of the many opportunities for librarians to work in partnership with other academic professionals to meet their evolving needs, especially the needs of adapting to and contributing effectively to an ever-changing networked information environment.

With the library a centralized collection of the expertise, information, and tools necessary to support learners and teachers, it becomes apparent that a consideration of the roles of academic libraries has the potential to advance SoTL conversations. At the same time, academic library communities stand to gain valuable insights by engaging more fully in these conversations; informing teaching and learning practices should be an ongoing part of the mission of academic libraries.

This volume explores how library spaces, services, and roles are changing in response to academic librarians' engagement with teachers and learners. Beginning with "Handing on the Splendid Torch," which considers three examples of how academic communities are adapting libraries as learning spaces, the volume brings together observations about aspects of libraries and librarianship that affect student learning and are also undergoing rapid change. "Creating Contact Zones in a 'Post-Truth' Era" reconsiders the challenge

of designing programs that develop student facility in information seeking and critical thinking in a way that is fully integrated with course curricula. "Exploring How and Why Digital Humanities Is Taught in Libraries" looks at several examples of library-based digital humanities research and research support initiatives, noting the affinities and tensions such initiatives have with the broader purposes of academic libraries. "Current Use and Prospective Future of the University Map Library" brings together viewpoints from multiple disciplines about the value of exposing students to maps and geographic information systems (GIS) data through academic libraries. "New Opportunities for Collaboration in the Age of Digital Special Collections" looks at the potential for deeper engagement of students and faculty with special collections and archives through digital libraries. Finally, the authors of "Shiny Things" provide a thorough overview of recent developments in 3D printing in order to examine the potential to integrate library-based "makerspaces" with curricula. Each chapter uses combinations of contemporary narratives and case studies to ground discussions in experience.

In crafting these chapters, the authors and editors used the collaborative writing framework to build consensus, test that consensus, and find examples of teaching and learning within academic libraries that best illustrate current practice. Each team of authors submitted drafts for an open peer-review process in the spring of 2017. As with the last volume, the process was invigorating, but the act of exploring together what for some of us was new intellectual territory came with moments of awkwardness, frustration, and humility. Collaborative writing is not always an efficient way of working; at the same time, the process mirrors the kind of sustained engagement among academic professionals that is required to re-envision academic libraries for the coming century.

As with any project of this scope there are numerous people involved. We are also indebted to CLIR sponsor institutions and colleagues, especially Charles Henry for his vision; Sharon Ivy Weiss for her help in securing resources; Alice Bishop for her continuous support, encouragement, and facilitation; and Kathlin Smith for her thoughtful comments and astute editorial guidance. All chapters in the volume were subject to an open peer-review process, and the editors would like to thank all of the colleagues who provided feedback on the chapters in this report, including members of the Digital Library Federation (DLF) Digital Library Pedagogy community, Adam Rabinowitz, Alyson Brown, Amanda L. Whitmire, Amy Chen, Andy Famiglietti, Anne Cong-Huye, Cherie van Putten, Curtis Kendrick, Daniel Traister, David Bowman, Jill Dixon, Joan L. Heath, Julia Glauberman, Kelly Miller, Koichi Tasa, Kristen Mapes, Lisa Baker, Lisa Hinchliffe, Lori Hughes, Louie Dean Valencia Garcia, Lydia Willoughby, Maysara Ghaith, Nicholas Riddick, Paige Morgan, Rebecca Lee, Sarah Huber, Sarah Naper, Timothy Norris, as well as anyone not listed here. Attempting to create a volume of papers with contributions from 24 authors within one year from the initial call to publication would seem to be an impossible task and would have

been if not for the collegiality and professionalism of the contributing authors. The editors would like to extend their heartfelt gratitude for the positivity and enthusiasm with which they approached this project. We thoroughly enjoyed working with everyone and sincerely hope that readers encounter the stories and ideas collected here with the same excitement we had while bringing them together.

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Handing on the Splendid Torch:
The Continuing Evolution of the Learning Commons

Martin Tsang, Tamsyn Mahoney-Steel, Jodi Reeves Eyre, and Christa Williford

In 2008 Andrew Dillon, Dean of the School of Information at the University of Texas at Austin, asserted that, while technology has been a major driver in the rapid evolution of academic libraries, "the real questions of interest are less the nature of these technological innovations … and more the social impacts and processes that have resulted" (51). For nearly a decade, many reports had speculated on the future of the academy, suggesting that an increasingly digital environment would result in significant changes in how universities and their libraries would operate (see, for example, National Research Council 2002). The reduction in physical collections and the combining of library and IT space were presented as likely scenarios.

Dillon asserted that the library is better viewed "as a complex socio-technical system that serves multiple stakeholders" (52) than as a physical place. From his vantage point a decade ago, library space renovation trends seemed disconnected from the acts of discovery required for learning and research:

> [M]any libraries clearly view their physical environments as social spaces for laptop-carrying, coffee-drinking learners, invoking terms like "commons" and "learning rooms" to convey the shift of emphasis from collection to user. All well and good, as this is bringing people to the space where their walk-in can be counted as a positive statistic. It is less clear, however, what impact this bringing of bodies to a room actually has on the delivery of information to enquiring minds when their first point of enquiry remains the Google box. As libraries become more concerned with creating social spaces, they should also be concerned with entering into the people space, the library as accelerator, where information is sought, communicated, shared, tagged, and mined. Without taking this second step, the library adds little value over a bookstore. (52)

While Dillon's assertion that the library has evolved into a "complex socio-technical system" rather than a mere physical space holds true, the past decade has shown that academic library space planning and renovations serve as opportunities for stakeholders to re-articulate their common goals as members of one learning community. Without taking advantage of such opportunities, we risk losing sight of what has, and what has not, changed about our libraries' purposes and functions within the academy.

This chapter considers three examples of how the social and procedural changes brought about by technology are affecting the design of contemporary library spaces, especially the "learning commons," a now prevalent term for reimagined library space. Rather than limiting our focus to formalized classroom teaching and learning spaces in academic libraries, we have chosen to consider the design of academic libraries holistically. To this end we will describe our own experiences of how changing social and academic processes, which have been impacted by technology, in turn influence the design of spaces.[1]

The design and arrangement of libraries can reflect the values and beliefs of the administrators, architects, donors, and librarians who plan them. With the passage of time, the designers' implicit worldview may either reinforce or conflict with the values, beliefs, and needs of new inhabitants of the space. Decisions to renovate academic library spaces are moments to re-examine these relationships and to reconcile past assumptions with current perspectives.

As the results of the 2014 ARL SPEC Kit survey titled *Next-Gen Learning Spaces* have shown, the physical arrangement of the vast majority of academic libraries has undergone significant changes in recent years (Brown et al. 2014, 21). Many survey respondents reported that the reorganization of library staff and the introduction of new services have been primary motivators for renovation. When asked to "describe what you envision as the role of next-gen learning spaces in the future of research libraries," respondents frequently emphasized how academic libraries had become "more than houses of books and other physical materials" (82). Overwhelmingly, the answers focus, in some way, on the human element—the various and changing requirements of the students, how their needs shape the environment and, in turn, how that environment can shape them. Several respondents emphasized that spaces needed to be designed with a flexibility that allows for multiple configurations and for future development. Informed by ground-breaking ethnographic and participatory design work undertaken over the past decade,

[1] The case study for the Albert B. Alkek Library at Texas State University is predominantly supported by information supplied by Joan Heath (associate vice president and university librarian), Lori Hughes (director, administrative services), and Sarah Naper (director of research & learning services) in response to questions asked of them in February and March 2017. Heath, Hughes, and Naper went over and beyond answering questions and supplying additional materials related to the redesign of the Albert B. Alkek Library; they also provided feedback on the case study that was essential to its accuracy. Their contribution to this paper is very much appreciated and any remaining inaccuracies are the fault of the authors.

academic librarians have been making these changes through intensive, systematic consultations with those who use the space rather than by relying solely upon the singular visions of library directors, donors, or architects (Duke and Asher 2012; Foster 2013; Foster 2014; Foster and Gibbons 2007; Steele et al. 2015). They are, to borrow Dillon's phrase, genuinely "entering into the people space" and considering how the physical environment of the library affects learning. What this informed and participatory process demonstrates is a drive to incorporate the value systems of those who use the space with those who are nominally in control of it, as well as an appreciation of the social changes brought about through technology. The aim of this approach to redesigning library space is to serve the overarching academic mission of an institution while paying attention to the daily needs of the contemporary patron.

Three Cases of Library Space Renovation

Each of our case studies is a story of an academic library in transition. Each is a space with which an author of this paper is intimately familiar. Like most contemporary academic libraries, each is evolving as members of the academy expand their notions of the purposes that libraries serve for campus communities at a time when digitization, search engines, and screens support and mediate our interactions with collections, ideas, and one another. The strategies that have shaped each renovation are naturally informed by surrounding geography, local needs, financial constraints, and the possibilities and limitations of existing architecture, but the leaders of each project have also chosen to set different priorities and engage users in decision-making in different ways.

All three cases illustrate one major trend in contemporary academic library design: the creation of the "learning commons." The modern learning commons inherits some characteristics of library-based computer laboratory spaces developed in the 1990s. Whereas early iterations of the "information commons" focused on technological and computational capacities, today's learning commons are more people-centered, have multiple uses, and offer flexible spaces suitable for individual and group work in a context that also provides access to further resources, services, and expertise nearby.

Case Study #1: The Milton S. Eisenhower Library of Johns Hopkins University, Baltimore, Maryland

The Milton S. Eisenhower Library (MSEL) and the Brody Learning Commons (BLC) annexed to it are two separate yet inextricable components of a system in the process of evolution. The MSEL, named for the university's eighth president, is the main research library on the Johns Hopkins Homewood Campus and was opened in 1964. In August 2012, the BLC, a modern annex with additional study and reading

Fig. 1. *Detail from Johns Hopkins Homewood Campus Map. Map by Johns Hopkins University*

rooms, was appended to the Eisenhower Library. Both are part of the wider Sheridan Libraries Network at Johns Hopkins. The new Learning Commons houses the Winston Tabb Special Collections reading room and the Department of Conservation and Preservation; however, it does not provide any additional collection storage space. Even special collections and archival materials are mainly housed offsite. Instead, most of the BLC square footage is dedicated to providing learning and collaboration spaces for students. In the next few years the MSEL will undergo a major modernization. In addition to revamping the layout, the renovation will entail moving nearly half of the print collection offsite to a storage facility. While access to the print collection will still be relatively simple—requested materials will be retrieved twice daily—the removal of such a large amount of print matter will drastically change the look and feel of the space.

Currently the MSEL (numbered 53 on the map in figure 1) reflects its red brick and marble colonnade surroundings, but with a 1960s twist. Its columns front and back are square, unlike the rounded columns of the other buildings on Keyser Quad. Its edifice is an imposing introduction to the Homewood Campus. The Learning Commons stands directly to the left of the Eisenhower Library and is attached to it on

Fig. 2. *The Brody Learning Commons, with the end of the Milton S. Eisenhower Library to the right. Photograph by Tamsyn Mahoney-Steel*

all levels (figure 2). Nestled down into the ground and with a curving glass facade framed in brick, the Learning Commons complements the straight vertical lines of the Library's columns, while subtly announcing its difference.

As the architects from Schwartz/Silver, who conducted the renovation feasibility study, explained, the MSEL is "symbolic of thinking of the time."[2] It has a "bunkeresque" design typical of the Cold War era—a space designed as a book repository, with minimal room for carrels and for study and collaboration spaces: books are first, and people are second. Yet with its red brick and marble columns it is "dressed in the clothes of the campus." It is an underground shelter for books, wearing the mask of buildings designed in 1915. The architects further pointed out that the building reveals the lean economy of the time: "everything is very precise, with not a lot of wiggle room." It is a "dense" building with low ceilings (figure 3). The building elicits strong and opposing reactions from patrons and staff, with some being thrilled to explore this dense bunker of books and others finding it oppressive and claustrophobic.

As the renovation architects commented, with security barriers the first thing a patron encounters and the books being concealed below ground, the Eisenhower Library's current design does not invite people to go beyond the lobby (figure 4). It gives, they believe, the impression of a building for "people in the know." This impression is reinforced by the lack of obvious access to library staff. Once patrons pass security there is a circulation desk to the right and a reference desk to the left; both are usually staffed by student workers. Gaining access to librarians typically involves going down windowless corridors or down staircases into the bowels of the building (figure 5). Often, students and faculty have to be given directions to find their liaison librarian.

Fig. 3. *Below, the low-ceilinged stacks in the Eisenhower Library. Photograph by Tamsyn Mahoney-Steel*

The MSEL modernization project was born from necessity—the aging heating, ventilating, air-conditioning, and fire suppressant systems needed to be updated. However, while this necessity may be the instigating factor, it has not been the driving force behind the planning. In rethinking the library, staff and hired strategists and architects have turned to the patrons to try to understand how they use the space and how they wish it to support their work in the future.[3] An initial visioning study examined the role of the library as a teaching space and concluded that the library had a track record of innovation on which it could build, but that it needed more

[2] We are indebted to Angela Hyatt and Jon Traficonte of Schwartz/Silver for meeting with us to discuss the design of the Eisenhower Library and its potential future direction.

[3] Library staff worked with Shirley Dugdale of Dugdale Strategy LLC and Schwartz/Silver Architects.

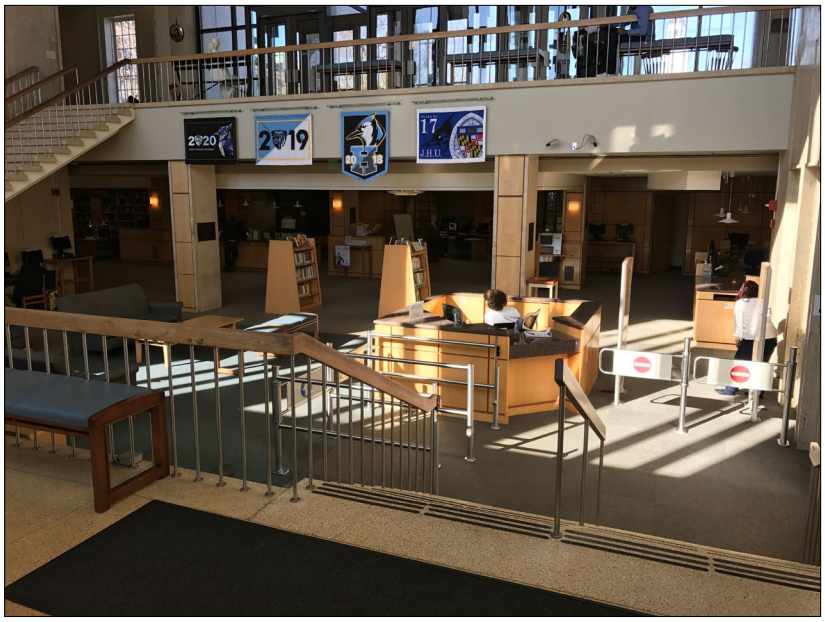
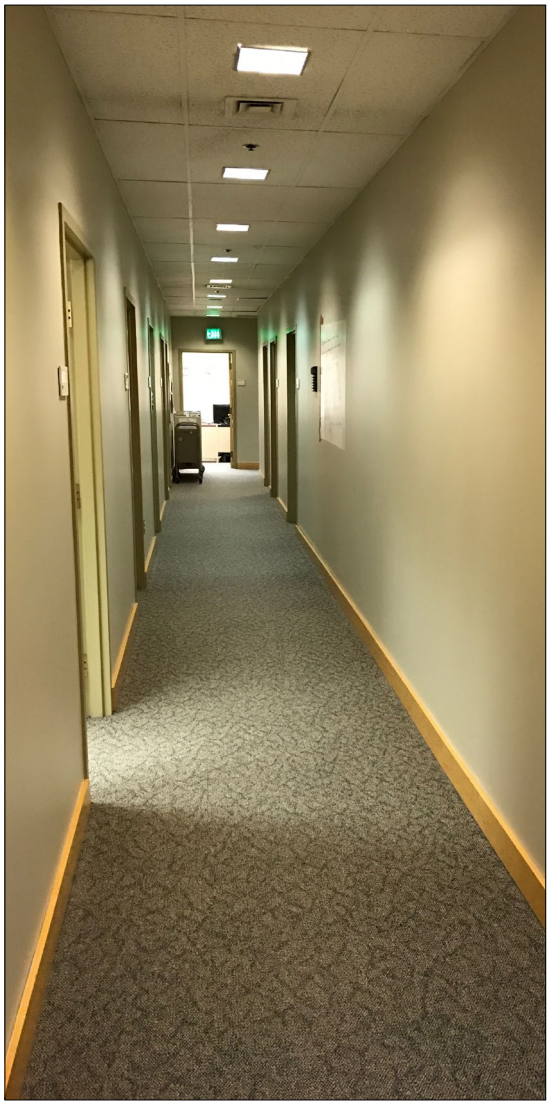


Fig. 4. *The Security Desk at the entrance of the Milton S. Eisenhower Library. Photograph by Tamsyn Mahoney-Steel*

Fig. 5. *Below, the windowless corridor of the Academic Liaison Department. Photograph by Tamsyn Mahoney-Steel*



spaces to enable and inspire coworking and collaboration. This study was followed by a survey of campus study and research spaces, meetings with the Student Advisory Committee, semi-structured interviews with faculty and students, a participatory design workshop, and focus groups. By paying close attention to user needs and experiences, library leaders aspire to shape the future of the library around the engagement of those users with the space.

The MSEL architects face the challenge of re-envisioning the Brody's older neighbor "to fit the concept of the research library of today." However, because the Learning Commons already provides flexible collaborative spaces, recreating exactly the same thing in the main library is not desirable. Naturally, the MSEL will continue to house essential library services such as circulation, research consultation, administration, technical and support services, reserves, Geographic Information Systems (GIS), the Center for Education Resources, and the digitization lab. It may also have some additions, such as a digital scholarship center. These services will help imbue the new Eisenhower Library with a character different from that of the Brody. However the building is redesigned, the architects stress that there are certain standards and ideals that they will strive to uphold. The library must "read together as one building"; in other words, it must be cohesive as an entity. It must also be an engaging place to be and one that balances the experiences of regular users with those of occasional users. It should also be human-based; that is, it should have an accessible design that aspires to enable all potential patrons, whatever their backgrounds and abilities, rather than appealing to "a higher order that is opaque." Essentially, the Eisenhower must break with a past in which libraries are either great reading

rooms that appeal to a history of classical learning or storehouses of vast collections. Instead, it needs to look to a future in which its identity is situated in its interactions with its patrons.

Both the recently completed BLC and the soon-to-be-modernized MSEL demonstrate the Libraries' desire to marry a broad vision with concerns regarding the rapidly changing expectations of individual learners. The two buildings together aim to provide an experience that acknowledges the library as a "complex socio-technical system" (Dillon 51), a single entity that can provide multifarious services and collaborative opportunities, while also being flexible to the needs of each user. Developing this degree of complexity and flexibility often results in library technologies becoming less obvious. In the new BLC building there are very few public-use computers. Most patrons are equipped with their own laptop and discreet laptop carts provide portable computers for those who do not own them. This has opened up spaces that once would have been filled with banks of computer towers and screens. Technology such as SharePoint and more simple solutions, such as additional power outlets and more ubiquitous ports for HDMI and VGA, mean that trailing cords are less frequently seen across communal spaces and classrooms. If anything, the most obvious communications technology is the least high-tech: the omnipresent whiteboard and writable glass. This beloved feature was provided in response to patrons' demands for more, and it is not only Johns Hopkins that finds the old-school technology to be popular; many research libraries have experienced a high demand for writable walls and windows.[4] This points not only to the usefulness of the whiteboard in facilitating thought processes but indicates how users see themselves interacting with the space: rather than envisaging themselves holed up in a cramped carrel, users see their work as more expansive, extending across the physical surfaces of the library and mingling with the multicolored, dry-erase thoughts of their peers. The change is from static to dynamic, from solo to collaborative, from confined to free. Technology may be getting smaller, but both physical movement and collaborative networks are becoming broader.

Where the MSEL renovation will likely emulate the BLC's design is in the use of light and transparency. The number one demand from staff and students has been to bring more light into the mostly below-ground MSEL. As a result, light wells will be added and stacks removed. This is a significant change in how users relate to the space: rather than placing a premium upon the availability of print materials, they would rather have pleasant surroundings in which to interact with the increasingly digital collections. The reaction against physical opacity goes hand-in-hand with demands for a more open and accessible university administration. Students and faculty want to be able to see their librarians in the flesh, but they also want to understand the machinations of the university system. Johns Hopkins has responded to this need by creating more opportunities for students in particular to be proactive in university decision making. For the MSEL architects, the use of glass and light embodies this philosophy of openness.

[4] See, for example, Pruneda, Wilson, and Riedmueller 2017.

These developments both reflect changes in teaching methods and influence how we teach. Flipped classroom approaches require spaces in which movement and change of the physical space is possible. In surveying and interviewing patrons, Johns Hopkins has discovered that patrons desire more classrooms where this kind of flexibility is possible. However, librarians have also discovered that working with faculty in the classrooms of the BLC has opened those faculty members to different teaching approaches. Where once a less technologically savvy professor may have stuck to a traditional classroom format, collaboration with librarians in these new spaces has engendered experimentation with technologies, classroom styles, and collaborative teaching with the librarians.

In sum, the addition of the BLC and the forthcoming modernization of the MSEL combine overarching values and philosophy, such as transparent communication, access to knowledge, and service to a community, with the evolving needs of individual users, who need not only good study space but also physical space in which to express their learning and research journeys. These developments are instantiated in how the library is used for pedagogy and how it influences pedagogy.

Case Study #2: The Albert B. Alkek Library at Texas State University, San Marcos, Texas

Texas State University's Albert B. Alkek Library opened in 1990. It was the fifth campus library at Texas State University, an institution that has transitioned through several identities, from Southwest Texas State Normal School (1903) to its present form. From 1903 to 1911, the library was located in a room in Old Main, the first building on campus. From there it grew in size with the student body, moving to Lueders Hall in 1911, then Flowers Hall in 1939, then the J. C. Kellam Building (originally the Library Administration Building) in 1969. In 1990, the library moved to its new home, where it would have twice the collection and study space that was available in the Kellam Building. By 2015, the student body nearly doubled again: from 20,940 to 36,790 students. As the university's population continues to grow, the library continues to change to meet the needs of students, faculty, and researchers (Toma 2015).

The Brutalist Albert B. Alkek Library cuts a dominant (and some students may say painful) figure on campus. People on foot wishing to make their way from the east and central campus to the west part of campus (and vice versa) most often need to ascend the stairs to the mouth of the library and pass under its bulk en route. There are seven floors, with the main entrance to the library being on the second floor.

In the 2010s, plans were initiated to renovate the 20-year-old building. Perry Dean Rogers Partners Architects developed a renovation plan that "focused on providing reinvigorated learning spaces for study and research with significant attention to the integration of technology" (personal communication with Joan Heath, Lori Hughes, and Sarah

Naper, February 2017). The plan recommended an infrastructure upgrade and a three-phase renovation. As with the Milton S. Eisenhower Library at Johns Hopkins, much of the physical collection is being moved elsewhere. While Perry Dean Rogers Partners developed their plan for the renovation, Harrison Kornberg Architects designed an offsite facility, to be called the Archives & Research Center. This "climate-controlled Harvard-style high-density shelving facility" will be home to many of the materials from the collections and is "capable of housing 1.5 million volumes." According to Heath and colleagues, "Some general collection materials will remain in Alkek as well as several distinct collections, which may be easily browsed, including the juvenile collection, graphic novel collection, DVD/media collection, models/kits, and the maps collection."

A collaborative approach was taken to incorporate technological advancements and the needs of staff and patrons. As of February 2017, the infrastructure upgrade to the Alkek Library had been completed, and the the Archives & Research Center was under construction. The library was in "programming phase I" of the Alkek renovation. For this stage, groups composed of library staff and other IT Division staff were convened to identify desirable characteristics of spaces in the library. One group was formed in a unique manner: an invitation was put out to the academic community over the summer asking for proposals for "centers" (dedicated areas for specialized work) in the library. The call received about 50 applications from faculty. Several faculty were also members of the "centers" team that solicited ideas for and recommended new centers to be incorporated into the next phase of construction. This has informed the centers that will be located on the first floor of Alkek. According to Heath and colleagues, the team planning the next phase of the redesign will also focus, among other things, on study spaces: "Through review of literature and campus surveys, the team determined that study spaces should be multi-type, flexible, ubiquitous, and everywhere. Any flat surface, corner or nook can become a study space."

In addition to their extensive consultation with the campus community, the renovation team has made dramatic changes to the second floor, which serves as the main floor of the library. The entrance to the library is dwarfed by the impressive stairs and breezeway. Before the current renovation, patrons entered the library through simple glass doors on the second floor. A large circulation desk was to the left upon entering, and the stairs and elevators to the other floors were on the right. The rest of the space was, from the point of view of a former student,[5] dedicated to computers for printing and tables where one could sit and wait for friends before going to lunch. Focused studying and group work was most often done on the floors above (see figures 6 and 7).

Today, post renovation, the main entry is still located on the second floor. The Circulation/Reserve Desk is still to the left, and the staircase and elevators to the right (figure 8). Now, however, the second

[5] Reeves Eyre attended Texas State as an undergraduate from 2003 to 2007.

Fig. 6. *View from the grand staircase of the main floor of Albert B. Alkek Library before renovation (2008/2009). Photograph courtesy of Albert B. Alkek Library, Texas State University*

Fig. 7. *Index tables, main floor of Albert B. Alkek Library before renovation (2008/2009). Photograph courtesy of Albert B. Alkek Library, Texas State University*

floor Learning Commons is directly in front of the main entry (figure 9). The Learning Commons includes several dedicated zones for resources and services, from new books, leisure reading, printing, stapling, hole punching, and a centrally located IT support desk to more specialized resources such as KIC (Knowledge Imaging Center) scanning, Lego and 3D pen creative tables, and a gaming area. At one corner of the Commons is the Open Theater, fitted with a 90-inch touch screen for library training sessions, workshops, or other special events. In addition to a variety of fixed seating arrangements equipped with computer equipment suitable for individual and group work, throughout the Commons are many moveable elements such as rolling whiteboards, power towers, reconfigurable tri-tables and chairs, and soft seating, which visitors can adjust to suit their needs. The adjacent coffee and snack bar provides convenient fuel for their labors.

The new second floor (figures 10 and 11) is designed for quick access to resources and space for working alone or in groups, albeit not in quiet or privacy. Heath and colleagues note:

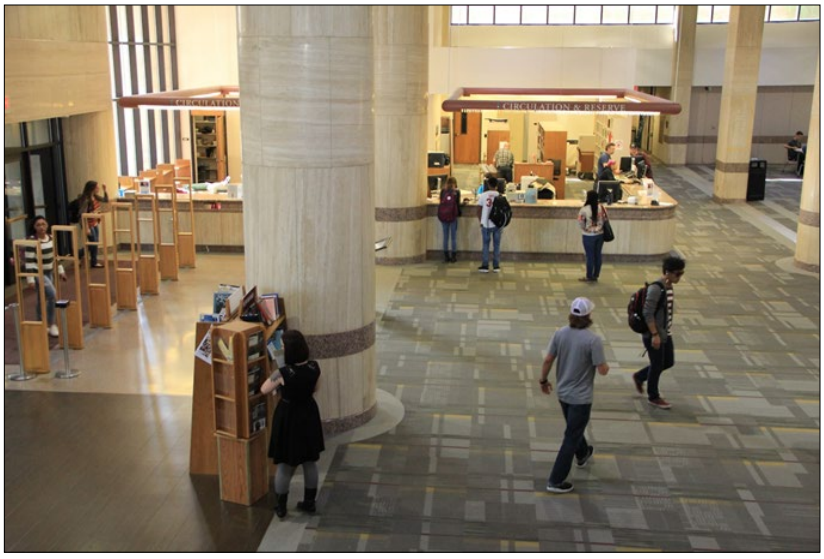


Fig. 8. *The entrance and circulation-reserves-research desk of the main floor of the Albert B. Alkek Library post renovation. Photograph courtesy of Albert B. Alkek Library, Texas State University*

Fig. 9. *View of the Learning Commons from the grand staircase post renovation. Photograph courtesy of Albert B. Alkek Library, Texas State University*

There are no individual study rooms or carrels on the 2nd floor, solitary reflection is not the main focus but could be achieved by placing movable furniture near windows or within whiteboard configurations.

The majority of the floor with the exception of the single user computers is geared toward group learning as needed. Groups of all sizes can utilize the stationary group areas or arrange flexible furniture into ad-hoc group areas. The Open Theater may be requested by an online form for group use.

While the space may not be designed for individual study, images of the space in use appear to show people working alone or in small groups, as they might in a coffee shop. The space allows patrons to work in a comfortable location, next to resources (such as coffee), surrounded by fellow learners.

Library faculty and staff also take an active part in engaging students in this space. Heath and colleagues note:

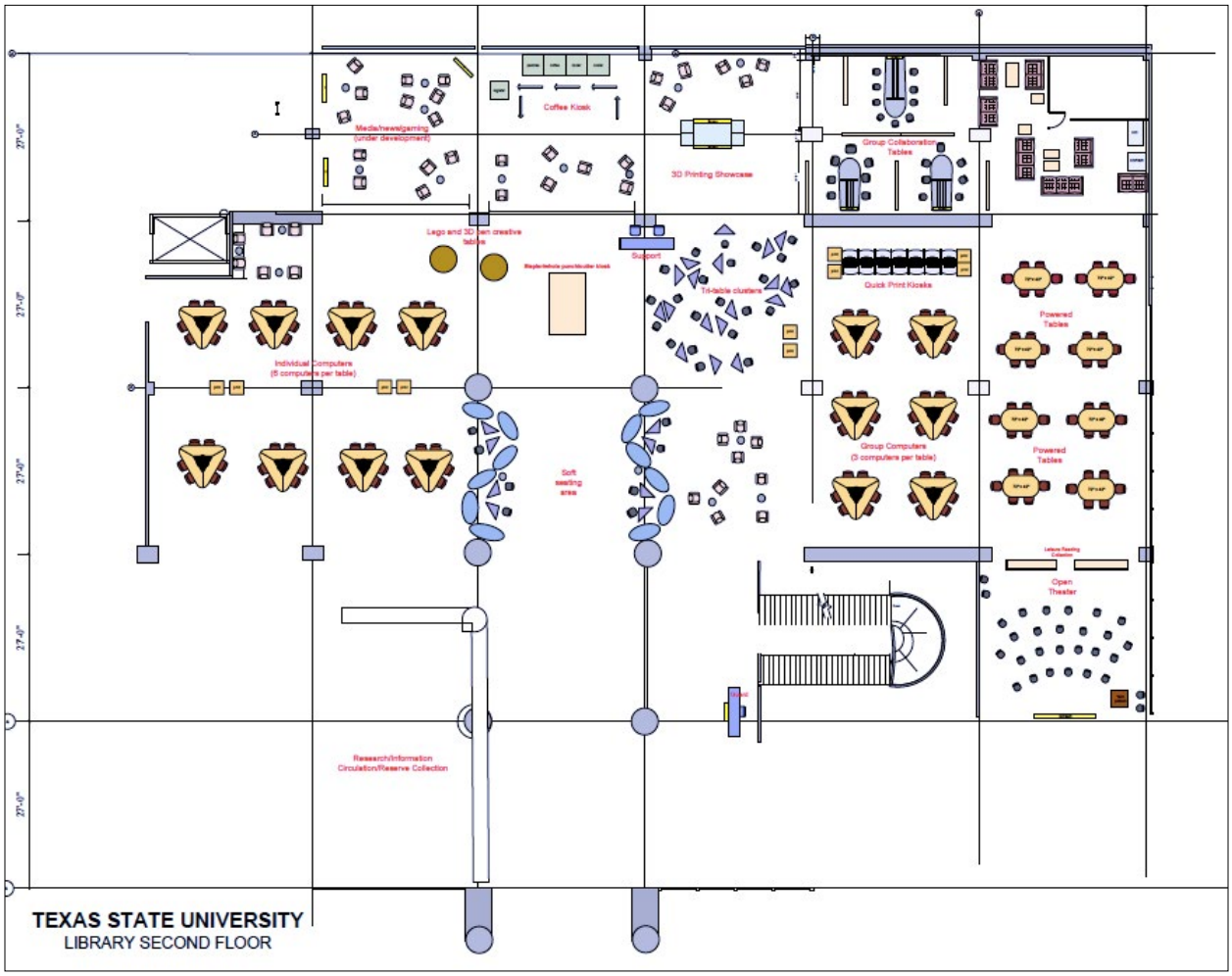


Fig. 10. *Floor plan for second floor. Image ourtesy of Albert B. Alkek Library, Texas State University*

Fig. 11. *Seating areas post renovation. Photograph courtesy of Albert B. Alkek Library, Texas State University*

> One of the most visible ways that we engage with users is by our weekly whiteboard question to users. Students enjoy responding and viewing responses. The media corner is an example of how our programming of this space has begun to enter this social arena. One example is our recent promotion of the space as a place to view the recent political debates. As part of this programming, we partnered with the local League of Women Voters to promote civil discourse about the election. We have also designated space for a Lego table and a 3D pen table to encourage creative social interaction.

The renovations being undertaken at Albert B. Alkek Library are driven by infrastructure, space, and technology needs, but also by the desire to create increasingly interactive learning environments for students. The modular aspects of the second-floor Learning Commons allow users to take control of their own surroundings by moving whiteboards, power towers, and furniture. Library users have always done this, to an extent, by moving tables or chairs. Now, however, the space has evolved to encourage this type of behavior. There is now even more direct access to technologies such as printers, computers, and monitors, but also continued access to more traditional support, such as the circulation desk.

Case Study #3: The University of Miami Libraries Learning Commons, University of Miami, Coral Gables, Florida

The University of Miami opened on April 14, 1926, and as it approaches its centennial milestone, there are two renovation projects planned for the first floor of the Otto G. Richter Library, the first being the new Jay I. Kislak Center (in process) and the second involving the redesign of the existing Learning Commons, whose physical renovations started in the summer of 2017. The aim of both projects is to ensure that the space adequately caters to the existing and emerging requirements of all of its users following in-depth research and planning with the full support and involvement of library partners. In particular, the re-imagination of the Learning Commons involved the development of a vision statement and guiding mission statement organized around key objectives that reflect the specific requirements and characteristics of users of the University of Miami Libraries, now and in the future.

The planned renovations for the library in the twenty-first century echo some of the narratives that shaped its twentieth-century history. For decades, university books were informally kept in a number of locations, close to their respective departments. Early collections relating to government and history donated in honor of William Jennings Bryan were housed by the School of Citizenship (Tebeau 1976, 98). With the expansion of degree programs into marine life and sciences, further collections of books were kept in Virginia Key, where the University of Miami's Marine Campus is located. By the mid-twentieth century, the university was still without a dedicated library structure, and in January 1957, a proposal was put forth to raise $3 million to build one.

In a special presentation, J. N. McArthur, then chairman of the university's Development Council, urged campus leaders to create a library that would be "the heart of the university," stressing the value of both collections and space for a center of learning. In the Development Council's view, an academic library's worth lay beyond the count of its catalog records and print holdings. McArthur and his team described library patrons—faculty and students who were, no less, "guides and explorers"—extracting from the new library its "gold-bearing ore which awaits discovery and enriches their efforts" (McArthur 1957, 1). Their arguments presage much contemporary thinking about the goals for the Learning Commons. McArthur's team gave much consideration to the space surrounding the texts that the library would house, suggesting that a central space dedicated to research and learning across the curriculum would help form a vibrant campus community:

> Various departments of a university need workshops, laboratories, practice-rooms, special equipment. The Library is all these things for all the university [...] There is the accumulated wealth of the ages, the wisdom to challenge all the minds which have gone before. There is the record of the past and the finger to the future. A Library is the university" [underlined in the original] (ibid, 2).

In 1999, the Richter Library underwent a large-scale, $16 million expansion and renovation that included the construction of a new three-story wing. The work was completed in 2002 and provided an expanded first floor Information Commons that comprised study spaces, computer stations, group study rooms, and training and multimedia facilities for teaching by faculty and staff in electronic resources (University of Miami 1980).

Today, the Richter Library is the university's largest and busiest interdisciplinary library. It is prominently situated in the Coral Gables campus and is lined by royal palm trees, art, and ornamental coral walls (figure 12). Students and faculty enter the library via a breezeway that runs through the building. This passage serves as a pedestrian thoroughfare to reach the nine schools and colleges that are on both sides of the library. There is a Starbucks coffee shop opposite the library's entrance from the breezeway. As they sip their coffee, visitors can gaze into the library through a wraparound tinted glass windowed facade. In the breezeway and around the outside perimeter of the library building are chairs and tables, which are popular spots to rest, weather permitting. The nearby Foote Green is frequently used for events that draw large numbers of people. Across the various campuses, there are additional libraries for music, architecture, law, business, medicine, and the marine sciences,[6] but both faculty and students from all of these departments also use the Richter Library regularly. The Richter Library is home to the Distinctive Collections, the collective name given to three entities: University Archives, Special Collections,

[6] These libraries are named the Paul Buisson Architecture Library, the Judi Prokop Newman Information Resource Center, the Rosenstiel School of Marine and Atmospheric Science Library, and the Marta and Austin Weeks Music Library. The university also has independent medical and law libraries.

Fig. 12. *The Otto G. Richter Library of the University of Miami. Photograph courtesy of Richter Library Communications team*

and the Cuban Heritage Collection, the latter being the largest repository of material on or about Cuba held outside of the island. There is an onsite conservation laboratory for the preservation of materials as well as both a digital media laboratory and a digital production laboratory.

The Learning Commons physical renovation will occur in phases, with phase 1 having begun in the summer of 2017.[7] As of publication, the Learning Commons is currently in a pilot phase. The research plans for renovation began in 2015, with an in-depth examination of the first floor use conducted by brightspot strategy. Subsequently, weekly planning meetings involving librarians and incorporating feedback from a variety of stakeholders from the campus have led to the development of a service model that underpins the design for the new first floor's layout and facilities. To date, the participatory redesign process led by the brightspot consultants, who have worked in partnership with campus leaders such as the dean of undergraduate education, the vice president for academic technologies, and the university architect, has involved more than 30 staff and hundreds of library users, including faculty, students, and employees. The complete spectrum of users and employees of the library were encouraged to participate in determining how the future space would function (figure 13). Many partners from other campus service units have been integral to space planning, including directors of the Camner Academic Resource Center, the Digital

[7] Note that all the following images of the interior Richter Library portray the Learning Commons designated space in its pre-renovation state, as renovation was just starting at time of publishing.

Media Lab, the GIS Lab, the Math Lab, the Student Technology Help Desk, and the Writing Center. Redesign and renovation will occur iteratively over the next few years. The evolving vision is for a multi-use space that will serve as a place for engagement, communication, and action rather than quiet, solitary study and contemplation. The team has constructed a dedicated Learning Commons website to keep users informed of progress and to map the elements of the library's service model to the changing facilities and services.

The 2015 report submitted by brightspot strategy sets forth valuable findings that will be incorporated into every successive phase of the Learning Commons development.

Fig. 13. *A visualization of the draft service and support model for the Richter Library Learning Commons. Illustration courtesy of University of Miami Libraries*

As part of the exercise with brightspot, the library articulated the vision and mission that would guide preparation of the space. The vision for the Learning Commons is to:

> Help students become effective and independent learners with the ability to identify, critically analyze and apply relevant information and technologies as well as the skills necessary to communicate across disciplines and cultures (brightspot 2016, 15).

The Learning Commons mission statement is to:

> Offer opportunities to work individually and collaboratively, learn from peers and experts, discover and explore resources and ideas, and create and experiment. Provide an inviting, comfortable, and technology-rich environment (ibid).

In tandem with the values and mission, five key principles inform the proposed Learning Commons space:

1. Coordinate services and resources across providers
2. Foster creativity and making with technology and digital tools
3. Create spaces for students to connect to each other and with experts
4. Lead users to more advanced services
5. Showcase stories of learning, research, and creativity (brightspot 2016, 16)

The library has identified several "space types" that would serve the vision for the Learning Commons. The comprehensive brightspot service, space, and staffing report (2016, 17–21) synthesizes these findings with identified user needs and organizes these space types according to their potential impact on the mission and vision, offering blueprints that can guide future renovations.

The University of Miami's student body is particularly diverse as 15 percent is composed of international students and 59 percent of students who consider themselves to be from minority groups. Just as the original library building consolidated the early, dispersed collections, the redesigned Learning Commons will help fulfill a variety of learning and research needs for this diverse community whose members were previously scattered across the campus. In addition to bringing together existing services and partners campuswide, the library

has implemented a new service for undergraduates by recruiting and training peer research consultants who are available for ad hoc research consultations within the Learning Commons.

The guiding principles for the proposed Learning Commons include clarity, choice, adaptability, visibility, and their respective physical and digital components (brightspot 2016, 43). Thus, both people and objects are given consideration in the Learning Commons design. Relationships between people and objects have helped demarcate specific areas for the new floor layout. Labeled "zones" to connote areas that are distinct yet contiguous and coherent within the entirety of the plan, a central service zone and a consultation zone support access and learning. The following are also important features of the Learning Commons: lobby/exhibition spaces, open user seating, enclosed study rooms, adaptable meeting and event spaces, creative/maker spaces, digital lab/technology areas, computing areas, and spaces for physical collections, including new books, faculty and student publications, bestsellers, graphic novels, travel guides, periodicals, DVDs/CDs, and more. The data from the 2015 user assessment showed that different groups have distinctive needs and use the space in unique ways. Based on this information, brightspot mapped four "future user experiences"—the freshman, the international student, the graduate student, and the faculty member—on the first-floor plan to indicate specific "hotspots" for each type of user (79). This analysis should result in a Learning Commons that will have service zones strategically situated to help different types of users find what they need easily.

One of the first and most impactful changes made to the Richter Library in 2015 was the removal of the imposing compact shelving for periodicals that dominated the first floor (figures 14 and 15). Since most patrons use exclusively electronic periodicals, many of the print journals were moved to make way for multi-use space and for the introduction of much-needed service areas. Before the periodicals were moved, a row of study desks was in place along the wall of the library, an arrangement that prevented effective collaborative work.

The stacks also served as a physical room divider, making the space seem dark and cluttered. Once the stacks were removed, the space felt bigger, open, lighter, and more welcoming. Parts of the floor were allocated to campus service partners, whose work meets a range of student academic and extracurricular needs. In addition to the existing Digital Media Lab and the GIS Lab, the space also became home and headquarters for research support, the Writing Center, and the Math Lab. The first floor also houses a satellite space for the university's Camner Academic Resource Center[8] and the Student Technology Help Desk. These centers are staffed with specialists accessible by appointment and to walk-ins according to individual timetables. Prior to

[8] The Camner Center offers help to students, parents, faculty, staff, and administrators by providing tutoring services, the Office of Disability Services, access to a learning specialist, "UMX" (an academic course that helps freshmen and transfer students transition to the University of Miami), academic workshops, faculty support, and the Independent Learning Initiative (an academic support program that provides structure, instruction, and monitoring for students needing additional guidance during the college experience).

Fig. 14. *The periodicals stacks before their removal from the first floor of Richter Library, 2014. Photograph courtesy of the Richter Library Communications team*

the redesign of the Learning Commons, these service centers were scattered across the campus, making it difficult for community members to discover them. Clearly signposted and staffed zones are color coded to make it easy for students to inquire about services in person and seek help (figure 16). The various service centers are also working with the library and each other to offer expanded working hours that better meet student needs, potentially to extend services into evenings and weekends. The testing and trialling of services offered in the newly redesigned space will help library partners learn what works best for the campus community. Based on observation of the various zones in action, it is clear that visitors are already enjoying an atmosphere that is energizing and friendly (figures 17 and 18).

The present stage of the Learning Commons renovation includes testing which styles of furniture seem most conducive to study, research, and discovery, and which arrangements best promote flow and openness in the space. Early testing made use of existing library and university furniture, an easy and low-cost way of experimenting with the proportions and relative proximity of people and objects while the space remained in active use (figure 19). With further piloting and feedback, architectural plans will be firmed and then implemented to create a more permanent arrangement of zones across the Learning Commons. The iterative process of rethinking the

Fig. 15. *Removing the periodicals stacks on the first floor Richter Library, 2015. Photograph courtesy of the Richter Library Communications team*

Fig. 16. *The southeast side of the first floor of the Richter Library after the periodicals stacks were removed. Color-coded columns indicate specific service and use zones. Photograph by Martin Tsang*

Fig. 17. *The flexible and open exhibition and event space adjacent to the developing Richter Learning Commons, March 2017. Photograph by Martin Tsang*

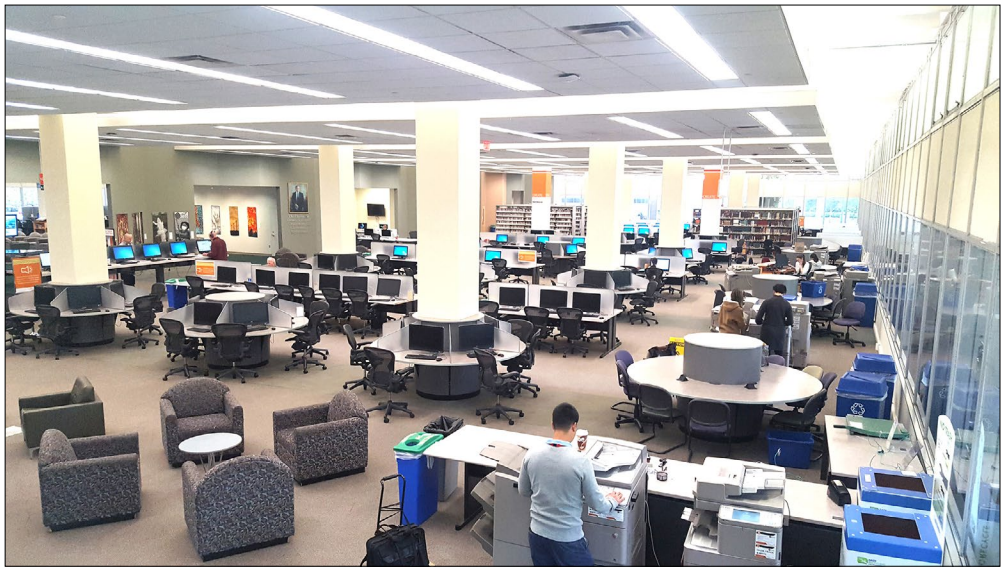


Fig. 18. *The southeast side of the Richter Library that is on its way to becoming a dedicated Learning Commons, March 2017. Photograph by Martin Tsang*

library's first floor space has emphasized flexibility of design, so that the future Learning Commons can be quickly adapted to the demands of its users. Early feedback, gleaned through conversations with undergraduates, faculty, and employees, has been overwhelmingly positive.

The sense of openness in the new Learning Commons and its emphasis on collaboration, engagement, and experimentation are novel concepts for some library users who have been previously accustomed to working in silence. For this reason, during the transition of the Learning Commons librarians have posted several large signs indicating that conversation is acceptable on the floor. Along with encouraging conversation, the planning team is also developing the concept of a "living room" within part of the Learning Commons space (figure 20). As the name suggests, this area extends ideas of the personal, of comfort, of conversation, and social living, bringing a sense of "home" to the library. The goal of incorporating a "living room" space is to give users a sense of the familiar and being welcomed. The concept is

Fig. 19. *The Richter Library's Learning Commons, April 2017. Photograph by Kelly Miller*

currently being executed in the most prominent area of the Learning Commons, the space all users see and walk past or through after passing through the turnstiles at the entrance. The layout is simple and uses existing furniture in new configurations, with comfortable, upholstered armchairs, coffee tables, and mid-height bookcases that showcase publications by the university's faculty, students, and alumni from all disciplines. It is a place where students can sit, read, converse, wait (for friends or appointments with the service partners) and gives a powerful first impression of the entire Learning Commons experience. The living room also echoes local public artwork installations that are

Fig. 20. *The Richter Library's first floor entrance with the beginning of a "living room" concept showcasing books recently published by the University of Miami's faculty, March 2017. Photograph by Martin Tsang*

important to the Miami/South Florida area; for example, Robert Behar and Rosario Marquardt, the professional duo behind the Miami architecture, design, and arts firm R & R Studios, created the iconic and larger than life Living Room in 2001.

Discussion

The early 2000s saw much speculation about what the academic libraries of the future would become. Many foresaw the reduction in or displacement of physical collections and the infusion of learning technologies into library infrastructures and services. These trends are now ubiquitous across the country, including the libraries profiled here. At the same time, distinct circumstances have motivated the development of each of the library spaces that have been described. In each case the renovators' focus was on creating and strengthening the library's relationship with its communities of users and on fostering their ability to shape spaces to their particular needs. These are also spaces built not to realize a static vision of what twenty-first century learning environments should be, but to evolve alongside local needs and expectations. They are built to accommodate new and future technologies and to facilitate access to collections and services that enrich visitors' capacity to consume and produce new knowledge.

Space for Relationships

In these examples, the success of an academic library "commons" is not contingent upon the wealth of technology or degree of adaptability that it affords; rather, "its strength lies in the relationships it supports, whether these are student-to-student, student-to-faculty, student-to-staff, student-to-equipment, or student-to-information"

(Educause Learning Initiative 2011, 1). While our studies have focused on the changes in space, the motivation behind these changes is to provide a space where these relationships can grow. While the breadth of the library's virtual services, digital collections, and learning technologies ensure that these connections are not bound in space or time, the design and arrangement of physical space and the face-to-face interactions it supports still seem vitally important on these campuses. The social context these shared spaces reinforce is one of their key functions, but academic library spaces are expected to do more than other "third places" like coffee shops or bookstores.

Beyond providing space, learning commons provide access: access to technology as well as to traditional library resources. The most successful "next-gen" spaces not only will allow for flexible physical implementations, but will continue to grow away from passive technology clusters and service points and toward sites of active, technology-supported material engagement. Alkek's new Learning Commons offers a rich array of technical resources in an environment that affords great flexibility and will be easily reconfigured in the future. Rapid growth of the student body has demonstrated the need for the library to evolve quickly and (presumably) on a budget. Ongoing formal and informal engagement with users informs the evolution of the space. Alkek is not only one flexible space, but a related collection of spaces with flexible, but still discrete, uses. Modular furniture was chosen to foster collaborative group work, but it also lends itself to individual work. The adjacent "Open Theater" gives a home to the types of information literacy classes and workshops often associated with libraries, yet it is also easily accessible for booking by other parties on campus through an online reservation system (Open Theater n.d.). Librarians are also using the new space to actively engage with patrons through their "weekly question," workshops, and events. The Johns Hopkins case study shows that such spaces provide an opportunity for librarians to work with teaching faculty on experiments with technologies and new ways of teaching.

The brightspot consultants at the University of Miami found that the library is considered a welcoming and comfortable space for students to meet and connect. In particular, the working habits of students "involve multiple cognitive states within one working session—focused concentration, spirited collaboration, retreat, quiet study, group huddles, sprints of production, etc." (brightspot 2016, 19). The library provides a space for students to strengthen learning relationships with one another, as well as with the library. The removal and relocation of the entire periodical stacks has opened up the first floor space considerably and allowed, for the first time, several "service partners" to take up residence in the Learning Commons.

A Deeper Understanding

Almost a decade ago, when concluding his call for an approach to academic library service design that focused not just on creating social contexts but also on accelerating discovery, Dillon astutely observed:

> Augmenting the learning and research processes will require a deeper understanding of the underlying psychology and culture of these creative acts and experiences, coupled with an ability to experiment with and evaluate the effects of new tools. Libraries are not alone in this effort, and partnering with faculty in exploring new practices is necessary for real progress to occur (2008, 57).

We would argue that learning commons, when thoughtfully developed in consultation with community members, offer more value than a coffee shop or bookstore. These spaces give patrons more control of their own study spaces, even if temporarily. By itself, this desire to change the space suggests that library space has an active influence on the learning and research process. In the Albert B. Alkek Library, the second floor is seen as a place for socially oriented work. Yet, as figures 9 and 11 show, there is an array of work being done within varying social spheres: some students are interacting with others directly, while many are interacting with library computers or their own computers. This solitary work is taking place in a social atmosphere. The same is true of the Brody Learning Commons at Johns Hopkins, which has added a more social dimension to the library. There is potential for genuine acceleration of learning.

The Johns Hopkins case study differs from the other two in that the modernization of the Eisenhower Library has not yet begun. However, the addition of the Brody Learning Commons in 2012 gives an idea of where the Eisenhower can go, and also how it might assert its difference from the Brody. The newer space is vastly different in character from the main library, offering high ceilings, open spaces, huge windows, and bright collaborative workrooms—a stark contrast to the confined environment of its neighbor. As one moves from the old building to the new, the potential for the material surroundings to affect the work being carried out seems clear. In the former, we mainly observe students in single carrels with wooden barriers between them, focusing on a solitary pursuit, while in the latter we see groups gathered around tables in glass-walled rooms, writing on whiteboards, using screens to present and share work, and generally appearing more animated in their endeavors. This is not to say that providing space for solitary focus is not necessary and important; however, a successful library appears to need both kinds of space, and the addition of a Learning Commons, with its provision for group interaction and ease of access to shared technology, added something that in turn enabled different working styles to coexist in close proximity. The forthcoming renovation offers the opportunity to explore further how the library can be developed in a more user-centric manner, while retaining some of the more traditional services that the Brody does not offer.

At the University of Miami's Richter Library, students are encouraged to work on projects together, seek assistance, and discover new resources and services that were previously scattered across campus. The new space is flexible yet coherent as a representation

of the library's current service model, mapped out in distinct zones for reference consultations, solitary work in a comfortable social context, and collaboration. The development and trialling of additional services and uses of the space, such as the "living room" concept, fits well within the university's aim to build a warm, open, and welcoming space for its diverse campus community. The flexible design of the Richter Learning Commons enables user engagement with materials, people, and services so that the experience of each person is individualized and easily accommodated.

Kelly Miller, associate dean for learning and research services and leader of the Learning Commons initiative at Richter Library, describes her vision for the space as "[making] the academic experience on campus more tangible and visible to students." She asks:

> Universities are typically very good at demonstrating the residential, social and athletic aspects of the undergraduate experience to visitors, but where can a prospective student catch a glimpse of their future academic life? The library holds the potential to manifest or embody the educational experience like no other space on campus. The Learning Commons ... provides opportunities to connect students to the academic support they need while giving them the chance to explore and discover what faculty and other students on campus are learning and producing. (Personal communication with Miller, July 2017)

According to Miller, the key to arriving at greater coherence in the design of the Learning Commons was the service model developed during the participatory planning process for Richter:

> The back end of the Learning Commons is still quite complex, with many different service units reporting to numerous deans and administrative units at the University, but the front end is increasingly unified and synergistic. The service model brings clarity and a shared purpose for the service providers. ... The ultimate goal is to foster student learners who are able to articulate and pursue their own academic goals, while recognizing the need to interact and collaborate with others along the way. (ibid)

The evolving visions for our three spaces are targeted at supporting learning and research. While some aspects of new library designs have features that echo the atmospheres of coffee shops or bookstores, other elements share parts of the laboratory, office, classroom, or home. There is a recognition that distinct social environments support distinct learning needs and that providing variety within a coherent context is desirable. So the possibilities for the "learning commons" and the recognition of the value of physical space in promoting learning seem to have grown over the past decade. Still, more work is needed to tie the configuration of academic library space and its use to the "underlying psychology and culture" of learning and research. Our space planners, and those who have inspired them over the past decade and more, have invested tremendous energy

into understanding their specific users' preferences and needs. These specifics are vital to making wise decisions about the use of scarce resources in optimizing space design at the local level, but at the same time a broader conversation about the interrelationships between space design, cognition, and the construction and integration of new knowledge remains timely and urgent. The faculty–library partnerships described in this volume's chapter on information literacy instruction could, perhaps, serve as a model for building a more sophisticated understanding of the impact of space upon learning.

Where Have All the Collections Gone?

The removal of the underused compact shelving in the University of Miami's Richter Library made room for user collaboration and the introduction of service partners, as well as growing and making more visible and discoverable a multitude of physical collections, including new publications, periodicals, multimedia, travel guides, and graphic novels.

With plans to move half the print collection offsite and an intention to dig in front of the library to bring in more light to the lower levels, the Eisenhower Library at Johns Hopkins is moving away from its Cold War bunker identity and looking to embrace a more open and transparent design. People, and the space and light that they inhabit, are becoming the main priority, with the amassing of books moving to second place (the intention moving forward is for non-growth in the print collection). The appending of the Brody Learning Commons in 2012 was one step toward this new identity; as the students eagerly inhabited the collaborative spaces and worked together, shaped by their new environment they began to want more of this and expressed that desire in interviews and consultations. Merely recreating the Brody is not the intention; however, a space is required that fits the needs of modern academia. And the creation of this space will shape the kind of work that emerges from it. How will this affect the way that research is done at Hopkins, particularly in the Eisenhower Library? One can guess that creating more light-filled collaborative spaces will engender a different type of research activity. But how fully do library space planners understand the consequences of their decisions to move so many physical materials away from immediate access?

For all the positive things these examples of Learning Commons development imply for user experience, we must also acknowledge that user experiences are substantively changed and that in gaining one type of engagement we must leave another. Many people have experienced the magic of being lost in the stacks, surrounded by the record of millennia of voices, and of finding new ideas through the serendipity of engaging with rows upon rows of shelves. What happens, as in our case studies, when substantial proportions of collections are moved offsite or certain collections are given priority over others? When we distance users from physical collections, do we cut off opportunities for them to engage directly with those materials—to be absorbed and overpowered by the full scale and diversity of

the collection? In short, does a user-centered library risk abandoning the experience of the sublime that can overtake us when confronted with seemingly endless rows of books? Or, perhaps and hopefully, is there a new sublime learning experience awaiting us in the library of today? At Texas State University, the plan is to actively encourage connections to collections within the new Archives & Research Center (ARC). As Joan Heath wrote in an e-mail response to this essay, "We're looking at the ARC as a new library on campus to be celebrated and eliminating the word 'storage' from our vocabulary."

The essays in this volume explore other growing trends in academic libraries that illustrate the role of material engagement in human learning. More and more, innovations in the use of academic library space are creating new opportunities to interact with the unique and the rare, both physical and digital. Makerspaces are becoming core elements of the Learning Commons with increasing frequency, resulting in libraries that are sites not just for exposure to unique and rare artifacts, but for their production as well. Both trends underline the necessity of designing environments that bring people together with collections, spaces that will inspire learners to seek out the unfamiliar, to come to terms with new ideas and experiences, and to engage with the world around them in new ways.

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Creating Contact Zones in a "Post-Truth" Era:
Perspectives on Librarian–Faculty Collaboration in Information Literacy Instruction

Bridget Whearty, Marta Brunner, Carrie Johnston, and Ece Turnator

If faculty come to me at all, they only ever want a one-off information-finding session. The first problem with this is that I'm not convinced these sessions really work for students or professors. Also, professors don't treat these sessions like they count and so students don't either. Another problem is that I often can see problems with assignments, but I do not feel I can point this out to faculty without getting negative reviews from them. So, I get stuck leading information sessions that I know students aren't taking in for assignments that I know aren't going to work. Finally, these one-off sessions are profoundly unsatisfying for me—like an endless string of one-night stands where you never get to know who your partner really is and what they/she/he want. (Librarian A)

I can spend a whole semester of a 100-level class teaching all these different library resources, only to get final papers citing "History.com," with the student–author showing zero awareness that this is the commercial site for the History Channel or what that suggests about its agenda or quality. In advanced courses, students often show me, by accident, that they don't understand what "peer review" means and why it matters. I also get papers revealing that students don't see how information ages. Finally, in all my courses, I find students who can find and recite pertinent information without demonstrating any comprehension of what they read—let alone practicing deeper critical engagement and/or higher-level powers of synthesis that I claim my class exists to help them master. (Faculty B)

Over the past year we have entered a crisis of information. In his reflection on three worrisome trends related to the web, Tim Berners-Lee (2017) observes that the commodification of "clicks," particularly on social media, has created a situation where "misinformation, or 'fake news,' which is surprising, shocking, or designed to appeal to our biases can spread like wildfire," at great social cost. Libraries—public and academic, K–12 and higher education—have stepped up against this tide of "alternative facts" and the creeping sense that truth is being fundamentally undermined (Najmabadi 2017). As Librarian of Congress Carla Hayden told her academic librarian audience at this spring's Association of College and Research Librarians conference, "Librarians are having a moment! Trustworthiness is our strength. We should revel in it and be confident in it. If we're having a moment, let's seize the moment!" (Carlton 2017). At the same time, there are critics like Rolin Moe (2017) who argue that libraries—and academic libraries, in particular—are the wrong place to seek a silver-bullet antidote to

this epidemic because of the ways they are complicit in hierarchies of information creation and consumption. At the heart of this emerging debate of library-as-savior or library-as-suspect lies a deeper and more important issue: the degree to which academic librarians are, in fact, able to teach information literacy given the existing hierarchies in academic institutions.

Information literacy is clearly the domain of librarians who, although not the inventors of the phrase, are its most avid users.[1] It is also the domain of faculty, who design, administer, and assess most courses and assignments through which our students are supposed to practice what faculty, librarians, think tanks, presidents, and international bodies unanimously agree ought to be a lifelong skill and way of being in the world (Hinchliffe 2001).[2] Above all, it is the domain of students who, while bearing the burden of all our expectations, are not consistently given the necessary tools, support, and time to foster these vitally important competencies across their college careers. Calls for collaboration with faculty are a perennial feature of librarian-authored literature on information literacy, indicating both the importance of collaboration and the difficulty getting there. However, today's information crisis is indeed a moment worth seizing, and not just by librarians. If collaboration was important before, it is vital now. And yet, this opportunity is being jeopardized (and has been for some time) by significant cultural, administrative, and institutional impediments in higher education that make collaboration between librarians and faculty more difficult to achieve and less helpful for our students than it needs to be.[3]

In this paper, we will explore the state of information literacy instruction, focusing on librarian–faculty classroom collaboration. We contend that a major obstacle to effective collaboration is a mutual lack of understanding of potential collaborators.[4] This, in turn, diminishes the effectiveness of the lessons, assignments, and rubrics we design. As a result, we fear that too many of our students graduate without a fully developed, flexible understanding of the complex information ecosystems that they will continue to navigate in future

[1] At least in library circles, Paul Zurkowski is thought to be the first person to coin the term. His interpretation (1974), which is from the business angle, aligns with the spirit of the 1989 Presidential Committee Report, which deems information literacy as an essential skill for the information age. We would like to thank Lisa Hinchliffe for the reference.

[2] Throughout this chapter, *faculty* refers to those who work within academic departments and whose work consists of a combination of research, teaching, and service. *Librarian* refers to a person who works within academic libraries in a wide variety of positions. The terms do not fully reflect the diversity of positions and types of work that occur under these umbrella labels, nor the fact that at some institutions librarians have faculty status. We have compromised here because we write for an integrated audience. For our longer discussion of the diversity of positions held by both faculty and librarians, see pp. 42–43.

[3] When we write about *information literacy*, we refer to an evolving set of abilities used to diagnose a need for additional information and then to locate, evaluate, and effectively use that information—all of which takes place within the larger context of a society in which the distribution of information is frequently fragmented and unequal.

[4] By writing together, from the librarian and faculty perspectives, we hope to facilitate much needed bridge-building on both sides.

The Enduring Quest to Become "Masters of Information"

The recent crisis and related debate over information literacy as its antidote may feel new, but they are not. In 2013, UNESCO's *Overview of Information Literacy Resources Worldwide* described information literacy both as integral to individual self-empowerment and as a vital tool in facing a conglomeration of global crises, each with "monumental, disastrous and irreversible negative consequences for people, institutions, countries and even the planet itself" (Horton 2013, 13). The same sense of crisis—and opportunity—threads through President Barack Obama's proclamation of October 2009 as "National Information Awareness Month" (White House 2009). (Declared, in part, in celebration of the twentieth anniversary of the National Forum on Information Literacy, this proclamation is limited to a single month in a single year and sadly does not include all subsequent Octobers.) Even earlier, in the first years of the twenty-first century, Caroline Stern (2002) wrote what has become an oft-quoted maxim of information literacy instruction in and beyond academic libraries: "To prosper in the Digital Age, people must become masters of information." And laments about cataclysmic tsunamis of information liberally mixing the profound and true with the pernicious and false can be traced back through the nineteenth and eighteenth centuries, to the Renaissance and Middle Ages, in poems like Jean Gerson's "*Metrum contra curiositatem scribendi plures libros*" ("Verses against excessive eagerness for writing more books," c. 1400). In fact, declarations of concern over the management of suspect knowledge appear in Ecclesiastes 12:10-12, (written sometime after 450 BCE): "Like nails firmly fixed are the collected sayings that are given by one shepherd. Of anything beyond these, my child, beware. Of making many books there is no end, and much study is a weariness of the flesh" (*New Oxford Annotated Bible*, 954, 958).

jobs and as citizens of the world. And understanding existing systems is only one part of information literacy. What we ultimately seek, librarians and faculty together, is to train new creators of information who can, and will, transform existing information ecosystems in the face of challenges that we cannot yet foresee.

We argue in favor of interlinked solutions, from openly addressing the structural inequalities hardwired into higher education and the ways these structures can undermine our abilities to engage in truly student-centered instruction, to redefining what we have come to think of as *collaboration*, to welcoming librarians into the training of future faculty (i.e., graduate student pedagogical development).

A History of Information Literacy

In academic libraries, information literacy has a long pedigree punctuated with heated debate over definitions, evolving new meanings, and how—by whichever definition—it ought to be taught.[5]

[5] The literature goes far back. The earliest definition of instruction within the library context in the United States may belong to Otis Hall Robinson, head of the University of Rochester Library, who during the Conference of Librarians in 1875 gave this response to a paper on the relationship between librarians and readers: "I sometimes think students get the most from me when they inquire about subjects that I know least about. They learn how to chase down a subject in a library. They get some facts, but especially a *method*. Somehow I reproach myself if a student gets to the end of his

Curiously, this multi-decade debate remains largely invisible to non-librarians, despite the ways it continues to shape librarian–faculty collaboration and classroom instruction. In her impressive analysis of the history of information literacy instruction in libraries, Susan Ariew (2014) argues that the first move toward a teaching library model took place in the 1960s. This was followed by a rise in activity in the 1970s traceable in guidelines and reports from the US Department of Health, Education and Welfare Office of Education's Educational Resources Information Center (ERIC), the American Library Association (ALA) and ALA's higher education division, the Association of College and Research Libraries (ACRL).[6] The ALA's first overarching analysis of information literacy instruction, titled the *Final Report*, is the first of three key texts that were produced at the end of the decades of debate.[7] Subsequent to the *Final Report* (1989)[8] were the *Information Literacy Competency Standards for Higher Education* (approved in 2000), and most recently the *Framework for Information Literacy for Higher Education* (adopted at the ALA Conference in 2016). Together, these three texts help explicate the rise of information literacy and information literacy instruction in the United States, both for instruction librarians and non-librarian college instructors.[9,10]

Then, as now, librarians were considered specialists who understood the organization of information in physical and virtual spaces. Librarians' original point of contact with students was teaching them library use; many institutions had specially tailored courses or programs where librarians taught students how to navigate the library

course without learning how to use a library. All that is taught in college amounts to very little; but if we can send students out self-reliant in their investigations, we have accomplished very much." (Robinson 1876, 124)

[6] ERIC reports online go back to 1998; print versions in the catalogs we searched go back to 1966. ALA began publishing standards and guidelines in 1957. See the ACRL website's institutional history section. Library Orientation Exchange (LOEX), an "educational clearinghouse for library instruction and information literacy information," was founded in 1971 after the First Annual Conference on Library Orientation at Eastern Michigan University. A history of LOEX is available at https://www.loex.org/about.php.

[7] *Improving Library Instruction* (Kirkendall 1979) is more evidence of interest in teaching and the information literacy landscape in the 1970s. We have not been able to access the preceding reports—if they existed—with the exception of "Towards Guidelines for Bibliographic Instruction in Academic Libraries" (ACRL 1975).

[8] Hereafter, 1989 *Final Report*.

[9] Other countries have also developed their own information literacy standards and frameworks; for example, the UK Standing Conference of National and University Libraries' Seven Pillars of Information Literacy, which builds upon the position paper of 1999 (Bent and Stubbings 2011), and the Australian and New Zealand Information Literacy Framework (Bundy 2004). The Nordic countries and South Africa, Botswana, Taiwan, and Brazil, as well as international agencies such as UNESCO, have played a role in defining information literacy practices worldwide. See Whitworth 2014, 52–55.

[10] Also worth mentioning here is the 1987 Model Statement of Objectives for Academic Bibliographic Instruction. A task force began to review it in 1998, and the review, which "updates and replaces the older Model Statement," was approved by the ACRL Board in 2001. The links to the 1987 Model Statement on the ACRL site are no longer active, but the University of Illinois at Urbana-Champain Libraries' website has a helpful summary of the goals outlined in it (see http://www.library.illinois.edu/infolit/learninggoals.html).

space, catalog, and collections.[11] In fact, faith in librarians' expertise navigating the difficult (pre-digital) information landscapes was so high that Mary Cassata proposed in 1973 that the library instructor be asked to "sit on the dissertation committee, being called upon his expertise to comment on the bibliography" (1973, 7). Cassata further suggested that the "ideal relationship between faculty and librarian would be for them to engage in scholarly collaboration as equals" (1973, 7).[12] About the same time as this ringing vote of confidence in librarians' important role in guiding researchers through complex information landscapes, however, a darker note was sounded about the cost of repetitious training sessions. For librarians "to repeat again and again the rules for the use of the card catalog costs not only professional time better invested, but drains morale reserves" (Larson 1972, 3, 10).[13]

In response to this profound sense of librarians' important, underutilized information expertise, librarians in the United States sought to categorize and standardize library instruction in the 1970s. A report prepared in 1972 by the ACRL Committee on Bibliographic Instruction, for example, identifies four discrete categories of bibliographic instruction: first, instruction that takes place within institutions that offer a formal course with or without credit. The second, "course-related library instruction," is bibliographic instruction related to a class assignment. The third category, "self-instructional library programs," was essentially on-demand audiocassettes or slides that taught students bibliographic instruction at their "own time, place and pace of learning." The final category identified was "non-formalized instruction programs." This final category, in retrospect, is an important precursor to the three core information literacy texts, particularly in its insistence on an "ongoing" bibliographic training (as opposed to a one-off) that pairs teaching students how to use a catalog with developing their understanding of when to use it (Kirk et al. 1973). However, by the end of this same decade of experiment and growth, librarians faced a creeping sense of the diminishing value of library/bibliographic instruction, with one study concluding that "most college students see it as sheer high school busy work" (Hardesty 1979, 18). On the one hand, librarians were more

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[11] In the 1960s, *College and Research Libraries* reported that 81 percent of the libraries indicated giving some form of library instruction (Hardesty 1979, 14, n. 13).

[12] Similarly, in "Instruction or Induction: The Human Approach to Student Involvement in Library Materials," Thelma Bristow wrote: "I am convinced that the shape of things to come in the universities must include full use being made of the university library in the teaching of undergraduates and the librarian and his staff being involved just like the teacher only in a different capacity. This is an area of library activity where no amount of automation or mechanized information retrieval will replace the competent librarian or displace the book as a teaching medium." (1969, 5).

[13] We see a concerted effort to define and improve instruction gaining momentum in this early moment; 1973 was also the earliest reference we found to the Model Statement of Objectives. The May 1975 issue of *College and Research Libraries News* notes "the beginning of an effort by the ACRL Bibliographic Instruction Task Force to provide a useful statement on bibliographic instruction." This note reveals that the terminal objectives were written in 1973 (their final version was approved at the ALA conference in July 1974).

important than ever. On the other hand, the importance of that work faced a public relations and communication crisis.

It is out of this potent blend of need, experimentation, ambition, and crisis that the three reports grew. The 1989 *Final Report* was written by members of the ALA's Presidential Committee on Information Literacy at the behest of then ALA President Margaret Chisholm in response to a sense of the challenges and opportunities birthed by the nascent "Information Age." The report focuses on information literacy specifically as it pertains to productivity and democracy. It highlights the importance of developing critical learning skills in students through "coordination of school/campus and public library resources/services with classroom instruction in offering resource-based learning." This document describes information literacy training as a necessity: "a survival skill in the Information Age" by which students are taught "how knowledge is organized, how to find information, and how to use information in a way that others can learn from them."[14] The 1989 *Final Report* explicitly lays out the pitfalls of a world without information literacy training and emphasizes the potential harm that the fragmented and unequal nature of access to information carries in undermining the democratic values of American society. "People—as individuals and as a nation," the report insists, "must be information literate" (ALA 1989).

But how do students get there? The methods of instruction by which this essential "survival skill" ought to be taught, according to the 1989 *Final Report,* required collaboration among librarians and teachers, both in K–12 and higher education.[15] Importantly, the 1989 *Final Report* positions librarians as the teachers of teachers, urging librarians to lead "frequent in-service teacher workshops."[16] The practice of professional development via "teacher in-service" is, of course, more common in the K–12 educational world than in higher education, where professional development tends to take other forms. However, the model is still revealing for the theory of librarian–instructor collaboration that it advanced. At least in the final decade of the twentieth century, getting information literacy instruction into the classroom happened through multiple degrees of separation. Librarians were to be trained in information literacy instruction. They were to then train instructors through teacher in-service workshops. Those teachers, perhaps days or months later, would (ideally) find ways to bring that in-service training into their own classrooms and train their own students.

The 1989 *Final Report* presents information literacy as a set of skills and insights that can be taught. To teach these, it calls for the restructuring of the learning process to "not only enhance the critical thinking skills of students" but also to "empower them for lifelong

[14] This definition is quite similar to that mentioned by Katherine Rottsolk in Kirkendall 1979: there the goal of information literacy is "developing intelligent persons who, independently, can locate and assess the sources of information needed for a wide variety of intellectual, social and personal concerns" (65).

[15] ALA 1989, *Opportunities to Develop Information Literacy* section.

[16] ALA 1989, *An Information Age School* section.

learning and the effective performance of professional and civic responsibilities." In this text, information literacy training is foundational in its significance and revolutionary in the way its delivery is planned. Were librarians and teachers/faculty able to carry out the revolution together then?

In legal history, if a law prohibiting an act is enacted time and time again, it is perceived as living proof that the law is not observed in practice. In this light, *The Information Literacy Competency Standards for Higher Education* in 2000 might be interpreted as evidence that the proposed revolution of the 1989 *Final Report* had not borne fruit after 11 years. However, it is more useful to see these documents less as revolutionary than as iterative and evolutionary. Tracing shifting terms such as *library orientation*, *bibliographic instruction,* and *information literacy* over decades indicates an ever-widening range of skills, knowledge, and literacies that librarians became responsible for mastering and then teaching. For instance, in 1995, ACRL changed the name of its "Bibliographic Instruction Section" to simply "Instruction Section," highlighting the significance of instruction broadly (Hinchliffe and Woodward 2001, 178). Thus, one could argue that the years following the 1989 *Final Report* heralded a gradual uptake and transmission of the values that the *Report* articulates.

While retaining the earlier document's sense of information literacy as an essential skill for students' collegiate, professional, and civic success, the 2000 *Standards* narrowed the focus of information literacy training to higher education—away from the all-inclusive (K–16) scope of the 1989 *Final Report*. According to this newer document, information literacy training must focus on college students' abilities to

1. define and articulate "the nature and extent of the information needed,"
2. access the needed information,
3. critically evaluate sources and incorporate selected information,
4. use information effectively for a specific purpose, and
5. understand many of the economic, legal, and social issues surrounding the use of information, and have the ability to use information ethically and legally.

Like the 1989 *Final Report,* the *Standards* positions librarians (and, sometimes, librarians working with faculty) as the primary instructors of information literacy. However, the *Standards* significantly broadens what librarian–faculty collaboration entails. First, instead of in-service, librarian-led, out-of-classroom teacher training, the *Standards* recommends that faculty and librarians work together to teach students. Overall, it emphasizes the importance of faculty and librarians "work[ing] together to develop assessment instruments and strategies in the context of particular disciplines" (ACRL 2000).

The *Framework for Information Literacy for Higher Education*, written in 2015 and ratified a year later, presents core concepts of information literacy rather than focusing on standards and performance indicators. Acknowledging the socioeconomic, historical, and cultural contexts of information and authority, the *Framework*

offers flexible options for implementation. Importantly, it also lays out even more explicitly the distinct roles that it argues faculty and librarians should play in fostering students' information literacies. For instance, faculty (which the *Framework* calls "teaching faculty") are positioned as having greater responsibility in designing curricula and assignments highlighting information literacy concepts within their disciplines (ACRL 2016). Librarians, by contrast, have greater responsibility to extend learning for students, create new curricula for information literacy, and collaborate "more extensively with faculty." And the *Framework* is quite clear just how much more extensive this collaboration needs to be:

> It is important for librarians and teaching faculty to understand that the *Framework* is not designed to be implemented in a single information literacy session in a student's academic career; it is intended to be developmentally and systematically integrated into the student's academic program at a variety of levels. (ACRL 2016)

Rather than seeing information literacy as a concrete toolkit that can be transmitted in a single workshop, the *Framework* treats it as a lifelong quest. Shying away from fulfilling all information literacy needs in a single disciplinary-specific session, class workshops here become the small-level training units through which that much longer, bigger, wider-ranging quest may begin to be fulfilled. Overall, however, the *Framework* is a statement of how academic libraries' goals for improving student learning outcomes via information literacy instruction are not yet being achieved—and how we might go about fixing that.

Thus, from the 1989 *Final Report* to the 2016 *Framework*, we trace a shifting focus: from teaching students a set of concrete skills to a process of inquiry, based on the notion that information is always created and contingent.[17] But this exciting, expanding definition causes expansions in other areas as well. Because information seeking and use must be integrated within field-specific contexts, the *Framework* implies, without explicitly recommending, that librarians be (or become) highly trained librarian–teachers. This arguably sets up an impossible checklist of perfection: librarians must maintain deep field knowledge, have expansive information expertise, be skilled at navigating potentially explosive institutional hierarchies, *and* be creators of innovative information literacy assignments that fold seamlessly into larger curricular arcs created by someone else (Buchanan and McDonough 2017, 3–7).[18] One might go so far as to say that the emerging best practices for information literacy set up instruction as an unreasonable task when it is assigned solely, or

[17] Most recently, see Fitzpatrick 2016.

[18] There is ample literature on how to integrate (critical and radical) information literacy training into hour-long bibliographic instruction sessions. Buchanan and McDonough 2017 provide lesson plans to improve the sessions, as do Bravender, McClure, and Schaub 2015; Burkhardt, MacDonald, and Rathemacher 2010; and Swanson and Jagman 2015, to cite some of the more recent literature. The Library Orientation Exchange (LOEX) publications and website are also useful reources.

even primarily, to academic librarians.[19] It pits libraries' best ideals against the realities of classroom instruction, in classrooms that are largely "owned" by faculty. In practice, it is still relatively rare for librarians to be fully integrated into specific courses and curricula. To achieve this rigorous collaboration championed by the *Framework,* faculty need to be fully onboard in ways that they often are not—yet.

The fact that higher education accreditation agencies incorporate information literacy into their own standards only when urged to do so by faculty and librarians[20] shows that even when faculty and librarians unite, there remain systems and habits in place that preclude the collaboration necessary for full integration of information literacy into the curriculum—almost 30 years after the 1989 *Final Report*'s publication.[21] Moreover, full curricular integration requires buy-in not just from faculty but from the *senior* faculty and high-level administrators who sit on faculty tenure and promotion committees that assess the value of these time-consuming collaborations. Thus, on the one hand, there are real and important benefits that result from integrating information literacy instruction into discipline-oriented instruction. Troy Swanson, library department chair and teaching and learning librarian at Moraine Community College, suggests that the 2016 *Framework* could be refreshing for faculty, because the perspective that librarians bring is "at once between and within disciplines" and therefore "helps faculty members to step away from their own disciplinary biases and gain perspectives" (Swanson 2017, 13–14). On the other hand, methods of assessing and rewarding librarian–faculty teaching collaborations lag far behind what they need to be (Lowe et al. 2015). For instance, cross-disciplinary collaboration between faculty is notoriously difficult to assess for tenure and promotion. And that is in the case of cross-disciplinary work that is being seen and rewarded (albeit sometimes in a flawed fashion) by institutional powers. Cross-disciplinary faculty-librarian interactions and collaborations are not even given that institutional buy-in—yet. Despite decades of work, we are far from institutionalizing student-focused library–faculty interactions with all the necessary systems, incentives, and trainings for it to materialize.[22]

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[19] The emphasis on collaboration in Appendix 1 of the *Framework,* titled "Implementing the Framework," could be interpreted as a tacit confirmation of and an attempt to compensate for this impossible task via suggestions for faculty and administrators on how to use the *Framework*.

[20] The Middle States Commission on Higher Education's accreditation Standard III, Criteria 5.b. includes information literacy in a list of "essential skills" that a curriculum should be designed to address, but the term was included only after a forceful pushback from librarians and faculty at a town hall meeting on the accreditation standards document (MSCHE 2014, 8; Evans 2014). Thanks to Lisa Hinchliffe for pointing out the discussions that led to Evans' 2014 blog.

[21] See "For Faculty: How to Use the *Framework*" and "For Administrators: How to Support the *Framework*" sections under Appendix 1.

[22] In something of a return to the teacher in-service model suggested by the 1989 *Final Report,* Swanson also refers to a course for faculty aimed at improving their pedagogical practices through the concepts outlined in the 2016 *Framework* (Swanson 2017, 12–14).

To test theories of information literacy collaboration in a practice-based setting, the faculty member of this writing team ran an experiment from December 2016 to June 2017 on integrating information literacy instruction within an existing "Introduction to Medieval Literature" course. In the narrative of practice that follows "I" refers to this faculty member's perspective. Thus, this narrative is not meant to characterize or speak for all faculty experience at all institutions, but rather to offer a window into information literacy collaboration praxis. In doing so, we seek to bridge the gap between theory and practice, as well as between faculty and librarian.[23]

Narrative of Practice: Creating a Team

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I began by e-mailing a cataloging and metadata librarian I had worked with in the past, asking if she knew where I might start. Librarian readers will likely roll their eyes at this: they should. But it is also a useful reminder. Even though I have been deeply engaged with libraries all through graduate school, as a CLIR postdoc, and into my professional career, librarian roles are often opaque to me. As a faculty member, I do not understand the intricate ecosystems of academic libraries. I do not believe I am alone in this.[24]

The process of identifying a collaborator was unexpectedly stressful because I had some inkling of what I wanted to do in my classroom but didn't know who in the library could or would want to partner with me. As someone keenly attuned to power dynamics in higher education, I did not want to skirt proper channels or throw my faculty weight around, saying I would only work with x or y librarian. But I also deeply cared about finding a partner who was invested in pedagogical innovation and collaboration. Happily, I was eventually connected with Julia Glauberman, the library's newly hired Instructional Outreach Librarian. Given the intricacies of academic library organization, and the complexities of inner library politics, I did worry—and continue to worry—about the ways in which I may have stepped on anyone's toes in the process of finding my library collaborator.

[23] Julia Glauberman and Bridget Whearty intend to co-author additional articles about their experiences collaborating on embedding information literacy instruction within medieval studies and literature classrooms. We hope that coauthoring will further decenter one voice (faculty or librarian) to better center a multiplicity of student voices and experiences.

[24] This lack of clarity about library structures is exacerbated as faculty move between academic institutions. Because the specific service model favored by academic libraries can vary by institution, faculty may be additionally challenged by transitioning between unexplained service models in their new institutional home. On this point, I am particularly indebted to Julia Glauberman, who diagnosed the underlying institutional and organizational issues for which my confusion is a usefully revealing symptom.

Facing the Realities of Institutional Hierarchies

While librarians' vocabulary has shifted from "information literacy" to "critical information literacies," a terminological shift that seeks to help students see, understand, and even destabilize inherited information hierarchies, these efforts are haunted—and curtailed—by a number of institutional hierarchies. Unless these institutional hierarchies are openly acknowledged and addressed, they will continue to form a maze of barriers to effective librarian–faculty collaboration.

First, librarians and faculty often lack a basic understanding of the institutional structures in which the other group moves—let alone how much those institutional structures may vary among institutions or how they change within a single institution as it responds to budgetary ebb and flow. For example, we have written about "librarians" and "faculty" as though those are straightforward categories, but they are not. In reality, many subcategories exist within each. There are librarians with faculty status and without faculty status—those with faculty status may be non-tenured or tenure track. There are also institutions where librarians are ranked as professional staff. Additionally, although non-librarian staff, such as library assistants at the circulation desk, may be the front line contact with students and faculty—and therefore be perceived by students and faculty as "librarians"—they tend not to hold positions involved in library instruction.[25]

Similar complexities lurk beneath the umbrella term "faculty." Pre- and post-tenure-track faculty experience very different institutional pressures, but both may find that these pressures profoundly shape what they are able to do with their teaching. There are also positions that the American Association of University Professors identifies as "contingent instructional staff," but which are perhaps better known as adjuncts. These positions can include full-time non-tenure-track faculty (sometimes called "lecturers," "instructors," "visiting assistant professors," or "VAPs"), some of whom hold renewable contracts of various lengths. This contingent category also includes part-time faculty: some part-time adjuncts may be experts brought in to fill curricular gaps. However, most part-time adjunct faculty have the same basic credentials as tenure-track faculty but, in general, carry higher teaching loads, get paid far less, and get little (or no) research support.[26] Finally, current graduate students also may work as full instructors, and these graduate students/instructors' pedagogical training and course loads vary, sometimes enormously, between departments and institutions. According to the American Association of University Professors report, *The Employment Status of Instructional Staff Members in Higher Education*, as of 2011, contingent instructional

[25] Although we do not directly address pay disparities between librarians and faculty in this discussion, readers wishing to do so could usefully consult Robert Perret and Nancy J. Young's "Economic Status of Academic Librarians" (2011).

[26] This is, of course, a general overview. A comprehensive list of faculty job titles can be found in Michael I. Shamos' *Handbook of Academic Titles* (2002).

staff (including graduate instructors) made up more than 75 percent of "faculty" in American higher education (Curtis 2014, 2).

We contend that a lack of clear understanding of these myriad, murky hierarchies inhibits mutual understanding—and, therefore, collaboration—between librarians and faculty. For instance, a faculty member may approach a library staff member as a potential collaborator, not realizing that their larger institutional hierarchies limit instruction duties to staff holding the designation "librarian" (however the institutional leadership, at that moment, may choose to parse the difference). Similarly, librarians might seek to collaborate with a faculty member who is actually an adjunct teaching at several different schools. In that case, a faculty member may have neither the time to collaborate nor the institutional support necessary for sustained, transformative collaboration to blossom.

Ultimately, the roots of the difficulties that librarians may have in successful instructional collaboration with faculty reach back into the pedagogical training that future faculty receive while still in graduate school. Given emerging research suggesting that a small number of elite universities produce the vast majority of faculty, these institutions' pedagogical training for their graduate students, or lack thereof, may well have an outsized impact on faculty teaching trends across North America (Clauset, Arbesman, and Larremore 2015; Oprisko 2012).[27] In other words, librarians' efforts to collaborate with faculty on student-centered information literacy instruction may be hampered not just by their own institutions' values and local hierarchies, but by a systemic valuing of research above teaching, reaching back to faculty members' graduate student days, their graduate school pedagogical training, and the relatively low value that faculty members' graduate school mentors and committee members may have assigned to pedagogical labor and the scholarship of teaching and learning.

Anecdotally, the experiences of the authors are consistent with the sense that most graduate programs underprepare future faculty for productive and innovative collaborations with librarians. We graduated from different PhD-granting institutions and different disciplinary programs, which offered very different teaching opportunities and pedagogical training. But none of us heard of "information literacy" in that pedagogical training. Though some of us had brief introductions to the library as teaching assistants, none of us were taught to view librarians as innovative co-creators of student-centered instruction. We were never taught, for example, that "[h]aving input on course research assignments is how librarians

[27] A few caveats are needed for these studies. First, they necessarily limit their sample groups to specific disciplines: political science in one; computer science, business, and history in the other. Second, both studies examine job placement at doctoral-granting institutions in North America. Thus, they do not shed much light on job placement at the vast majority of institutions of higher education, including community colleges as well as public and private institutions that grant only bachelor's and master's degrees. Third, their inquiry is into tenure-track job placement. Thus, the only light they shed on non-tenure-track faculty job placement (i.e., the majority of faculty positions today) must be read in absentia and between the lines.

can make the most difference" in helping ease students' difficulties managing research (Davis 2002, 54). As PhD students running our own classrooms, we knew nothing of librarians' multi-decade debates about information literacy. Nor were we aware of the existence of many librarian-authored, pedagogically oriented publications calling for collaboration with us.[28] We might further note that this lack of knowledge continues as graduate students become faculty.[29] For instance, in preparing this paper, no faculty colleagues we spoke with who were not already associated with CLIR had heard of the *Framework for Information Literacy for Higher Education*—let alone the subsection of the *Framework*'s Appendix 1, "For Faculty: How to Use the Framework."[30]

Another institutional hierarchy that stands in the way of effective collaboration is the prioritization of disciplinary instruction above library instruction. Consider, for example, laments such as, "I just don't have time for a library session, let alone one dedicated to information literacy; I have too much to cover this term." But privileging content or discipline mastery as separate from, and above, information literacy does not reflect the reality of information seeking, use, and consumption. In our own research, and in our lives beyond the academy, we seek and use information to answer pressing, content-oriented questions. In college-level course design, information literacy and disciplinary mastery cannot be separated from each other. Failure to recognize this weakens our students' potential to be information literate as they move through their courses, careers, communities, and world.[31]

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[28] This phenomenon of librarians' and information literacy's absence in our training as graduate student teaching assistants (TAs) and instructors must be contextualized. Graduate student teacher development is a growth field. There is no earlier golden age of pedagogy during which all graduate students everywhere were impeccably trained as instructors and TAs for undergraduate courses. Instead, we believe we are on the horizon of the golden age. Furthermore, we believe that as graduate pedagogy training is being reinvented, department by department and institution by institution across North America, increasing opportunities for collaboration with librarians—both in training seminars and in the courses that graduate students go on to teach—may well be one of the missing links that can lead to the improved, student-centered classroom collaboration that we have been seeking for years.

[29] Weiner notes that tenured faculty take a more capacious view of, and are more engaged in, information literacy instruction than their pre-tenure colleagues (2014, 9–10). One reason for these inconsistencies in instruction, pre- and post-tenure, may be that pre-tenure faculty are playing a game of pedagogical "catch-up," in essence *rediscovering* and *redeveloping* the same or quite similar curricular tools for teaching information literacy that their post-tenure colleagues have already created.

[30] This raises a larger question that we cannot answer here: how many librarian-created resources explicitly addressed to faculty or containing recommendations for faculty are languishing unread by their target audience? In a way, we suffer from another version of the information overwhelming our students. To draw on Ann Blair's iconic study, there is still "too much to know." Faculty may be expert researchers, but their efforts are generally focused on staying abreast of their own fields. Those who wade into research on pedagogy find the scholarship of teaching and learning another enormous field of study. Given the sheer size of the field and the number of publications written by faculty for faculty, how likely is it that professors and graduate students seeking solutions will actually find librarians' pedagogically oriented publications—or those publications' *cris de coeur* for better collaboration with faculty on research instruction?

[31] Even though the main tenets of our discussion are intended to apply to information literacy efforts across the disciplines, we acknowledge that our narrative of practice is

This reality of a healthy back-and-forth between discipline mastery and information-seeking is outlined in the *Final Report*, in the *Standards*, and in the *Framework*'s recommendations for best practices for information literacy instruction: information consumption *plus* knowledge production. When librarians teach their own credit-bearing courses, they can and often do teach information consumption *plus* knowledge production.[32] However, not all institutions allow librarians to design and lead their own courses, and in collaborations with faculty, librarians may in fact be discouraged from seeing knowledge production as their domain. The ACRL's *Objectives for Information Literacy Instruction: A Model Statement for Academic Librarians,* for example, does not include performance indicators, learning objectives, or outcomes for Standard Four ("The information literate student, individually or as a member of a group, uses information effectively to accomplish a specific purpose") because "its Performance Indicators and Outcomes are best addressed by the course instructor, rather than by librarians."

Furthermore, what is often taught as *information literacy* is, in many ways, *information consumption*—a subsection of information literacy that focuses more narrowly on finding and assessing sources. To be clear, this is a vitally important skill. The ability to make key quality judgments is the difference between a research paper that uses "ancienthistory.about.com" or "history.com" and one that uses *The Oxford Dictionary of the Middle Ages*. It is also the difference between a person who believes misinformation masquerading as news and one who can distinguish a reputable newspaper from a fringe propaganda site, or a news source that has been invented to spread one false story. While we must help students learn both to find information and to constantly assess its quality, over-reliance on *use-this-not-that* instruction can result in faculty and librarians skipping the deeper and richer lessons of information *literacy.* Literacy implies, or ought to imply, a thorough understanding both of what the source itself says and of why it says those things: Who wrote it, who funded it, why and when? How were the underlying data gathered? How is the source accessed and maintained? Literacy also means helping our students place their one source within a larger information ecosystem and then helping them parse the *whys* of that ecosystem, too. But, as Alison J. Head and Michael B. Eisenberg's study of 191 handouts for research assignments reveals, very few prompts are designed in ways that help students engage with this shifting web of authority, timeliness, honesty, and power (Head and Eisenberg 2010).

Concerned critiques of the ways information literacy may risk training students to respect information hierarchies rather than

from one humanities discipline and that collaborations in STEM classes, for example, will likely be very different from those in the humanities.

[32] For example, Mackey and Jacobson's (2014) "metaliteracy" approach, a "reinvention of information literacy for a postmodern social age," acknowledges the changing landscape of information production due to emerging and changing technologies (14). Their metaliteracy model "includes the ability to incorporate and use information but also expands the domain to include the ability to produce and share information, and to collaborate and participate in social media settings" (25).

dismantle them have their place.[33] These critics note that much of the "authority" baked into academic library collections comes by way of highly profitable publishers like Elsevier or Taylor and Francis as well as industry-dominating database purveyors like ProQuest and EBSCO. But while students must not unthinkingly worship the information hierarchies that they inherit, they also cannot burn them to the ground. Instead, they must be empowered to understand, navigate, *and* transform them. Fundamental to these transformations, however, are the foundational truths that not all information is created equal and no piece of information is ever truly neutral. We must never forget the outright information erasures that have been and in real ways continue to be the products of lasting racism, class bias, sexism, heteronormativity, eurocentrism, and other systemic biases. A shared central task, perhaps *the* central task, of librarians and faculty is helping our students confidently see, negotiate, contribute to, dismantle, and ultimately transform these hierarchies of information that they inherit from the partial, multi-intentioned, and complicated generations of knowledge producers who came before.

Finally, it is important to note that a central part of information literacy, and of critical literacy studies and critical pedagogy, is training students by modeling ways to constructively question authority. Let us acknowledge what a monstrous task this can be for librarians, whose authority is often undermined by institutional structures that persist in treating them as *less than* faculty, providing service for faculty and students.[34] In information literacy instruction, librarians are simultaneously tasked with teaching students to question authority, while invested with only minimal or undermined institutional authority, placing them in an already contradictory position that can be exacerbated by the ongoing gendering of librarianship as "pink collar" labor (Gaines 2014, Pagowsky and McElroy 2016).[35]

Narrative of Practice: Surfacing What Tends to Go Unsaid

When I initiated the collaboration with Julia Glauberman, holder of my university's newly created role of instructional outreach librarian, I didn't think my Introduction to Medieval Literature course was an obvious fit with information literacy instruction. My assignments and learning goals for this 200-level class didn't ask my students to use the correct databases to find relevant, well-vetted secondary sources—which is what I, at this point, took information literacy instruction to address. Instead, for this collaboration, I wanted help teaching my students how to understand 1) when they lacked adequate information to "get"

[33] For example, Wilder 2005 and Moe 2017.

[34] For expert analysis of the tensions between perceptions of librarianship as a care/service/female profession and librarianship as an expert/managerial/male profession, also glossed as "small librarianship" versus "big librarianship," see Gaines 2014.

[35] We hope that one effect of this paper will be renewed community advocacy for information literacy instruction that is cognizant of the role that academic institutions and notions of "literacy" have played in perpetuating fraught and intersecting legacies of race, class, gender, sexuality, and trans oppression.

their reading (primarily medieval poetry) and 2) what resources beyond JSTOR, Google Scholar, and Wikipedia they could use to fulfill their own information needs. Often, I do not see students demonstrating a deep comprehension of what they read. My experience with information literacy instruction to date told me that this particular learning goal—reading comprehension linked with thoughtful inquiry—didn't qualify. It was too basic, and not something faculty usually asked librarians for help with. Should I even be bothering a librarian? Was it a failing of my own pedagogical approaches that my students seemed able to rattle off answers, but often didn't seem to understand what those answers actually meant?

Librarian readers deeply steeped in their field's multi-decade discussions and debates are probably bemused by this narrow view of the scope of information literacy. Julia certainly had a broader view of what information literacy entails, as will become clear in this narrative. However, it is important for those readers to recall that most faculty know little of librarians' long-term information literacy discussions. Instead, particularly if librarians played no role in our pedagogical training to become graduate student–instructors, we faculty may rely on our own experiences of library instruction as graduate and undergraduate students—and believe that what we were given (5, 10, 15+ years ago) is what librarians have to give.

The larger point here is twofold. For librarians, the take-away may be to recognize that faculty members likely hold assumptions about what information literacy is and is not, even if they have not heard the phrase itself. These assumptions may get in the way of collaboration, either because the faculty member doesn't think to ask a librarian for help in the first place, or because her sense of the librarian's role is limited. For faculty, the take-away can be that some of the challenges we face in helping our students master research skills for navigating information glut may, in fact, be something a librarian can help with. Furthermore, even if these challenges do not obviously involve what we think of as "librarian work" or "information literacy," there may be librarians at your institution interested in helping you help your students learn.

With the help of an instructional designer from my campus's Center for Learning and Teaching, Julia and I designed an in-class "lab" to help students start to focus on what they didn't know and some of the tools they might use to fill those gaps. Students read the first third of *The Consolation of Philosophy* (written 524). In addition to doing the reading, they were supposed to come to class with a list of at least 10 concrete things (words, references, allusions) they encountered in their reading that they did not know or fully understand. They were instructed to bring their laptops, so that Julia could introduce them to three types of library resources we had selected to help our students begin to answer their own curiosities and questions.

Then class fell behind. The first day that Julia was supposed to come in, most of class was spent finishing up on work from the previous class pertaining to the "myths" and misconceptions commonly held about the Middle Ages. (That Julia and I did not postpone the "myths"

module to get straight to library approaches to information-seeking reveals the ways that the hierarchy of content above library tools was still, insidiously, shaping our collaboration.) We pushed our planned lesson off to the next class day—miraculously, Julia was still available. Then that day was canceled because of snow. By the time Julia ran class, our third attempt, students had not looked at the reading for a week or more. They forgot their laptops. All things considered (the snow day, the fact that Julia and I had never worked together before, the fact that we were not doing the standard session), things worked out okay. However, we noticed that students—once they found the information they were looking for in the resources we'd selected for them—did not do much with it. Having accomplished their task—who is X? find X—they sat back and waited for us to tell them what to do next. It was not the empowered, curious information-seeking we had hoped for.[36]

After this class, Julia and I held a postmortem: What went well that we could repeat in the future? What had the students found difficult? What went less well, and why did it go poorly? What might we do differently together, and individually, in the future? And then we did it all again. We planned a second in-class assignment that would help students practice using the information resources that Julia had shown them and the information-seeking habits of mind that Julia and I, librarian and faculty, hoped to foster. This time, they worked as teams, writing on giant posters (Julia's idea) containing lines of Anglo-Saxon poetry. Their assignment was to look up words they didn't recognize and concepts they didn't understand, write their discoveries on their posters, and look for patterns in what they were uncovering. After this assignment, Julia and I met for yet another postmortem. Although this assignment seemed to go better than our first experiment, I retained lingering doubts. As we spoke together, I found myself thinking: "What I'm asking my students to do doesn't sound like information literacy to me. I love working with Julia, but maybe this close reading and deep comprehension thing is really just my problem. Maybe the library's not the best partner in this?"

Crucially, though, Julia offered her perspective, and her perspective kept our collaboration moving forward. As Julia (drawing on her own studies in information literacy theory and practice from the library side) saw it, the learning goals that we were trying to address stood firmly within the realm of information literacy instruction. However, she also could see that a lot of library instruction never includes this kind of foundational work that, ideally, precedes more obvious and more advanced information literacy work. There are, after all, only so many hours in the day, and a librarian gets only so much time with individual professors and their students. Librarians are keenly aware of faculty expectations, so the worry is that if the librarian chooses to address more basic, foundational skills like moving from reading to inquiry, she might come off as not doing her job. For example, a faculty member may

[36] In other words, we slid into the common trap of being what Mary Thill identifies as research *idealists* in a room of students who were largely, at this point in the term and with this assignment, functioning as research *pragmatists*. (For extended discussion and ethnographic study of *idealist* and *pragmatist* modes in librarians and in faculty, see Thill 2012.)

book a library session expecting the librarian to show students Database X and Database Y. But the librarian may suspect that the students don't even know what a database is, let alone have a context for understanding how a database functions or why they would want to use one at a particular moment to help answer their particular questions. The librarian would then be in a bind: do they do what they've been asked to do, or do they meet students where those students really are? In the same situation, a librarian tasked with teaching database searching might also know that because the students lack a basic understanding of what a database is, they also can't know (without the librarian's help and time) that the interface is not the database and the company is not the database. Likewise, students do not understand that when they fail to find relevant full-text results, it may be an economic issue (i.e., limited by what the library can afford) rather than a technical issue (i.e., something's wrong with the database) or scholarly issue (i.e., nothing's been written on this topic). The librarian can know these gaps in her students' understanding and want to help fill out their understanding of the information economy, but feel hamstrung by faculty expectations.

Because faculty, like me, often believe that students already know the basic things about information, a librarian might hesitate to suggest that she spend precious instruction time explaining what a high-level dictionary is—even if that is what she suspects the students really need. One of the worries of librarians in Julia's place, she explained to me, is that a faculty member might not ask her back in the future if she spends time on what she thinks the students need rather than on what the faculty member thinks they need. Given pervasive institutional hierarchies that often put teaching faculty's expertise and priorities above librarians', librarians also might worry, she explained, about coming off as insubordinate by asserting their sense of what the students need. Finally, she observed that librarians often see any opportunities for face-time with students as the highest priority. This means that she will almost always say yes to an instruction session, even if she knows she may not have the freedom to experiment with a more effective pedagogical approach than the database demonstration that a faculty member is asking for.

As we met together across several weeks, we began to build a real rapport. Because of this rapport, we grew comfortable speaking frankly about our concerns and goals. Through these (sometimes uncomfortable) conversations, we connected through our shared goals for empowering students. In classroom assignments, in midterm papers, in their careers and lives, we hoped to help students ask questions that matter to them and then go on to answer those questions using a diverse array of carefully selected information resources appropriate to the task at hand. Perhaps more importantly, our conversations revealed how many things go unsaid in librarian–faculty interactions, particularly interactions dedicated to helping students gain expanded, more dynamic information literacies.

Hierarchies, Inequalities, and Contact Zones

Perhaps one way around some of these challenges lies in faculty members and librarians deliberately shaping the information literacy classroom as a *contact zone*.[37] Coined by Mary Louise Pratt, the term refers to a space in which "cultures meet, clash, and grapple with each other, often in contexts of highly asymmetrical relations of power"—a space that can be used to rethink the utopian "models of community that many of us rely on in teaching and theorizing that are under challenge today" (Pratt 1991, 34). She argues that, instead of perpetuating an illusion of equality, we should acknowledge the uneven power structures and struggles in the academy. This process, she further contends, has the potential to yield "critique, collaboration, bilingualism, meditation, parody, denunciation, imaginary dialogue, vernacular expression," what she calls "the literate arts of the contact zone" (37).

Applying Pratt's theory of "contact zones" to these kinds of collaboration helps show that part of the problem in information literacy instruction (as it has been practiced) lies in a systematic investment in the idea that "we are all equal." We are not. Papering over inequalities between librarian and faculty (and among librarians and among faculty) hinders effective collaboration and instruction. Instead, if faculty and librarians are more able to highlight and demonstrate those unsteady contact zones at work, students will have a better window into what rigorous, cross-expertise critique, dialog, and collaboration can look like in action.

Moreover, we contend that deep engagement with and production of these "literate arts of the contact zone" by librarians and faculty, working together, will better equip students to recognize "fake news" and other forms of misinformation. In this supposed "post-truth" era, helping students use course assignments to practice nuanced, ongoing evaluation of information from a diverse array of sources has incredibly high stakes. Given this context, it is important for faculty and librarians to acknowledge that—although academic library information literacy instruction does not traditionally focus on assessing news media but rather on finding and evaluating scholarly sources—research suggests that many students do not perceive a stark difference between scholarly and popular news sources (Davis 2002; Georgas 2015). Thus, whether or not academic librarians teach students to evaluate news sources in information-literate ways, news sources are coming into the college classroom—on information-seeking students' screens and their bibliographies and "Works Cited" pages.

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[37] Another may lie in using Alison Cook-Sather's work on education as translation. Using translation as an interpretive framework, Cook-Sather suggests, "captures the iterative, analytical, and relational work of meaning making that unfolds in the pedagogical relationship." While Cook-Sather's recent work centers on translation as a useful metaphor for transforming the student–faculty relationship, we suggest that her findings are applicable to the student–librarian relationships in librarian-led classroom instruction and to the librarian–faculty relationship more broadly. (For the precise phrasing, see Cook-Sather and Abbot 2016, 2; for the larger concept, see Cook-Sather 2006.)

Rather than lament this state of affairs or shame students into lying about their true information-seeking methods, we—librarians and faculty together—would do well to join forces to help students see the research leading up to those contested Works Cited pages as another contact zone. As they read and think, our students are already drawing together different cultures of information. We can help them learn to see those asymmetrical relations of power and hierarchies in those information sources, so they can make informed and empowered choices. In simultaneously demonstrating the flexibility of information literacy for "real world" work and showing how information literacy is deeply attached to the learning goals of specific courses and disciplines, we can develop a better collaborative classroom instruction that will empower students to become critical, literate users of inherited information as well as discerning producers of new knowledge.

Pratt's list of perils of the contact zone reads much like the labels we give to failed assignments and lack of student engagement: "[m]iscomprehension, incomprehension, dead letters, unread masterpieces, absolute heterogeneity of meaning" (1991, 34). As discouraging as these perils may be, they also show that we are already working in a contact zone. The process of inquiry encouraged by the 2016 *Framework* will allow a deeper engagement with information that once would have been overlooked, as Pratt puts it, "in defense of a stable, centered sense of knowledge and reality" (37). Explicitly questioning not only the information itself, but also the networks and power structures that produced it, allows us to grapple with the very hierarchies that inform our classroom dynamics. Instead of ignoring these hierarchies or purporting to eliminate them with a change in terminology—for example, the twenty-first century trend of insisting on library work as collaborative rather than service-oriented—we can improve student learning through engaging with those hierarchies in the contact zone of the classroom. Doing so will help students learn to recognize their own formidable influence on the creation and dissemination of information.

By openly acknowledging and grappling with institutional hierarchies that are so pervasive that they seem natural, we can productively use the imbalance of power that influences librarian–faculty interactions in both subtle and explicit ways. Taking this logic a step further, we can also recognize the ways that power dynamics in the classroom influence our interactions with students and inform our expectations of them. It is easy to bemoan students' limited application of the information they find, but how are we encoding these limitations and expectations into the assignments that we write? Perhaps our assignments are too prescriptive, consisting of a rigid prompt and a rubric that guides students into focusing on the minutiae of margin size but gives minimal (or no) guidance on either the complexities of scholarly communication today or ways students might masterfully seek and vet a wider variety of online (and offline) resources.[38] If students are to be actors in a contact zone, their perfor-

[38] In fact, this is very much what Head and Eisenberg's 2010 study of research handouts suggest.

mance of Pratt's literate arts of "critique" and "collaboration" must be allowed and encouraged—not just on the content but even on the assignments and goals themselves. These arts of the contact zone cannot occur if students are discouraged from cultivating their own processes of inquiry independently.

The key to achieving a true contact zone in the classroom is therefore empowering the students to generate their own research questions, rather than requiring them to gather information to answer a question that the assignment poses. This also helps respond directly to an important, common student critique of many research-oriented assignments as they currently exist: *Is this really new? Or am I being sent on a treasure hunt, set up to write down and report the same known wisdom that 30 other people in my class are also recreating and that 30 other students probably wrote the semester before and the semester before at schools around the country.*[39] In rewriting assignments in collaboration with librarians, faculty can lay the groundwork for a more productive classroom environment that teaches, and reteaches, every stage of the research process from generating a topic to finding quality resources to generating a thesis to confidently proposing new directions of research and inquiry.

In fostering skills like these, repetition is key: it is not enough to have these skills be curricularly located primarily in a first-year writing course or advanced capstone seminars.[40] Rather, helping our students develop the sort of flexible, highly adaptable information literacy toolkits that will serve them well not just in college-level research but in their lives beyond academia requires threading information literacy throughout their careers in a self-consciously contact zone-oriented way. By this we mean that faculty ought not to present the ways in which they gather information in their discipline as "*the* way to do research." Instead, they must emphasize transitions and toolkits: *This is how engineers gather and vet information and why they do it that way; by contrast, this is how economists gather and vet information*

[39] To push this somewhat further, students' knowledge that their "research" (in lower-level humanities courses, in particular) is not doing anything particularly new (i.e., not the actual work of scholarship) may also contribute to a generational sense that the humanities (as opposed to the arts, sciences, and social sciences) have nothing new to add. Better assignments—those more responsive to students' needs and interests *and* more in line with instructor research—may also help push back against the seemingly endless tide of crises in which the humanities have existed for decades and which has accelerated since 2008. This is not a starry-eyed claim that better prompts will suddenly result in a spike in enrollments or funding. We are neither so optimistic nor so naïve. Instead, it is an acknowledgment of some key facts about our students that often are not part of the assignment design process: many students are smart, ambitious, clever participants in the work of "doing school" (Pope 2001). They are entirely *able* (thanks to No Child Left Behind and similar public education policies) to dutifully recite back to instructors the pre-existing information sets that they think we want to hear. But they are more interested in being a full part of the conversation about their learning, in gaining useful librarian and instructor feedback, and in fostering their abilities to ask their own questions and chase their own answers (Blum 2016).

[40] Moreover, putting information literacy in one or two places in the curriculum leaves large gaps through which many students will fall. What about students who test out of first-year writing? Where will they get their information literacy instruction? What about transfer students? What about students who do not want to write a senior, capstone, research paper or honor thesis? Where will we give them the space and support to practice the skills necessary to succeed as civilians, workers, and voters?

and why they do it that way; and this *is how medievalists and literary historians gather and vet information and why we do it that way. When you leave school, you are going to need more than one field's methods and insights. I want you to add as many as you can to your toolkit, so you can integrate them as needed into whatever you are trying to accomplish.*

We anticipate that faculty readers will likely have at least two objections. Some may point out that they themselves already encourage this kind of integrative learning. If so, we applaud these individuals. Nevertheless, given the scope of the information literacy crisis of the "post-truth" era, we cannot depend upon individual faculty excellence to make enough of a dent in student outcomes. What about the students who do not take a course from said faculty member? Other readers may point out that, given the demands of staying abreast in their own field(s) of study, a faculty member cannot be expected to also have a basic working knowledge of research methodologies across the disciplines. We agree with that assertion. But you do not have to be that expert who understands complex information-seeking behaviors across the disciplines. We already have those experts. They are called librarians.

In a way, we advocate for an information literacy cousin to Writing Across the Curriculum (WAC) writ large, and Writing in the Disciplines (WID), in particular. This suggestion in itself is not new. Librarian readers might point to a number of studies, such as Sharon A. Weiner's "Who Teaches Information Literacy Competencies?," which notes the importance of "learning and practicing information literacy competencies occur[ring] throughout a curriculum, building progressively throughout an academic program" (2014, 5–6). Faculty readers, particularly those specializing in teaching rhetoric and composition, may rightfully claim that they are already involved in much of this labor, particularly work at the intersection of information literacy and "fake news" (Wayland-Smith, Brown, and Najmabadi 2017). Again, objections like these are also not wrong. We advocate for an approach to information literacy across campus that does not drop this vitally important work primarily upon one or two disciplines (as in the case of composition instructors) or leave students to translate and transition between disciplinary information ecologies without experts helping them compare, contrast, and build out their toolkits with the best information literacies from across the disciplines.

By creating an institutional culture that self-consciously and explicitly positions librarians as expert navigators at the confluence of the diverse information watersheds in which faculty swim, we hope to empower students to see information and information seeking, creation, and reuse as it exists "in the wild," as it were. The university becomes a transparent and accessible model of the kind of conflicting information contact zones that must be grappled with off campus. With librarians as students' trusted cross-disciplinary guides (like Virgil guiding Dante through the realms of the afterlife), we move beyond *consume-this-not-that* instructional modules to a broader arc that empowers students to approach information challenges armed with the tools of multiple disciplines and types of

expertise. In other words, across years of collaborative labor uniting librarians, faculty, and students, *use-this-not-that* is replaced with *use-which-skills-in-what-context-for-what-goals-to-what-ends*. Ultimately, this is what higher education exists to achieve. As Head and Eisenberg's multiyear study, *Project Information Literacy Report* (2010) reminds us, while students show gains in information literacy throughout their college career, they still do not feel confident about their ability to "ask and frame questions of their own" (Head 2017a). As a result, Head recommends "Fewer lessons on 'search'"; more lessons on "Integrat[ing] curiosity into search lessons"; and more "Embed[ding] librarians within courses" (Head 2017b).

Therefore, we advocate a move away from *consume-this-not-that* toward an instruction model that gets students to actively create new constellations of information to answer their own questions. We aim for learning outcomes that empower students as thinkers, workers, and voters, and enable them to adapt to future changes and challenges in the technological, social, and information landscape that we cannot anticipate today. As Mackey and Jacobson point out, information literacy instruction as "search-and-retrieval mode" does not meet the needs of scholarly communication today. They maintain that we must "acknowledge the interactive social resources for creating original materials such as shared texts and hypertexts, tags, bookmarks, digital images and audio, multimedia, and virtual worlds" (Mackey and Jacobson 2014, 22). Now, more than ever, there exists an urgency to empower students to adapt to this wider variety of materials, as information and the format in which it is presented will continue to grow and evolve.

Narrative of Practice: Putting Student Learning Objectives First

When Julia and I met to plan my Medieval Literature course's midterm, we did something we—I—had not done before. We discussed her goals and learning objectives, as well as mine, with an eye toward identifying what information literacy behaviors/muscles we could make sure the midterm helped students exercise.[41]

Julia identified two goals, with connected concrete assessments, inspired in part by the 2016 *Information Literacy Framework*.

1. If doing research involves engaging in real inquiry, then the midterm needed to get students beyond either a passive consumer model (tell me what to say and I will say it back to you) or a retriever model (tell me what to seek and I will fetch it back to you). To fit information literacy/library learning objectives, this midterm needed to put students explicitly in charge of the figuring out what

[41] That it took me until midterms to realize I could, and should, ask this is yet another indication of the ways that pervasive unequal hierarchies in higher education deform librarian–faculty collaborations. I should have realized that I could—that I needed to—ask this much earlier in our collaboration. I hope my *mea culpa* empowers other faculty to learn from my mistake: I doubt I am the first faculty member to fail to ask a librarian about her learning objectives and goals for our shared time with students.

question(s) they need to answer and determining what kinds of information would enable them to develop answers.
2. If we are trying to teach that information and authority are always constructed and contextual, then this midterm needed to get students out of the "I found it; I can cite it" model to think critically about the authority of the sources they were using.

In other words, we needed to co-create a midterm that was only part paper. Students needed to be graded on a) voracious information-seeking behavior, and b) seeking information from authoritative and high-quality sources.

This stage of the collaboration required flexibility on both sides. Julia, as librarian, had to help me catch up on all that "information literacy," from a libraries' perspective, can contain. She also had to practice saying "no"—or rather "No. If these are really our learning goals, I think X would work better than Y here."[42] I, as faculty, had to understand that my librarian partner had strong, informed, passionate opinions about assignments and assessment. Growing into being a better faculty collaborator meant listening more and talking less. This interaction was not entirely comfortable for either of us. But it produced much better results. In that productive discomfort of the "contact zone"—where we acknowledged our unequal positions in institutional power structures—we began to help our students move beyond mere information consumption and repetition. For their paper revisions, I began fielding push-back e-mails from students: "Professor, the prompt says I need to use X. But that approach doesn't help my argument for the following reasons. Is it okay if I cut X and seek out Y-other-information-source instead?" In other words, our students were not just seeking information because I told them to, from sources that Julia had taught them to use. They were weighing what information they needed for the task at hand and experimenting, mostly respectfully, with creating meaningful new information constellations.

Today, I sent an e-mail to Julia, asking if she'd like to work with me on my medieval course's final. This time, building on the lessons I learned working with Julia, I asked:

> Do you want to see the old assignment that I'm hoping we can build on? Or would you rather I revised alone, and then sent you something? Put differently, how involved in this revision/collaboration do you want to be? Would you prefer to roll up your sleeves and muck about from the beginning? Or play a more limited advisory capacity?
>
> Julia's response? "I'd be happy to roll up my sleeves and be really involved in the revision/creation process."

[42] As our collaboration continued, she shared touchstone texts for librarians seeking to say this kind of "no," or ways to turn down faculty requests that are pedagogically unsound and not in students' best interest, including Meulemans and Carr 2013 and "How and When to Say 'No'" in Buchanan and McDonough 2017, 25–27.

What Is Lost and What Is to be Gained for Librarians Going Beyond the Standard Bibliographic Session?

The librarian–faculty collaboration illustrated in the narrative of practice in this paper is much more resource-intensive than a single 50- to 90-minute library instruction session. We acknowledge that difficulty and the very real limitations it can impose on instruction. At the same time, we urge our readers (wherever possible given their institution's mission and resources) to focus more on the broader payoffs that could stem from making the customary one-shot session approach the exception and making more intensive, creative information literacy instruction the starting point for collaboration.

If a librarian and a faculty member aim to improve students' research skills, the interaction can go in a broader range of contextually appropriate directions, including, but not limited to, the one-shot instruction session—which in some contexts might still make the most sense, depending on the teaching goals and objectives.[43] In cases where there is flexibility and an openness to a range of possibilities, the one-shot instruction sessions need not dominate the librarian–faculty collaborations. By reducing the reliance on one-shot instruction sessions, librarians can devote more time to the harder work of outreach and collaboration that truly requires their high level of knowledge and expertise. Importantly, this more satisfying experience for the librarian also recenters students and, one hopes, could result in better student learning outcomes.

What is the potential payoff for librarians if they steer information literacy instruction efforts away from one-shot instruction sessions if and when the occasion arises? First, there is the potential for better learning outcomes because the information literacy instruction that occurs is more likely to be pedagogically aligned with the course. Second, we can expect that deeper librarian–faculty collaboration in the development of courses will lead to more lasting and potentially more fruitful relationships between librarians and teaching faculty. Third, through these more dynamic collaborations, the larger campus community may come to see librarians as expert educators in their own rights, and not just pinch hitters or support staff. Moreover, the collaborations could result in teaching experiences that are more challenging and rewarding for most librarians, and—most importantly—that are more student-centered and empower learners to better navigate the complex information economies in which we are all immersed.

Time will be a significant barrier since liaison librarians often wear many hats, whether at small colleges or large universities. For librarians who traditionally provide one-shot instruction to dozens of courses each semester, it may appear that taking this more

[43] There are many helpful books about how to get the best possible outcomes from those relatively brief interactions with students, such as Markgraf et al. 2015, *Maximizing the One-Shot. Connecting Library Instruction with the Curriculum*.

open-ended approach to pedagogical collaboration is unscalable. However, the library may well have a more positive impact on learning outcomes across the university by shifting, wherever possible, toward in-depth or substantive collaboration in fewer courses than skimming the surface in a larger number of one-off library sessions. Ideally, we envision something of a ripple effect for this transformation of the role of librarians as teachers: first, as collaborators with faculty in the (largely undergraduate) classroom; next, in sessions co-organized with centers for teaching excellence; finally, and we hope quite soon, as expert consultants and collaborators in graduate student pedagogical training and development. This eventual scope may well create profound, positive impacts, first on college and university campuses, and then, reaching out through the students we empower and train, on our particular historical moment of "alternative facts" and "post truth," of information crisis and opportunity. Now more than ever, the work of librarians and faculty is incredibly important; the stakes are too high for either group to continue to go it alone.

Appendix 2A: Possible Strategies for Librarian–Faculty Collaboration

We acknowledge that all suggestions and strategies that follow can be used only as the situation allows. Many librarians and faculty will not be in a position where they can pursue these suggestions (see "Facing the Realities of Institutional Hierarchies" in this chapter). Many institutions may not have the budgetary resources or time to support these activities. There are always on-the-ground possibilities and constraints that the authors cannot anticipate. Thus, in what follows, we offer a range of engagement possibilities from the resource- and commitment-light to the resource- and labor-intensive. Above all, we seek to foster generous collaborative possibilities that are responsive to the realities of different librarians' and faculty's day-to-day work.

Part I: Possible Strategies for Faculty Advocacy and Involvement in Information Literacy Instruction

1. **Engage in casual, deliberate conversation.** Librarians are experts in the student research process and see things faculty never do. When you encounter librarians in the course of your daily work, get in the habit of asking them, "If you could wave a magic wand and change one thing about how faculty help students use the library, what would it be?" Then, figure out how you can revise one day in a course that you have already written to do some of what they ask.
2. **Meet with librarians to discuss research assignments.** Librarians are on the front lines of student research, but not all librarians are on the same front lines. As you seek out librarian collaborators to improve student information literacy and research skills, meet

with your subject area librarian. But don't meet *just* with your subject area librarian. If your institution has them, also meet with instructional specialist librarians. Find ways to connect with the librarians who will be staffing the reference desk and research help stations the day and night before your research assignment is due, as these will be the first people that panicked students turn to. A united front—not just one faculty member with one librarian, but with many librarians—can make a huge difference between students' sense of failure and success.

3. **Design assignment prompts with librarians as partners.** Being sensitive to the many demands on librarians' time, see if you can sit down with a pedagogically inclined librarian to not just revise an existing assignment but to design an assignment from the ground up—so that information literacy is its lifeblood rather than a final garnish.
4. **Support librarians teaching information literacy courses at your institution.** Advocate to the right members of the administration. If the library at your institution is not empowered to host its own credit-bearing courses, offer to locate librarian-taught courses within your department so that their instruction counts not just as an extracurricular "workshop" but as a credit-bearing course within university curriculum.
5. **Read librarians' writing on information literacy instruction.** If you have trouble identifying the best articles, books, and syllabi, ask a librarian or two.
6. **Get other faculty and teaching staff to read librarians' writing on information literacy instruction.** Whether you officially advise or unofficially mentor graduate students who hope to become future faculty, share librarian-authored articles and books on information literacy instruction. If you run graduate students' pedagogical training (either in short workshops or in term-length formal courses), build librarian-authored articles and books into your official syllabus.
7. **Apply for co-teaching workshops with library colleagues.** This step is likely primarily for faculty who are either post-tenure (and perhaps in the mid-career slump and seeking a new intellectual challenge) or are at institutions where workshops and collaboration contribute directly to tenure and promotion. If a librarian approaches you to co-teach and you feel you cannot because your institution does not count that work toward tenure or because you are contingent labor and lack the time or power to take on any additional unpaid university work, explain how the structural hierarchies are tying your hands. In a follow-up, if you are in a position of power, point out to your university's administration how these constraints are limiting students' learning. If you are in a position lacking power, ask your librarian contact if they might mention your limitations to their more powerful librarian administrator.
8. **Apply to co-teach (and actually co-teach) co-designed courses** that pair your subject-area expertise and learning goals with

librarians' information literacy expertise and learning goals. Be sure to discuss up front the separation of labor for things like grading.

9. **Partner with librarians to redesign graduate-level courses**. As simultaneous students and instructors, graduate students have the most to gain from librarian-led information literacy instruction. Some departments already have methods courses in which students are introduced to advanced research practices specific to their discipline, but many do not. Whether or not yours is a department with a research methods course, find ways to get librarians involved in graduate education beyond the common one-off databases or special collections session. You might begin by partnering with librarians to create a module in a particular course. You might grow into initiating a department-wide collaboration with librarians to create a template for incorporating information literacy instruction in every graduate course. While graduate students may be better equipped than undergraduate students to conduct advanced research, they can still benefit from training geared toward making them more confident and *efficient* researchers.[44]
10. **Involve librarians in graduate student pedagogical training.** If your department has pedagogical seminars for graduate students (voluntary or required), include a session dedicated to a theme like "teaching effectively with librarians" and bring in a panel of different types of librarian (e.g., subject area/liaison, reference, instructional outreach, course reserves) to engage directly with your graduate students. You might also try to include librarians in workshopping graduate students' syllabi and prompts, so that librarians' unique perspectives on undergraduate research can enrich graduate students' pedagogical practices from the start. More broadly, if you have the institutional resources and backing, facilitate partnerships in which librarians and graduate students co-design (and perhaps even co-teach) courses with information literacy instruction as a central learning outcome. Graduate students with this type of pedagogical training will not only continue to incorporate such instruction into all of their courses, but will be more likely to engage in meaningful collaborations with librarians beyond graduate school.[45]
11. **Include scaled information literacy competencies within your program or department curriculum.** As a unit, identify what

[44] With thanks to Dennis Foster, professor of English at Southern Methodist University, for pointing out that information literacy instruction could be instrumental in rethinking the design of an Advanced Literary Studies graduate course.

[45] Some faculty may object that additional pedagogical training for graduate students might increase time to degree. We refer them to the fifth major finding of *Building a Better Future STEM Faculty: How Teaching Development Programs Can Improve Undergraduate Education*: "Participating in TD [teaching development] programs during the doctoral program had no effect on students' time to degree completion, which was six years on average. However, actual teaching experiences did increase doctoral time to degree" (Connolly et al. 2016, 2, 40, 62). In other words, one of the real issues with time to degree is asking graduate students to teach too much while not giving them the tools and support to teach better and more efficiently.

information literacy competencies within your discipline ought to be taught at the 100-, 200-, 300-, 400-, and 500-levels (or your university or college's equivalent numbers covering the range of available courses offered, stretching from remedial/undergraduate to advanced/graduate). Make sure that new faculty and new graduate students about to embark on teaching for the first time are welcomed into your department's information literacy curricular culture in ways that make these tools a coherent feature of most (ideally all) department course offerings. Be explicit with your students and with each other about what information literacy prerequisites you expect to be fulfilled before ascending each course level. Partner with librarians to help students fill in competencies that they have not yet fully nourished.

Part II: Possible Strategies for Librarian Advocacy and Involvement

1. **Ask a faculty member to describe the (disciplinary or other) context** in which students will be doing tasks and research assignments. Start from the assumption that information literacy is contextual, not a freestanding set of skills. Hold firm to that idea, even if a faculty member seems to be asking for free-floating skills unconnected to their specific discipline.
2. **Focus library instruction more on how to think about or evaluate information** rather than focusing narrowly on how to find and access it. This may well be the reverse of how that faculty member perceived previous instances of library instruction they have experienced: as faculty, as a graduate student, as an undergraduate. While faculty might have misperceived what previous librarians were trying to do for and with them (perhaps even what you have tried to do for and with them), understand that some de-programming of ineffective habits may be in order. It may help for you to remember (although it goes without saying that it likely won't help to remind *them*) how little sustained pedagogical training many faculty have received.
3. **Establish common goals by focusing on students.** Focus discussions of library instruction on how your faculty member wants to empower their students to think about and evaluate information rather than just how to find and access it. You can help your faculty collaborator diagnose their deeper concerns underlying variations of common refrains like "please teach them not to use the Internet and use scholarly sources."
4. **Clarify your terms** when exploring new collaborations with faculty members. When your faculty member says "information literacy"—do they mean what you mean? How might you need to help them expand their understanding of key terms? If someone mentions co-teaching, what does that look like? What is possible given structural conditions on your campus? Other terms to clarify include *embedded*, *collaboration*, and *shared assessment responsibility* (i.e., who is doing the actual grading?).

5. **Use faculty's evolving research cultures to improve students' diversity of sources.** If your faculty member appears too reliant on false binaries like "the library" vs. "the Internet" in ways that don't help students research, get them to articulate how the digital age is transforming scholarly communication in their research field. You may be able to use their lists of new types of publications and sources to crack open that tired notion of "the library/Internet either/or."
6. **Seek out instructional designers, pedagogy specialists, and instructional technologists** periodically to make sure your pedagogical approach is current and relevant. If your university or college has a center for learning and teaching, reach out to staff there as a resource for your own ongoing professional development in the scholarship of teaching and learning. If you are already doing this and your center for teaching excellence is on board, see if they might host a librarian–faculty teaching research "mixer" to help you connect with interested faculty who might not be on your radar.
7. **Continue to invest time in outreach and assess that outreach.** What is actually working to help you find the collaborators you want to work with? Don't assume that faculty will seek you out if they need library instruction or that students (graduate or undergraduate) will diagnose their own needs and know the best ways to find you. It can be tempting to hold off on outreach because you're overloaded with instruction and wear multiple other hats. Re-centering on students can help: keep experimenting to find out what yields the most productive instruction models in light of student outcomes on your campus.
8. **Create blended learning, online learning modules**. Ideally, these will come with some kind of credential or e-badges that can be used both to document what students have done and prevent them from having to repeat the same modules in different classes. If you have instructors interested in experiential learning, you may even be able to find students to help create these modules as part of a class assignment. Alternately, if you have student clubs looking for a project or professional development, you might skip faculty altogether and partner directly with students looking to nourish their skills outside the typical classroom setting.
9. **Get librarians into new faculty orientations**. If your college or university does not offer the libraries a full slot at faculty orientation, find ways to connect with—and recruit—new faculty collaborators. (And then get your new faculty to demand that librarians have a place at future orientations!) Are there new-faculty receptions you can attend? Keep an eye also on early semester gatherings, and other university-wide faculty/staff gatherings. If your university has a pre-tenure faculty support club, see if librarians can be invited to one group meeting. If your university has a contingent faculty or graduate student union, connect with it directly.

10. **Connect with departments' directors of graduate studies** to better understand the state of their graduate students' training, in terms of both research skills for graduate students and what their graduate students are being taught to teach. How can you help? (Use this report to anticipate and prepare answers to common objections about things like time to degree.)
11. **Reach out to graduate students directly.** Although this may be politically tricky, depending on your campus climate, there are often ways to connect with graduate students outside typical department channels. Look for graduate students already connecting with your school's center for learning and teaching. Look for programs that offer certificates in college teaching. Look for ad hoc graduate student groups dedicated to improving their pedagogy. Look for graduate students running labs and taking part in public engagement programs. What role can you create for librarians and information literacy instruction within these other conversations about the present and future of teaching and learning?

Part III: Potential Pitfalls to Anticipate

1. **Librarians and faculty manage their time differently.** Both librarians' and faculty schedules can fill weeks in advance, but they often fill in very different ways. Librarians should not expect faculty to have (or even perhaps understand) public-facing online calendars. Faculty running at the last minute (whether because of overbooking, procrastination, or pedagogical principles of agile design and close response to students' emerging interests and needs) should never expect librarians to be available at that last minute.
2. **Librarians and faculty work different hours.** Faculty can and will e-mail at all hours of the day and night, weekday and weekend, workweek and holiday. Librarians may, or may not. Faculty should expect, and respect, a librarian workweek. Librarians should not be offended (or feel pressured to break into work mode in off time) by faculty who do not share the same work-life balance.
3. **Librarians and faculty come to collaboration with their own unique histories.** Whatever faculty might read in librarian-authored literature, not all librarians will want to collaborate with you. Or, they may want to collaborate with you—but not in the way you are looking for. The same goes for librarians seeking faculty collaborators: you might be eager to break the one-off mold but get approached primarily by faculty seeking "the standard session." In cases like these, it behooves you, whatever position you hold, to step back and assess the situation as coolly as possible. Try to understand why this person does not want to collaborate with you in the way you seek. Is your suggested plan pedagogically unsound? Is your would-be partner more comfortable with more traditional teaching approaches, and perhaps feeling distinctly uncomfortable departing from the "tried and true"? Do they not have the time or resources to dedicate to the kind of no-holds-barred

collaboration you seek? After you have attempted to sympathetically assess their reasons, determine whether this is a situation where you can collaborate effectively with them in a truly student-centered way by adapting your usual approach or if you would be better off working with someone else. You will not work well, or want to work, with everyone. Do not expect everyone to work well, or want to work, with you.

4. **Political missteps will occur.** Apologize gracefully in situations where you ought to. Try to assess what can be compromised on without sacrificing pedagogical quality. Do not feel the need to over-apologize in situations where you need not.
5. **Faculty and librarians continue to exist in unequal power relationships.** Although there are a growing number of publications on the power of librarians' "no," it is important to note that librarians may not always have the choice of opting out of a kind of faux "collaboration" of doing exactly what a faculty member wants. Both librarians and faculty must understand that refusing to do a "one-shot" session because it doesn't align with your pedagogical philosophy is not a luxury all librarians have. Librarians should therefore protect themselves by understanding where they can push their institutional hierarchies to improve and where they cannot. Faculty should likewise be aware of the power that they are given by these unequal hierarchies in which we all currently move: beware of exploiting, either on purpose or by accident, librarian colleagues. In the end, faculty and librarians need to remember that supporting and empowering students to be flexibly and fearlessly information literate is always the ultimate purpose and goal.

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Exploring How and Why Digital Humanities Is Taught in Libraries

Hannah Rasmussen, Brian Croxall, and Jessica Otis

In late 2016 we, the authors, were discussing the different ways the digital humanities are taught in our respective libraries. One author, Jessica, frequently guest lectures on digital humanities in other people's courses, both at her own university and at nearby universities; helps run a four-day summer workshop on digital humanities for entering graduate students; and is in the process of developing a graduate digital humanities course that will be officially taught through the Department of History. Another author, Brian, worked with colleagues to develop a series of workshops that offer three different subjects in digital scholarship each week for an entire semester, where digital scholarship is defined as including, but not being limited to, digital humanities methodologies and the humanistic study of born-digital objects. Like Jessica, he also makes appearances in courses around campus to discuss digital humanities methods scholarship, projects, or theory, but he does not at the moment teach his own, stand-alone class.

Our discussion turned quickly to the many different ways that digital humanities is taught elsewhere in libraries and by librarians. It often takes the form of the ubiquitous, 90-minute workshop, but it has other manifestations as well. Library staff can be embedded in a for-credit course, for example, or librarians can be instructors of record and teach their own course in an academic program or department. We all agreed that, despite how frequent digital humanities teaching has become in libraries, it is an underexamined phenomenon. For example, in the two SPEC Kits produced by the Association of Research Libraries (ARL) on digital humanities—one in 2011 and the other in 2016—pedagogy merits only cursory mentions, with the reports favoring service descriptions, project planning documents, and organizational charts (see Bryson et al. 2011; Mulligan 2016).

From that conversation, this essay was born. We created five cases to explore the variety of ways *libraries*—a term we will use as a shorthand to describe both people working in libraries and librarians working outside the physical library—teach digital humanities. Using constant comparative analysis, in which the researcher moves back and forth between data collection and data analysis (Glaser and Strauss 1967), we looked at both the opportunities and challenges that university libraries experience in teaching digital humanities. We conducted interviews with library employees at five US colleges and universities, to which the authors had easy access and existing, trusting relationships that we believe facilitated honest exchanges. While these institutions are diverse in terms of size, student body, and geographic location, the five schools we chose are clearly not a representative sample of higher education in the United States, nor does the number of responses approach a statistically significant number. That said, this initial exploration enabled us to identify three themes, or patterned responses, that represent consistent and major elements of the cases (Braun and Clarke 2006). These three themes illustrate some of the unique and shared experiences in the teaching of digital humanities in libraries: the variance depending on local context, the importance of informal communities of support, and the tangential relationship between teaching digital humanities in libraries and in digital humanities or digital scholarship centers.

Literature Review

Over the last decade, three broad surveys of digital humanities centers have been conducted by either the Council on Library and Information Resources (CLIR) or ARL: Diane M. Zorich's *A Survey of Digital Humanities Centers in the United States* (2008); Tim Bryson, Miriam Posner, Alain St. Pierre, and Stewart Varner's SPEC Kit *Digital Humanities* (2011); and Rikk Mulligan's SPEC Kit *Supporting Digital Scholarship* (2016). Although writing under the aegis of two organizations whose names foreground "libraries," these scholars surveyed centers regardless of where they were physically or virtually located. Zorich, for example, sought input from 32 "entit[ies] where new media and technologies are used for humanities-based research, teaching, and intellectual engagement and experimentation" and that undertake a range of activities she identifies as constitutive of digital humanities centers (Zorich 2008, 4). Some of these digital humanities centers were based in campus humanities centers, such as Columbia's Heyman Center for the Humanities or Berkeley's Townsend Center for the Humanities; others, like West Virginia University's Center for Literary Computing or Michigan State University's Writing in Digital Environments, were located in English or writing departments, a phenomenon that Matthew G. Kirschenbaum discusses in "What Is Digital Humanities and What's It Doing in English Departments?" (2010); and some centers refused physical embodiment, like the online Humanities, Arts, Science and Technology Advanced

Collaboratory (HASTAC). In other words, Zorich's survey had a capacious notion of where digital humanities centers could be found. Still, almost 30 percent of these centers (n=9) were located in libraries (Zorich 2008, 48), suggesting that libraries were a likely location to find digital humanities work.[1]

Coming three years later, Bryson et al.'s 2011 survey of the then-126 ARL libraries points to the continuation of this trend: "A number of research institutions host digital scholarship centers. ... These centers are *often, but not always*, located in libraries and incorporate library staff or services into their core programming" (Bryson et al. 2011, 11, emphasis added). Of the 64 institutions that responded to their survey, 15 hosted a digital scholarship center, which included the humanities, and 5 had a center that was specifically oriented toward the humanities. A total of 20 library-based centers represents a more than 100 percent increase when compared with Zorich's report only three years prior (Bryson et al. 2011, 16). Tellingly, only seven respondents (11 percent) indicated that services for digital humanities were hosted outside the library (Bryson et al. 2011, 16).

Looking back at Bryson et al.'s work with the benefit of an additional five years, Mulligan writes that they "found [library] support for digital humanities to be primarily ad hoc in nature" and that by 2016 "more ARL institutions have dedicated units if not also [digital scholarship] or digital humanities centers or hubs in their libraries" (Mulligan 2016, 3). This latest survey focuses more on the roles of staff who perform the titular support of digital scholarship, and there is consequently no direct count of the number of digital humanities centers among the 73 ARL institutions (of the then-124 members). But the answers to a question about how staff are organized in the library to support digital scholarship (Question 6) suggest approximately 20 dedicated digital scholarship or humanities centers (Mulligan 2016, 6, 41). Although this number is the same that Bryson et al. observed in 2011, Mulligan notes that 69 of 70 respondents (98.5 percent) "report that the work of supporting digital scholarship is distributed *across* the library," with dedicated centers receiving distributed support from other units in the library (Mulligan 2016, 6, emphasis added). Even if "proper" centers have not been created, library organizations have had to adapt, with 41 of 70 (59 percent) respondents indicating that a department or unit in the library has "been created or reorganized specifically to support digital scholarship activities" and an additional 8 institutions (11 percent) planning to take that work on in the near future (Mulligan 2016, 45). What's more, although the number of centers has not increased, the number of people doing digital humanities work in libraries certainly has. Survey respondents were given the opportunity to describe up to four jobs related to digital scholarship in their libraries; 46 percent of

[1] In the nine years since Zorich's survey, at least one of the non-library centers moved into the library. The Scholarly Technology Group at Brown University moved from the campus IT organization into the university library in 2009 and became the Center for Digital Scholarship, which features in one of our cases below (Mulligan 2016, 6). While this move undoubtedly reflects local circumstances, it simultaneously points to the broader trend of locating digital humanities centers in libraries in the current decade.

the positions (*n*=106) were "new, repurposed from others, or newly defined" and the majority of staff (67 percent) in all of the jobs described (*N*=231) are new to libraries, having worked in that sector for five years or less (Mulligan 2016, 6–7). Even if no new centers have begun in ARL libraries in the intervening five years between Bryson et al.'s and Mulligan's work (a claim that is, as mentioned, hard to verify), it is clear that libraries have continued investing in the work of digital humanities.

Methodological differences aside, the extensive work done by these surveys makes it clear that US libraries go to great lengths to provide a home for digital humanities at colleges and universities. As detailed as these surveys of digital humanities research and support may be, however, there is an area that remains all but unexamined: how libraries and librarians *teach* digital humanities. Zorich (2008) includes a section in her report on "Teaching and Other Pedagogical Activities," touching briefly on academic programs, for-credit courses, internships, graduate assistantships, fellowships, and "other learning/training opportunities" (20–22). In this final catch-all category, Zorich does mention that centers "offer learning opportunities distinct from the traditional offerings of internships, assistantships, and fellowships" and that "these opportunities are in the form of workshops and training programs held within a university community or taken on the road for K–12 educational communities" (21–22). (It will amuse some readers to see that in 2008 workshops were *not* considered to be the "traditional offerings" for digital humanities instruction.) While the whole enumeration of activities provides an illuminating sense of the range of learning opportunities in digital humanities centers, the report does little more than recount that there are *some* academic programs (read, certificate programs), *some* courses, and *some* workshops. It does not address the specifics of who does the teaching, how the teaching functions, or what makes for effective teaching. Nor does it address the library context specifically in any way.

One might expect that the library-centric perspective of Bryson et al.'s and Mulligan's work would help uncover more about the digital humanities pedagogy done by librarians. But both the 2011 and 2016 SPEC Kits are relatively silent on the subject. Bryson et al. ask only two questions that relate to pedagogy. The first of these (Question 7) asks respondents to "indicate which of the following types of services your library offers users who are engaged in digital humanities projects" (27). Under the subsection on "Preservation and Education," 32 of the 47 respondents (68 percent) indicate that the library provides "instruction in technologies," with one commenter clarifying that this is "Library instruction in use of mature digital humanities projects" (29). The second question (Question 9) asks how "library staff contribute expertise to digital humanities endeavors" with a subsection on "Instruction" (30). Thirty-six of 39 respondents (92 percent) report that library staff are involved in teaching "tools or techniques used in digital humanities research," and 26 respondents (67 percent) describe librarians as providing instruction on

"pedagogical use of digital object collections" (31). Individual comments to the question suggest that libraries also provide instruction in metadata, XML/text mark-up, and copyright and licensing. These two broad questions make it clear that in 2011 those libraries involved in teaching digital humanities did so primarily through instruction in digital humanities tools or methods. Tools and methods are, of course, the gateway to further digital humanities work, as knowing what options there are for computational analysis allows faculty and graduate students to imagine ideas for research or teaching projects. But even in writing that previous sentence, we realize that we are assuming what the audience for this instruction was, as well as what the intent of the teaching was. The survey is silent on these matters, as well as on who does the teaching, where the teaching takes place (e.g., in library workshops, in credit-bearing courses), and how librarians made choices about what was taught.

Whereas Bryson et al. focused on *what work* libraries were doing in digital humanities, Mulligan instead tries to examine *who* does that work. But given the nature of surveys, what this means is the *number of people* who do certain kinds of work in libraries. To get at this, Mulligan creates 20 different categories of digital scholarship activities for his first question and then re-uses those same activities in subsequent questions to learn more (numbers 4, 5, 6, 17, and 22) about the individuals who do this work. These activities, based on a 2015 *EDUCAUSE Review* article by Nancy Maron, range from GIS and digital mapping and metadata creation to encoding content and developing digital scholarship software (Mulligan 2016, 13). While exhaustive enough to distinguish between the activities of "project planning" and "project management," Mulligan's categories completely overlook any sort of teaching or pedagogy related to digital scholarship. The respondents to the survey, on the other hand, appear very aware of the absence. When asked to describe what they included in "Other digital scholarship activity," 9 of the 17 respondents (53 percent) to that question mentioned some connection of the library and digital scholarship teaching (Mulligan 2016, 14). This teaching takes different forms, from instruction and workshops on digital scholarship methodology and tools to training graduate students through formal and informal internships to being integrated/embedded in teaching to helping faculty work with undergraduate students to create websites (Mulligan 2016, 14). Comments attached to two of the other five questions that draw on Mulligan's 20 digital scholarship activities (numbers 4 and 17) similarly highlight the teaching of digital scholarship done by those who work in libraries (Mulligan 2016, 32–34, 63–67). In other words, a significant number of those who completed the survey recognized that their library frequently teaches digital scholarship or digital humanities. This means Mulligan's survey accomplishes what those of Zorich and Bryson et al. did not: making visible the teaching of digital humanities/digital scholarship that librarians do. But this visibility is ironically conferred only by virtue of the survey instrument's rendering pedagogy invisible, a fact that clearly struck those who completed it as

an unaccountable absence that needed to be addressed. The pattern of commenting suggests that libraries are well aware that they teach digital humanities. Indeed, the representative documents that Bryson et al. and Mulligan collect as part of the SPEC Kit frequently describe digital humanities centers or digital humanities-centric staff who are engaged in research, research support, *and teaching* (Bryson et al. 2011, 66–184 passim; Mulligan 2016, 109–199 passim). Until now, however, the literature has largely failed to describe this teaching.

This elision of teaching is also evident in a narrow survey of digital humanities in libraries conducted by Alix Keener in 2014 and published in *Digital Humanities Quarterly* in 2015. The study aimed to discover the points of agreement and tension between librarians and faculty members in research relationships. The study's methodology, which like ours used purposive sampling and a semi-structured approach to the interviews, covered the experiences of "5 faculty, 4 librarians, and 2 postdoctoral researchers, positioned in the library and thus included in the 'library' group" (Keener 2015, paragraph 22). Like the authors of the other studies mentioned in our literature review, Keener did not specifically ask respondents about the teaching of digital humanities. Unlike the other interviewers, however, she does address this gap in her conclusion: "Another theme that emerged from this project was the need to study curriculum around digital humanities. Surprisingly, though there were no interview questions specifically about teaching, many participants talked about changing or 'overhauling' the curriculum, or about using the library in their digital humanities courses. However, it was unclear whether course content was tied to faculty's research. There is more work to be done in this area" (paragraph 45). Keener's call for research about how librarians teach digital humanities corroborates what we had already identified as likely ground for investigation.

Cases

Methodology

We chose to use a case-based approach for this research because it allows for a detailed understanding of context and personal experiences using a fairly small number of events (Stake 1995). In addition, our research goal of exploring the variety of ways libraries teach digital humanities is nicely matched to the strengths of case-based research, which allows for the exploration of research questions that begin with "how."

We chose to use a semi-structured approach for this research (Galletta 2013). This involved creating a series of questions in advance to ensure that our main topics and interests are covered but also allows diversion from those pre-scripted questions as needed to explore new ideas. Interviews can thus have a conversational tone and can explore different institutional and personal differences in teaching approaches and focuses. Our first step in this research was to develop an interview protocol (see appendix to this chapter) to understand how librarians and other individuals who teach digital

humanities in the library approach that teaching, as well as the challenges they face and the solutions they have devised.

Our second step in this research was to identify subjects to be interviewed. We approached this step using both convenience sampling (a nonprobability sampling technique in which subjects meet the practical criteria of ease of access and willingness to participate) and purposive sampling—another nonprobability sampling technique in which we deliberately chose participants because of their characteristics (Etikan, Musa, and Alkassim 2016). We used convenience sampling by identifying librarians who taught digital humanities and to whom we could gain easy access, and who would be open to an honest discussion of their teaching. However, we wanted to ensure that we explored how digital humanities was taught in more than just one type of library. We used purposive sampling to ensure that we had subjects who could tell us how they taught digital humanities in libraries in different regions, to different audiences, and with different funding models and mandates.

Brown University is a private, Research I university in Rhode Island with a student body of 6,300 undergraduate and 2,200 graduate students who come from all over the United States and the world. Carnegie Mellon University is a relatively young, private, Research I university in Western Pennsylvania with an equal emphasis on undergraduate and graduate education, having a student body of 6,400 undergraduates and 7,100 graduate students, with 23 percent of undergraduates and 63 percent of graduate students coming from overseas. Michigan State is a public, land-grant, Research I university in the Midwest with a student body of 39,100 undergraduates and 11,400 graduate students, approximately 80 percent of whom come from Michigan. The University of Miami is a private Research I university in Florida, with 10,800 undergraduates and 5,700 graduate students, approximately 40 percent of whom are from Florida and 25 percent of whom identify as Hispanic. And Whittier College is a private, Hispanic-Serving, Division III, liberal arts college in Southern California with a student body of 1,602 undergraduates and 68 graduate students, more than 25 percent of whom are Hispanic.

While we have a diverse range of universities, the five schools we chose are clearly not a representative sample of higher education in the United States. For example, four out of our five cases come from private institutions and four out of five cases come from Research I universities. Most colleges and universities in the United States do not meet either of these criteria, so more representative research could be done following this initial report.

Our third step in this research was to write five cases from the interviews to illustrate how each individual experiences teaching digital humanities in the library. We did this by returning to the interviews and writing a report on each subject focusing on both his or her description of teaching digital humanities and any background on the institution or individual experiences that might help the reader understand the subject's approach to teaching digital humanities. Member checking was performed to ensure that each subject felt their case was a fair representation of their experiences.

Our final step in this research was to use a cross-case identification of themes that emerged from the cases. We did this by asking each author to read the case and listen to the interviews. Having examined the data thoroughly, each author then noted any themes he or she had identified. These themes were distilled into the three high-order themes that we explore in detail.

Case #1—Brian Croxall, Rockefeller Library, Brown University

Brian, one of the authors of this essay, works at the Rockefeller Library as one of two digital humanities librarians; he is also the subject liaison for English. Brian helps imagine, design, manage, and execute digital scholarship projects. He works with colleagues in the Center for Digital Scholarship, which is a virtual center that includes staff with expertise in digital humanities as well as in digital science and social sciences. No one at Brown is 100 percent allocated to working on digital scholarship apart from the soon-to-be-hired digital scholarship editor, a position funded by a grant from The Andrew W. Mellon Foundation.[2]

Since fall 2015, five members of the Center for Digital Scholarship staff—the two digital humanities librarians, the social sciences data/GIS librarian, the scientific data management librarian, and the visualization coordinator—have taught about three workshops a week throughout the semester in a digital scholarship series. They meet before the beginning of each semester to plan the schedule and their offerings, some of which are based on previously successful workshops but some of which are new offerings.

Brian recounts that when developing workshops at Brown, he begins by researching the subject (e.g., principles of good poster design or the specific vocabulary of social network analysis). This research includes looking for specifics from those who work in other digital humanities centers or libraries, as individuals in these organizations tend to prioritize sharing their labor with the broader community. In the case of more technical subjects, such as topic modeling, he looks for tutorials for software packages that he can walk through to determine that he knows how the tool works and that he understands the results he gets from it. *The Programming Historian,*[3] for example, is a great resource for the Brown team, since it includes software walkthroughs created and peer reviewed by members of the digital humanities community. In the absence of previous descriptions of teaching a particular subject, Brian will simply read widely on the subject and learn on his own since he and his colleagues have already decided that the subject is worth pursuing.

[2] The Andrew W. Mellon Foundation provides major grants related to scholarly communication, among other fields, in the United States, many of which have placed a premium on digital humanities initiatives in the last two decades. These grants often include a teaching component, such as offering workshops and providing educational fellowships. It is worth noting that three of our five cases (Brown, Carnegie Mellon, and Whittier) have funding from Mellon and that two of these three (Carnegie Mellon and Whittier) explicitly include support for transforming the teaching of undergraduates and the training of graduate students and faculty. This trend and its connection to libraries deserves further study.

[3] http://programminghistorian.org/.

After finishing this initial research, he plans the workshop, which includes an overview and hands-on activities. For the latter, he draws on example files that are often provided by software packages. But he also tends to teach subjects that are related to his own classroom praxis or from his research, so he leads workshops with those datasets. This allows him to discuss how to build a suitable data set related to one's own research. Alongside these efforts, he reports that the most important strategy for preparing his workshops is to come up with a rhetorical strategy for presenting the information that allows for a "through line"—a narrative for *why* one would use a particular approach or method. He refines this narrative with each presentation of the workshop, with it taking a final form generally after three or four iterations.

Case #2—Jessica Otis, Hunt Library, Carnegie Mellon University

Jessica, another of the authors of this essay, works in Hunt Library as a digital humanities specialist. She is tasked with supporting the development of digital humanities (and digital scholarship more generally) at Carnegie Mellon University (CMU). This involves consulting with faculty and students, building networking and informational resources, and undertaking a wide range of instructional activities. She has taught for-credit courses and has guest lectured on various digital humanities-related topics both for courses offered at CMU and at the neighboring University of Pittsburgh.[4] She also serves as an embedded librarian for a graduate course for the recipients of CMU's Andrew W. Mellon digital humanities fellowships and a four-day summer digital humanities workshop for entering graduate students in the humanities. Other workshops are in the planning stage.

At present, faculty members working in digital humanities have been interested in library involvement, particularly for technical and preservation support, but Hunt Library does not currently have the capacity to help them. To address this weakness and expand the use of digital humanities on campus, CMU is building a digital scholarship center to facilitate faculty members' research and teaching. This center will be co-directed by Hunt Library and the Dietrich College of Humanities and Social Sciences, staffed by faculty librarians, and expected to offer for-credit courses on digital humanities, digital publishing, research data management, and other related subjects.

To prepare for her courses, Jessica consults a wide variety of resources including published books, e-books, articles, conference presentations, blogs, pedagogical websites such as *The Programming Historian*, and LibGuides, which is a widely used CMS in libraries for creating research guides. She also directly consults with colleagues and mentors for specific information, lesson plans, syllabus examples, and

[4] Because of the concentration of institutions of higher education in Pittsburgh, the Pittsburgh Council on Higher Education has established a program that allows cross-registration of students at 10 local colleges and universities. As CMU and the University of Pittsburgh main campuses are adjacent to one another, there are many cross-institutional connections, particularly within the digital humanities community.

anecdotes about what has worked well for them in the classroom. She sometimes finds information or interesting readings on Twitter; however, she usually does not have the bandwidth to monitor social media constantly and thus is more likely to ask for help on social media than to serendipitously find something useful.

Case #3—Kristen Mapes, College of Arts and Letters, Michigan State University

Kristen is the digital humanities coordinator in the College of Arts and Letters at Michigan State University. She is a librarian but is embedded in the College of Arts and Letters, where she teaches a for-credit course, Introduction to Digital Humanities. Although the course is taught outside of the library, she takes her class into the library many times during the term and includes an embedded librarian in class throughout the semester. There are a variety of teaching activities that occur in the library, which Kristen describes as "teaching in classes, library based workshops, and for-credit courses." These include a series of five digital humanities workshops each semester, in addition to GIS and makerspace workshops run by other units in the library.

Kristen notes that she benefited from having a mentor when she started to design her courses. She makes use of the various informal digital humanities communities (she specifically mentioned using Twitter and the Digital Humanities Slack team) when designing courses instead of relying on textbooks because she felt they were not dynamic enough to teach digital humanities.[5]

According to Kristen, many in the library are moving away from the role of a subject liaison who teaches in traditional library workshops, works with faculty members, and works at the reference desk to one that focuses on methodological expertise such as GIS or data science. They are still working to serve the traditional needs of the library (reference, collections development, and circulation) while also trying to think more broadly about how to serve the needs of the patrons. There is commitment and an investment of resources into hiring for this new approach to the library.

Michigan State also has a wide range of digital humanities activities on campus beyond the library, including a digital humanities minor for undergraduates and a graduate certificate for master's and PhD-level students. These activities occur throughout campus in spaces that include, but are not limited to, the Digital Humanities and Literary Cognition Lab; the research center WIDE (Writing, Information, and Digital Experience); the student-centered lab LEADR (Lab for the Education and Advancement in Digital Research); and Matrix, the Center for Digital Humanities and Social Sciences at Michigan State University.

[5] Slack is a team communication tool that was developed in 2013 and publicly released in February 2014. It made rapid inroads in the technology sector, and in October 2015 a team devoted to digital humanities was created by Amanda Visconti, then digital humanities assistant professor & digital humanities specialist librarian in the Purdue University Libraries. The Digital Humanities Slack team is open for anyone to join who agrees to abide by its code of conduct; individuals can sign up at http://tinyurl.com/DHslack.

Case #4—Paige Morgan, Richter Library, University of Miami

Paige is the digital humanities librarian at the University of Miami. Her primary interests include developing curriculum for graduate students, staff, and faculty to learn about digital humanities/digital scholarship and understanding and working to advance digital scholarship service infrastructure. Her job currently focuses on introducing digital humanities approaches to researchers, both faculty and students, and supporting them as they explore how digital humanities approaches could fit into their research. This is a "floating role," and Paige is a liaison for any faculty member who wants to explore digital humanities.

Paige has a lot of experience teaching digital humanities workshops within the library; however, she is in the process of rethinking how she teaches digital humanities workshops. She expressed some frustration with the workshop approach, specifically how it feeds into researchers' desires to learn new tools quickly at the expense of a more thoughtful engagement with the broader methods and questions of digital humanities, including the type of questions digital humanities allows researchers to ask.

Paige characterizes her library as one that is in the process of learning and understanding what its role is in providing digital humanities support, guidance, and mentorship to the university community. It is listening to its patrons and looking to support the patrons as they explore digital humanities, rather than prescribing the use of digital humanities. In addition to hiring Paige, the university has hired digital humanities faculty in English and modern languages. They have also recently hired a GIS librarian and created a department of digital strategies.

Case #5—Anne Cong-Huyen, Digital Liberal Arts Center in Wardman Library, Whittier College

Anne is the digital scholar and co-coordinator of digital liberal arts (DigLibArts) at Whittier College. Anne's job focuses on faculty consultations in which she meets one-on-one with faculty members to talk about classes they are teaching. She helps them develop semester-long, project-based assignments, as well as small drop-in assignments, and helps them in developing and re-developing courses to include digital assignments and activities. Anne also manages many aspects of The Andrew W. Mellon Foundation's grant to the DigLibArts Program. Finally, she teaches one or two media studies courses per year and manages the Domain of One's Own project, Whittier.Domains.

At Whittier College, the library is the heart of the campus. It is a small library with only five librarians and three additional professional staff. Librarians do a little bit of everything, including act as liaison librarians in three to four subjects, teach, provide training, and serve on college committees. They are deeply embedded in the operation of the campus. Anne works in the DigLibArts Collaboratory that is housed in the college library. It has modular furniture and is a space that has

become popular for faculty who attend teaching workshops or bring their students to dedicated workshops taught by Anne and her colleagues. When faculty members hold workshops for digital classes in that space, the natural traffic patterns at the school inevitably result in other students walking by and becoming curious. The program offers small grants and course releases to faculty for them to experiment with digital teaching approaches. Teaching digital humanities in the Whittier College Library is very focused on helping the faculty use digital humanities in their courses, which, according to Anne, aligns with Whittier's mission as a teaching-focused college.

As Anne related her work, she referenced the "Whittier Way," in which, even in the climate of scarcity that comes with a small liberal arts college, the librarians and other staff try to preserve the services that they provide and offer new things the patrons want and need. Anne and her co-coordinator do not do much traditional library work, but they serve on library committees focused on instruction, space, technology, and other topics. They also supplement the digital/information literacy education that is done primarily by the instruction librarian. The training takes place in specific project-focused workshops for classes. Anne also provides digital project and research help, but finds the pedagogy work is in higher demand.

Thematic Analysis

In comparing the cases, we identified three themes that help us better understand the opportunities and challenges associated with teaching digital humanities in libraries. First, teaching means different things to different people and in different library contexts. Second, librarians and people teaching in libraries tend to rely on informal communities to assist in the development of teaching materials and to support their teaching endeavors. Third, while founding digital humanities/digital scholarship centers is often seen as a crucial step for supporting local digital humanities communities, these centers do not appear to play a necessary role in the teaching of digital humanities in a library context.

Theme #1: Teaching in Context

Our cases revealed five main types of digital humanities teaching: (1) supporting faculty in developing syllabi and assignments for their for-credit courses; (2) conducting guest lectures in for-credit courses; (3) co-teaching or embedding librarians into for-credit classes for just-in-time assistance; (4) individually teaching for-credit courses; and (5) teaching variously formatted, not-for-credit workshops.[6] The first three largely involved collaboration between librarians and faculty working outside the libraries, although some guest lecturing occurred physically within the library. For-credit courses taught by

[6] This list of teaching types does not include creating LibGuides or the significant amount of one-on-one tutoring that librarians do during consultations with individual faculty and students, as we considered these to be fundamentally different types of interaction than in-person group instruction. They are worthy of study in their own right.

librarians were also generally offered through departments outside the libraries—regardless of where the class physically took place. This is likely because none of our cases involved a university with an MLIS or other program that would lead the library to develop the administrative structure to offer for-credit classes in its own right. Not-for-credit workshops were more likely to take place physically within the library, and their formats varied from traditional one- to two-hour workshops to multiday workshops, such as Carnegie Mellon University's summer workshop.

The content and format of library instructional activities appear to vary among libraries depending on the needs of the university, the strengths of the library staff, and the interests of faculty and students. In two of our cases, librarians who changed universities attempted to recreate teaching situations that had worked well for them at their previous university. Brian—moving from Emory University to Brown University—was able to duplicate his former success in offering a two-part workshop on managing online identity, as well as other workshops he had led on a regular basis. By contrast, Paige—moving from the University of Washington, where she was a graduate student, to McMaster University, where she was a CLIR-DLF Postdoctoral Fellow, to the University of Miami—found she had to make significant revisions to her "Demystifying Digital Humanities" workshop material to accommodate local needs and interests.

Factors that librarians might need to consider when designing instructional content include whether instruction will be limited to their institution or open to a broader audience; whether faculty and students can be taught simultaneously, for size or cultural reasons; what the overall goals of the faculty and students in learning digital humanities skills are; whether course and workshop attendees are motivated by learning new tools or answering specific research questions; what length of time is needed to teach specific digital humanities skills; what foundational knowledge is needed to teach specific digital humanities skills; and what overlap there is between digital humanities and more general digital scholarship skills. Administrative structures that enable or limit the offering of for-credit courses by librarians may also be a factor, as is the willingness and ability of local faculty to invite librarians into their courses for one-off or a series of guest lectures.

Consequently, it seems clear that teaching digital humanities in the library cannot be a one-size-fits-all approach, although similar approaches may work for similar institutions. Librarians must think carefully about how they want to teach digital humanities to make sure their approaches and content fit within the library culture and serve the needs of the local community, rather than relying on what "everyone else" is doing or what the library "has always done."

Theme #2: Informal Communities

Our cases also indicated the importance of informal communities within the digital humanities and library world for enabling both teaching and learning of new skills. Traditional methods of teaching

that rely on printed textbooks were considered less useful, given the rapid pace of technological and methodological change within the digital humanities community, not to mention the general lack of textbooks. Instead, people tend to rely on informal methods of communication to develop and support their teaching activities, such as working with a more knowledgeable mentor, asking friends and colleagues for advice, and seeking answers on social media such as Twitter, Digital Humanities Questions & Answers,[7] and the Digital Humanities Slack channel.

These informal communities can be considered communities of practice in which people who share a common interest or job engage in collective learning (Wenger 2000). Research has shown that communities of practice are very effective in allowing members to engage in self-learning through digital technology (Bates 2014). However, a critique of communities of practice is that new members may experience difficulty entering a community and as a result may not experience as much deep learning as is possible (Viskovic and Robson 2001). New members may feel discouraged from entering and interacting within the community because of a community-specific vocabulary, the time needed to learn how to navigate a new community, or the community's underlying power structures.

Although the current, informal state of digital humanities communities makes it very easy for newcomers to ask for advice, it does require some time and effort to discover the entrances to these communities. Knowledge tends to reside in individuals, who carry practices from institution to institution in person (as in the case of Brian or Paige) or through social networks that are welcoming of—but often invisible to—newcomers to the field. Furthermore, the informal nature of many important digital humanities conversations means that they tend to happen repeatedly and lead many librarians to reinvent the wheel before discovering the community that could have handed them a fully operational wheel. Finally, the informal nature of these communities can mean that knowledge within the community is not valued outside the community.

One potential advantage to this informality is the subsequent freedom to experiment and customize digital humanities teaching to accommodate local needs. As digital humanities encompasses a wide variety of skills and disciplines, it is often amenable to importing and adapting teaching techniques from specific disciplines—including library and information science—which may make it easier for librarians to teach digital humanities in workshops and for-credit courses.

Theme #3: Teaching Outside Digital Humanities Centers

Given the extent to which the construct of the "digital humanities center" appears in narratives of digital humanities and the aforementioned trend of locating digital humanities centers in libraries, it is easy to conflate the teaching of digital humanities in libraries with the teaching of digital humanities in centers. Although digital humanities centers may be a place for both disciplinary faculty and

[7] http://digitalhumanities.org/answers/

non-MLIS library staff to teach, it is important to remember that library-based digital humanities teaching does not require a center. By focusing on centers, as did Zorich and to a lesser extent Bryson et al., we miss a significant portion of the teaching that happens in libraries and by librarians. Perhaps, then, it is the center-centric orientation of investigating digital humanities in libraries that has led to the paucity of information regarding how digital humanities and digital scholarship are taught there.[8]

In Keener's examination of relationships among faculty and librarians who work together on digital humanities, she describes an initial start-up phase in which digital humanities is supported in an ad hoc manner by librarians rather than through formalized—and potentially ongoing—partnerships with faculty. Such an approach allows librarians to provide just-in-time support, which helps build capacity at the library and interest on the part of faculty. One might expect that this ad hoc support would eventually be supplanted by the creation of a center or a "one-size-fits-all suite of services," which then moves away from the ad hoc to formalize both the support and the relationships among the different parties engaged in digital humanities (Keener 2015, paragraph 44). Keener's conclusion resists this teleology, however: "The answer is not on either side of that line, but rather on both sides: librarians and library staff can provide ad hoc digital humanities services while also being research partners" (paragraph 44). Her work suggests that digital humanities support happens along a continuum and that this meets the needs of both researchers and librarians.

Our initial research suggests that the teaching of digital humanities in libraries follows a similar pattern. It tends to begin in an ad hoc nature, in response to the needs of the local community. Once demand for all digital humanities services—including teaching—increases appreciably, it may lead to the creation of a digital humanities center in the library, with a dedicated staff who offer, among other things, a predictable and more formalized series of educational opportunities, ranging from workshops to for-credit classes taught by the librarians, many of whom are in newly created positions, as Mulligan observed (Mulligan 2016, 6–7). But it may *not*; the center is not necessarily necessary, as Yeats would have it. Our research demonstrated this, as only two of our five cases come from a school that has a "center" in the traditional sense. Of these, Brown is, as mentioned, a virtual center that is a center more in name than in practice, with its entire staff assigned to multiple units in the library and none of them dedicated 100 percent of the time to digital scholarship

[8] The frenzy for centers and the (Freudian) anxiety about whether or not you have one perhaps reached its peak in Jennifer Schaffner and Ricky Erway's 2014 report for OCLC Research, *Does Every Research Library Need a Digital Humanities Center?* The report, which is targeted at "library leadership," expresses its conclusion in its very first sentence: "There are many ways to respond to the needs of digital humanists, and a digital humanities (DH) center is appropriate in relatively few circumstances" (Schaffner and Erway 2014, 5). Bethany Nowviskie, then director of the University of Virginia's Scholars' Lab, a digital scholarship center in the Alderman Library, wrote a long blog post about the report and summarizes its chief value as "its clear reinforcement of the notion that a one-size-fits-all approach to digital scholarship support *never fits all*" (Nowviskie 2014, original emphasis).

work. And while Michigan State is the home to Matrix, it is not *of* the library, and Kristen is not affiliated with it. Carnegie Mellon may be in the process of building a center, but Jessica and her colleagues already perform a wider range of teaching than do many libraries with centers. Paige reports that while Miami University has made cluster hires in digital humanities and that a center seems like a logical next step, they are not yet convinced that it is the right step. It is also unclear to what degree a center would change Paige's approach to teaching digital humanities, as she is already engaged in workshops and co-teaching for-credit classes. Finally, while Whittier has the DigLibArts program and its attendant Collaboratory, its emphasis on consultative support for digital pedagogy across the college makes it less like a traditional digital humanities center as it instead emphasizes teaching digital scholarship and even more specifically the role of teaching digital scholarship *in a library*.

Our research, as well as that conducted by Mulligan, suggests that libraries teach digital humanities at several levels and to several audiences, even when they lack dedicated digital humanities specialists. While the digital humanities community is broadly aware of the variety of teaching that occurs in the library, the question remains whether this teaching garners as much attention as that which happens within dedicated centers. More research is necessary to determine how libraries can better draw attention to their role in pedagogy.

Conclusion

When we first decided to explore how digital humanities is currently being taught in libraries and by librarians around the United States we developed a twofold plan. First, we would perform case studies intended to help us identify and understand the apparent haphazardness of digital humanities teaching in libraries. Second, through the analysis of these cases, we believed we would be able to unify and streamline teaching digital humanities in libraries by creating a series of best practices and standards that could be applied to libraries throughout the country. Specifically, we proposed creating a series of templates that libraries could use to develop a more structured and standard approach to teaching digital humanities.

Instead we have realized, through the three themes we identified in our case analysis, that the lack of standard approaches to teaching digital humanities in libraries is not a "problem" that needs to be solved. Our research helped us identify context-dependent approaches to teaching digital humanities in libraries and reliance on active informal communities that complement the fluid nature of digital humanities. This decidedly dynamic nature would not respond well to the rigidity of best practices and standards. In short, our hypothesis was disproven.[9]

[9] While this could be considered a failure of our initial goals, we decided to err on the side of transparency to show the progression of our work. Although our hypothesis was proved false, we believe in the value of failing in public as we explore the phenomena of teaching digital humanities in libraries (see Croxall and Warnick forthcoming).

Nevertheless, our research has identified findings that should be considered when making decisions about the teaching of digital humanities in libraries. The first of these is the value of local context. Our cases identified the importance of paying attention to local faculty, students, and library colleagues, particularly their needs and interests when designing a digital humanities curriculum for the library. Naturally, those needs can change over time along with the local community. The second finding is the existence of a large informal community of individuals who help each other rapidly exchange ideas and develop resources to keep up with changing needs and approaches. Part of this informal nature of the community comes from the librarians themselves who may move from one institution to another, transplanting experience to their new local context while simultaneously evaluating that context and then identifying resources to meet new needs.

From our observations of the digital humanities community's ability to share and redeploy ideas across local contexts, we have begun to imagine developing a series of flexible patterns—rather than standards—for approaches to library teaching, based on generalized contexts that could then be adopted to the individual contexts of a specific library. This would provide librarians with some guidance and examples of previously successful approaches in similar contexts, while also relying upon their local expertise to customize these approaches to their library's specific needs.

Moving forward, we believe the next step to understand more fully how digital humanities is taught in libraries is to use the results of our cases to reformulate our survey, administer it more broadly, and look for trends that indicate which universities might profitably emulate each other's teaching approaches. Additionally, in our current phase, we realized that the bulk of the individuals we interviewed earned PhDs in the humanities. We wonder to what degree the teaching of digital humanities in libraries is colored by the fact that it anecdotally seems to be performed by those who trained to be professional researchers and teachers. Our expanded survey might profitably seek to understand similarities and differences among MLIS and PhD librarians.

One aspect of digital humanities practice that is simultaneously a significant strength and weakness is the informal and often oral nature of its discourse, which means that sometimes the same conversations occur over and over and *over* again without ever moving into wider circulation through print or the Internet. As such, perhaps our main contributions have been to collect this information about digital humanities teaching in libraries into one place so that other scholars can find and reference it. We hope that bringing private, ephemeral, and frequently repetitive discussions into the public eye means that people can cite, debate, and ultimately *teach* them.

Appendix 3A
Interview Guide: Teaching Digital Humanities in Libraries

1. Can you tell me a bit about your library as a whole?
   a. Where is it located?
   b. Who are the intended patrons (graduate, undergraduate etc.)?
   c. How large is the university/department it serves?
   d. What would you say are the strengths and weaknesses of your library?
   e. What are the future goals of your library?

2. Can you tell me a bit about the role of librarians in your library?
   a. Is there a teaching component to most subject librarians' or other librarians' roles?
   b. How would you describe your role in the library?

3. Can you tell me a bit about the digital humanities element of your library?
   a. Does your library have a dedicated center for digital humanities? If not, is there one elsewhere on campus?
   b. Are there librarians/library staff assigned to teaching or supporting digital humanities specifically?
   c. How have the staff embraced/not embraced digital humanities?

4. Can you tell me a bit about teaching digital humanities in the library?
   a. What does it mean to teach digital humanities in your library? Do you or anyone else at your library teach workshops on digital humanities? Day-long events (e.g., THATCamps)? For-credit courses? Other formats? What subjects/topics do you teach?
   b. Is there any particular intellectual programming associated with digital humanities that happens in the library?

5. Can you tell me how you learn how to teach digital humanities?
   a. Do you attend conferences? Workshops?
   b. What resources do you access?

6. Can you tell me a bit about digital humanities in your university?
   a. Are there digital humanities courses that are taught?
   b. Do you assist or support any of the digital humanities courses on campus?
   c. Is there a digital humanities minor, major, certificate, or other degree for undergraduate/graduate students?
   d. In your experience, how many faculty are interested in digital humanities at your institution? How many of them are involved with the library? How many of them are going it alone?

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Current Use and Prospective Future of the University Map Library: A Case Study of Multiple Perspectives From One Institution

John Maclachlan, Jason Brodeur, Brian Baetz, Patrick DeLuca, Julia Evanovitch, Rebecca Lee, and Supriya Singh

There's a big difference when you can actually see the history and you can touch it; it makes learning that much more enriching. You can come into the map library any time and examine any map you want. When you come to university you don't realize how many learning opportunities there are, but this is a great resource.

Mack Gilles
McMaster University undergraduate student

As both a repository of cartographic information and a source of human guidance for the use of such material, map libraries in academic institutions have a long tradition of preserving, transferring, and facilitating access to a wide array of knowledge. From special collections of historically significant rare maps to assemblages of modern topographic sheets, plans, and aerial photographs, map libraries offer researchers, students, and members of the public an opportunity to better understand human and natural environments of the past and present.

As with much of the broader academic library, the goals and day-to-day operations of the current-day map library are influenced by myriad organizational and discipline-related factors: pressure for space on academic campuses and budgetary constraints influence curators' decisions on collection development; digitization programs and born-digital data have transformed the ways in which information is provided to users and broadened audiences, but also require new systems, skills, and personnel to support them; and growing interest in geospatial data and Geographic Information Systems (GIS) beyond traditional geography-related disciplines has created a service need within the academic institution. The confluence of these influences (along with many others unmentioned

here) provides the canvas upon which the course of the modern map library may be plotted.

To describe, contextualize, and understand the changing role of the modern map library, this paper compiles the personal narratives of several users of a single collection—the Lloyd Reeds Map Collection in the McMaster University Library. While the perspectives provided in this study convey only a sample of the diverse commentary on this subject, they provide an opportunity to explore the varied experiences with (and conceptualizations of) a single map library among individuals of differing academic backgrounds and career stages, who have varying expectations for support and guidance. To highlight this diversity, contributor reflections are presented in their entirety, and their general themes are identified and discussed in greater depth. By exposing and synthesizing themes from contributed accounts, this paper underscores the broadening role of map libraries in improving spatial literacy across the university.

The McMaster Lloyd Reeds Map Collection

The Lloyd Reeds Map Collection is located in the Mills Memorial Library on McMaster's main campus in Hamilton, Ontario, Canada. Shortly after being founded within the McMaster School of Geography in the early 1960s by Professor Lloyd George Reeds, the Map Collection was transferred to the McMaster Library for stewardship. The collection has continually grown since its inception and today consists of more than 130,000 paper maps, 18,000 aerial photos, and 3,000 atlases. Recent large-scale digitization efforts within the library have made close to 10,000 of the collection's historical maps, plans, and aerial photos freely available online through the library's Digital Archive.[1]

Beyond making the physical and digital collections available to all campus groups, the library professionals within the Map Collection provide guidance on searching for geospatial datasets, as well as on the use of GIS and other specialized cartographic and statistical software for research or teaching purposes. Map Collection staff also offer pedagogical support for various labs and courses, including guest lectures and assessment design. To facilitate its integration with teaching and learning, the collection has its own flexible classroom with a SmartBoard that seats up to 40 people, but converts to a study area when not in use (figure 1).

The recent creation of online modules (figure 2) represents a major undertaking by Map Collection staff to provide spatial literacy instruction to undergraduate students (Maclachlan et al. 2014; Vine et al. 2016). The purpose of this initiative was to bring added value to geography and other disciplines by improving student spatial literacy, while also addressing an increasing demand for spatial literacy lectures by the Map Collection library professionals, which

[1] https://library.mcmaster.ca/maps/.

Fig. 1. *Floor plan for the the McMaster Lloyd Reeds Map Collection, March 2017. Image courtesy of Gordon Beck.*

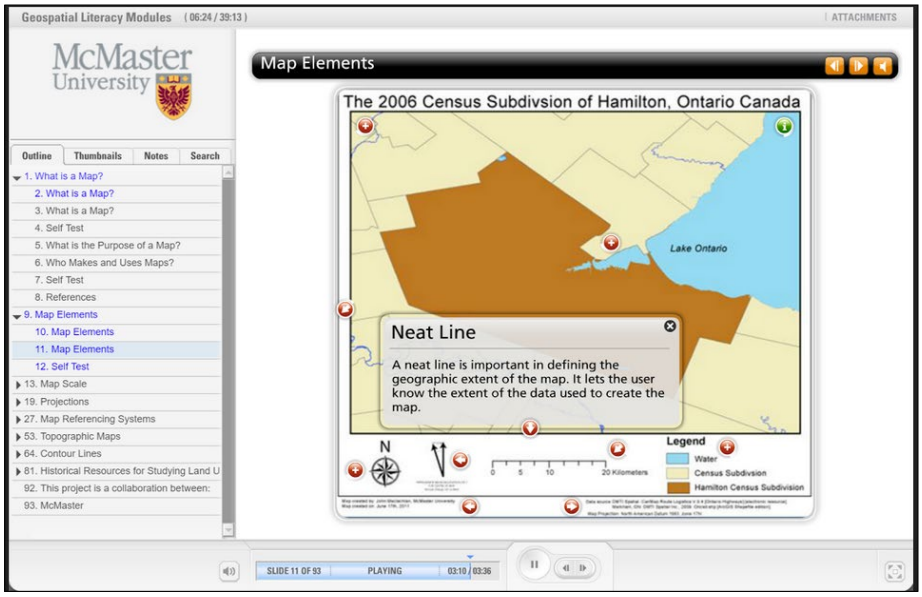

Fig. 2. *Screenshot of spatial literacy modules created by library professionals in the Map Collection for use by students, staff, and faculty*

was unmanageable with current staff resources. The online modules cover numerous aspects of spatial literacy (from map elements to projections), while allowing students to learn at their preferred pace and on their own time. Student feedback on the modules has been extremely positive (Vine et al. 2016), and staff time has been freed to answer the higher level research and pedagogical questions that often stem from student on-demand learning (Maclachlan et al. 2014).

Spatial Literacies in Multiple Disciplines

"The term spatial literacy is rarely explicitly described; rather it is more often discussed with reference to spatial abilities and spatial thinking" (Jarvis 2011, 294). Evidence supports the theory that individuals have a baseline of innate spatial understanding and ability, and that spatial skills must be actively encouraged and practiced to promote student development (Jarvis, 2011). A comprehensive definition by Bednarz and Kemp (2011) describes spatial literacy as the ability of an individual to "capture and communicate knowledge in the form of a map, understand and recognize the world as viewed from above, recognize and interpret patterns, know that geography is more than just a list of places on the Earth's surface, see the value of geography as a basis for organizing and discovering information, and comprehend such basic concepts as scale and spatial resolution" (19).

In the following narrative, Jason Brodeur illustrates the diversity of requests, academic backgrounds, and expertise of those requesting geospatial data and support, and highlights the challenges associated with providing spatial literacy across a university campus. As such, those working within the field of map collection must be experts in the specific disciplines of the spatial sciences (e.g., cartography, GIS, spatial statistics) to properly facilitate discussion and improve research and education goals on campus.

Narrative #1—The Perspective of the Library Professional

Jason Brodeur, Manager, Maps, Data, GIS, McMaster University Library

The McMaster University Library provides broad support for the varied GIS-related needs of students, staff, and faculty members in their research and learning. Generally, users' requirements are addressed through a number of supporting activities, which include providing training and guidance in the use of GIS software; developing finding aids and assisting with searches for geospatial data and consulting on its appropriate use; and providing access to restricted or licensed data sets by negotiating terms of use with data providers and purchasing licenses, where required. Given the heterogeneity of potential users across the campus, providing the aforementioned resources and services in an effective, efficient, scalable, and sustainable manner presents manifold challenges that require a variety of solutions.

A significant challenge that I face is the degree to which users vary in their understanding of, and experience and skill with, GIS software and geospatial data. While uninitiated users typically seek general information and training with software and data, experienced users commonly require specific information on data or analytical processes to inform their methodological decisions. Beyond this, users also have diverse disciplinary backgrounds and interests in using GIS approaches, which leads to variation in the types of data being sought, as well as in requirements for data processing and dissemination. For example, those applying Historical GIS (HGIS) approaches often require support with georeferencing images, building datasets, and visualizing results, while those evaluating quantitative hypotheses—for logistical and remotely sensed imagery analyses, for example—more commonly seek guidance on topics relating to data access and quality, as well as on methodological approaches. We address this diversity in users' knowledge, experiences, and interests by taking a broad and flexible approach in training and consultation. For example, we compile and disseminate information for a wide array of geospatial data, recommend software and methodological approaches according to specific needs, and tailor training resources to the users' background and aspirations. In many cases, we develop recommendations through a reference interview, which consists of a combination of exploratory discussion and targeted questions.

Another persistent challenge relates to users' ability to find, access, understand, and use the data they need for their work. While consultation is typically the best approach for connecting users to data, such an approach is not scalable to the entire population of potential users at the university. Furthermore, it is a reasonable assumption that many users are unaware of where to look for geospatial data for their projects or whom to ask for guidance with this process. Anecdotal evidence supports this hypothesis, as the exclamation "I had no idea this resource/service/data existed" is common during first-time consultations. For users with no prior knowledge of prominent geospatial data sources or the library's services, it is probable that web searches are the first (and perhaps only) method of inquiry. In such cases, it is critical

that searches result in discovery of the most appropriate information. To address these requirements, the library leverages the power of the semantic web by providing thorough and structured metadata for a wide range of geospatial data through web crawler-exposed web pages. The goal of this approach is to maximize the likelihood that the user finds the data they need or at least is aware of the library as a source of information and guidance.

The importance of spatial literacy instruction in higher education has been emphasized in recent years as it is perceived to be a valuable skill for employment (Tsou and Yanow 2010), and because of a proliferation of geospatial data and easy-to-use viewing and analysis software, such as Google Earth (Bednarz and Kemp 2011; King 2006; Maclachlan et al. 2014; Newcombe 2006; Youngblood 2006). The ubiquity of geospatial data and expectation for their use in diverse applications requires both academic and private sector professionals to have a practical understanding of spatial literacy concepts in order to effectively communicate their work to each other and the general public (Kim 2011). As such, interest has broadened for spatial skill and knowledge development outside of traditional disciplines.

The following narrative comes from engineering professor Brian Baetz who, through the expertise of the Map Collection staff, introduces not only concepts of spatial literacy but the technology used in creating and interpreting the data. The class is taught in an experiential fashion with students spending most of their time working with the data.

Narrative #2—GIS and Spatial Literacy to Build Students' "Tool Kits" in Civil Engineering Instruction

Brian Baetz, Professor, Civil Engineering, Faculty of Engineering
McMaster University

Through the introduction of QGIS[2] fundamentals and applications into a third-year core civil engineering systems course and a coursework master's core course in systems engineering and public policy, I have been fortunate to have my students exposed to GIS concepts and practices. For both courses, after an hour of introductory material, the students plunge into the creation of three maps based on hypothetical but representative situations from municipal engineering practice. Library professionals very capably introduce this material and adroitly guide the students to the successful completion of the three mapping modules and also make themselves available for student questions on GIS software and dataset availability as the students use GIS in downstream courses and project research.

The most significant challenges associated with the introduction of GIS into these two courses have been the lack of background these engineering students have in GIS fundamental concepts (and even cartography fundamentals, a lack of working knowledge of the QGIS software, and the potentially limited availability of data for downstream

[2] QGIS (Quantum Geographic Information System) is a free and open-source software

courses and project research. The most significant benefits arising from the introduction of QGIS into the courses have been the expansion of the students' professional "tool kits" (particularly for communicating and illustrating spatial results from other optimization or simulation-based tools) and the development of an awareness of the potential power of GIS and its tremendously useful application in future research and professional practice.

As mentioned earlier, the library professionals' role in this integration of GIS into two engineering courses has been at the instructional level and at a technology resource expert level (providing details of software use, and addressing follow-up questions from students on downstream integration of GIS into other courses and research, and identification of possible sources of data). The implementation of this role—as technology expert and information resource specialist—was particularly effective because of the professional staff's enthusiasm and their ability to help solve software problems on the run within a group of demanding students.

A series of video modules was prepared by the library professionals and loaded up on the cloud for students to view anywhere and anytime. This greatly reduced the number of questions that needed to be answered. As engineers are always interested in practical applications of software tools, a suggested improvement could be the provision of "real world" case studies of GIS application to municipal infrastructure, transportation systems, and environmental systems problems.

In summary, the introduction and integration of GIS into these two engineering courses has been very fruitful and has generated considerable positive feedback from the student cohorts over the last five years.

Using Spatial Data for Interdisciplinary Studies

It is not a new idea to incorporate spatial information into disciplines traditionally considered part of the humanities and social sciences. For centuries, society has understood that location and spatial patterns of resources and markets can influence planning in commerce and politics (Goodchild and Janelle 2010). For example, the first works relating space and health in the mid-nineteenth century (e.g., Snow 1855) initiated the field of epidemiology and has led to the modern-day use of maps to inform public discussion and policy (e.g., Maclachlan et al. 2007). In the humanities, efforts have been made to document the role of place in society through the Electronic Cultural Atlas[3] and the value of the spatial perspective in the Spatial History Project at Stanford University.[4] In general, there is a trend toward the inclusion of spatial understanding in the humanities and social sciences (Gregory and Geddes 2014; Okabe 2016).

[3] http://www.ecai.org/

[4] http://web.stanford.edu/group/spatialhistory/cgi-bin/site/index.php

The following narrative is by John Maclachlan, an instructor in the McMaster University Arts and Science Program.[5] The vast majority of Arts and Science students have had either limited or no experience with spatial data and technologies.

Narrative #3—Spatial Literacy Instruction in Non-Traditional Programs

John Maclachlan, Instructor, Arts and Science Program
McMaster University

As an instructor in the McMaster University Arts and Science Program, I have the opportunity to work with students from various academic disciplines. The program is designed to provide students with interdisciplinary educational experiences, with substantial training in fields thought traditionally to be both in the arts and the sciences. Within this program, there are numerous courses that are meant to offer students similar skill-building opportunities, but have a course theme that varies with each instructor. Once such course is Society and Technology II, which explores the impact of technology on society; when I had the opportunity to instruct this course, it revolved around spatial data and decision making.

The diversity of disciplinary backgrounds of the 30 students in this course meant that it was important to have the data necessary for course success available in an academically neutral area, such as the McMaster Map Collection located within the library. Additionally, students in the class had varying experience with both geospatial literacy and geospatial data, so face-to-face time was used to explore the importance of spatial information throughout history. Having the geospatial data located in one area, coupled with the expertise of the library professionals at the McMaster Map Collection, allowed student access to expertise into all aspects of geospatial literacy, from the understanding of historical maps through modern census data. This ensured that the students had a wide range of opportunities to interact with data. Students interacted with the collections in the map library throughout the second-semester projects, which offered unique methods to disseminate their findings.

The Arts and Science 3BB3—Rare Maps Exhibit 2016 was created to explore and promote some of the interesting rare maps in the Map Collection. Students were assigned an archived rare map (typically from the 1500s–1800s); they were asked to create the metadata necessary for map identification and to research an aspect of the map that interested them. Each student had the opportunity to display their work publicly in an effort to help others better understand how cartography has evolved and the importance of understanding the maps that existed before Google Earth (figure 3). Having access to the rare maps and the staff's expertise helped students explore the maps' significance and digitization. The opportunity for students to disseminate their research results made this project valuable to both the students and the general

[5] https://artsci.mcmaster.ca/program/

public. This was a valuable crowdsourcing project where the students had the opportunity to create information that is available for public use.

The second, more ambitious, project was the Collaborative Writing Group (CWG), which aims to incorporate undergraduate research into a course, giving students the opportunity, over an eight-to-ten-week period, to go through the entire research process, from formulating a question to disseminating results. In this course, students are being asked not only to create within a few weeks a research project that is worthy of peer-reviewed publication, but to do so using subject matter that is new or outside their primary discipline. The expertise of the library professionals in the map library allowed students to interact with geospatial data and necessary software at a level that ultimately led to five student-led research projects being published in the international peer-reviewed journal *Cartographica* in June 2017 (Maclachlan and Lee 2017). The challenge of organizing thoughts and arguments for an international audience required the undergraduate researchers to take true ownership of their ideas; their success would not have been possible without the in-house expertise of the map library professionals.

Fig. 3. *McMaster Arts and Science Program undergraduate students examining historical maps with Gord Beck, map specialist. Photograph courtesy of McMaster University Communications and Public Affairs*

The Role of the Library in "Traditional-Discipline" GIS Courses

Given the range of spatial analysis expertise that exists between disciplines and instructors, it is reasonable to assume that support requirements vary among courses. Departments with strong GIS programs will likely have less need for technical expertise for their courses but will often require specific data for teaching and research purposes. While not all courses require the same amount or type of support from the map library, there remain opportunities to add value, nonetheless.

Narrative #4—The Role of the Map Library With Instruction in "Traditional Disciplines"

Pat DeLuca, Instructor, School of Geography and Earth Sciences
McMaster University

Teaching courses that are entirely GIS related, I incorporate GIS and all sorts of spatial data regularly. In the introduction to GIS, we (the teaching team for the course, including the instructor and the teaching assistants) set out to teach the students the basics of using a well-known GIS software, ArcGIS. Accordingly, different themes for each of the assignments are selected to make use of a variety of spatial data. The third-year courses, Advanced Vector GIS, Advanced Raster GIS, and Remote Sensing, also use ArcGIS and an array of other spatial products. The fourth-year course, Special Topics in GIS, uses a variety of tools in the ArcGIS platform. Finally, Spatial Statistics uses R, ArcGIS and GeoDa. We were an Esri Development Center and now we are an Esri Canada Centre for Excellence for GIS, so using Esri software products makes the most sense for us. Esri also has the largest market share and many companies use a variety of its products. My role in each of these courses is either as an instructional assistant (Intro and Vector) or as an instructor.

With respect to challenges with integrating data and technology into instruction, I find there are none on the technical side as I am—safe to say—an expert in this area with 20-plus years of experience. On the data side, there are always challenges in finding quality data to use for instruction and in supervision of thesis students. In particular, any remote sensing data aside from Landsat and very few others is quite expensive. When teaching Remote Sensing, I am stuck with Landsat products, which is fine for most parts, but for some instances using finer resolution, even for demonstration only, would be beneficial.

The benefits of using spatial data/GIS are many, but primarily, it helps develop spatial thinking. This critical skill set will benefit students a great deal in the job market now and in the future. Many can improve their communication and dissemination of information through mapping. Take something like Code Red, for instance (DeLuca, Buist, and Johnston 2012), where instead of reams of tables and statistics, we have 25 maps that communicate the health of the City of Hamilton in a much more effective way.

I have always used the library to help with course projects in Advanced Raster GIS. Typically, Jay Brodeur (or John Maclachlan or Cathy Moulder before) would come into the class to let the students know about the variety of data available to them and how to access it. Then, the students would go on their way forming topics and collecting data for analysis, getting help from the library when necessary. In my view, the library staff were very effective in this role, and not much could be improved.

I believe the library can play an important role in instruction, particularly outside the suite of GIS courses. I fully believe that everyone can benefit from GIS on campus, but of course we could never teach them all here in the McMaster School of Geography and Earth Sciences. It is not necessary for all students to have the level of depth we offer, nor do most on campus want it, but the library instructors can help in other disciplines, perhaps by thinking about an exercise or two using GIS to illustrate concepts instructors are teaching in their classes. They can offer workshops to those interested in learning some basics of GIS. They can also point people to me. I have access to unlimited Esri Virtual Campus courses, and I can grant them access to these to introduce them to concepts in GIS using the ArcGIS platform.

Introducing Spatial Literacy Concepts to First-Year Students

Teaching complex topics such as spatial literacy and technology to large (and growing) first-year classes who have minimal—or in some cases, no—background with such material is a difficult undertaking that requires varying approaches to help the student experience (Maclachlan et al. 2014). It was for this reason that the spatial literacy modules were initially created. An effective teaching strategy is to allow students to interact with the material (Payne 2006) and, where possible, to have interactions with the course material occur within smaller groups (Jenkins et al. 1993). With approximately 30 to 35 separate tutorial sections, with up to 40 students in each, it became untenable for the library professionals in the Map Collection to teach the basics of spatial literacy and still allow students time to interact with the course material and resources. The online literacy modules (figure 2) help meet this demand and allow students to interact with material at their own pace prior to beginning their work in the Map Collection (Maclachlan et al. 2014).

The following narrative comes from the perspective of Julia Evanovich, who is currently an educational developer in the McMaster MacPherson Institute for Leadership, Innovation and Excellence in Teaching, but was previously the instructional assistant for first-year geography courses at the time the online modules were implemented.

Narrative #5—Integrating Spatial Skill Development in First-Year Studies

Julia Evanovitch, former Instructional Assistant, first-year Geography program

During my role as the instructional assistant (IA) for our program's two first-year human geography courses, it was very important to incorporate GIS and geospatial data into the development of course activities and assessments. It was also important to have multiple voices and perspectives involved during the development of the teaching and learning activities. Both of the first-year courses that I have been involved with incorporate in-class introductory geospatial data activities that align with the course concepts and methods used throughout the term. These include activities that are set up at the university's Map Collection (within the campus main library) to ensure students also have an opportunity to become familiar with this space, as there are times throughout the term when students will access geospatial data resources from here; it is a critical resource for students moving forward in their studies. The resources used include fire insurance maps, atlas plates, topographic maps that use various map referencing systems, case studies regarding projections, and various other resources offered at the Map Collection. One of the assignments incorporates a blended learning approach, where prior to the in-class assessment, students are asked to complete online geographic skills modules that align with the in-class tasks. This was a new approach, as historically our Map Collection staff would provide a presentation to each tutorial group of students. Staff and students have responded positively to the blended format. Students appreciate the preparatory component prior to introduction of the assignment, and it has also been less labor-intensive for the Map Collection's staff. My role as IA was to prepare the teaching assistants who would be leading the tutorials and to regularly consult with the library staff and instructors regarding the operational planning of the tutorials. As a sessional instructor, I hold a similar role by ensuring that the teaching team and tutorials are well prepared.

One of the challenges associated with integrating geospatial data into the assessment and instructional activities is ensuring that there is enough support in the tutorials when introducing the various resources. Our tutorials hold up to 40 students, so a piece of this operational development is to ensure that accessibility standards have also been considered. The successes of these tutorials include positive feedback from students at the end of the term (and years later), the positive collaboration with the library team, and the introduction of the blended approach to introducing geospatial data. This approach has been effective, as we have used this model for the last seven years, adapting each year with the support of the teaching team and library staff. Having the library staff integrated within the first-year courses has been critical. The library staff has helped in the development and delivery of various instructional tasks such as guest lecturing, helping to develop the geographic skills online modules, co-leading training of the teaching assistants, organizing content at the Map Collection, and regularly consulting with the teaching team. Executing such assignments and

instructional activities would not be possible without the collaborative relationship that our teaching team has with the library staff. Continued development of these collaborations would allow for further discourse surrounding the value of integrating geospatial data into our instructional and tutorial activities.

What About the Students?

Both graduate and undergraduate students interact with staff at the Map Collection regularly for their coursework and individual research projects. In many ways, use of the Map Collection is not much different for these two groups, in that it revolves around teaching and research. The important difference is that, often, students work on projects that incorporate spatial data and technologies without being (or having time to become) experts in this discipline. In such cases, the embedded expertise of the Map Collection staff becomes valuable not only for their ability to help students, but also for their availability to consult with instructors to design assignments that incorporate spatial literacy instruction at an appropriate level, without overwhelming the capacity of the library staff.

The following narrative comes from PhD candidate Rebecca Lee. In her research, Rebecca examines landsystems in Iceland (Lee 2016); when possible, she also works on projects that fall under the umbrella of the scholarship of teaching and learning (Maclachlan and Lee 2017). Rebecca also acts as the lead teaching assistant for many courses that incorporate spatial technologies into their assignments.

Narrative #6—The Graduate Student Perspective

Rebecca Lee, PhD Candidate, School of Geography and Earth Sciences

As a graduate student, I have had the opportunity to use GIS within the courses I have taken and as a tool for teaching others as a teaching assistant. I have used geospatial data and GIS within many research projects, and it was a major component of my master's thesis (which was related to the analysis of digital elevation models and aerial imagery from Iceland). As a teaching assistant, I have been involved in courses that incorporate GIS in different ways. The most significant of these was the use of geospatial data in an upper-year glacial sedimentology course. One of the first labs involves the use of aerial imagery and digital elevation models to map landforms. I have found that the most significant challenge in using GIS and geospatial data in courses is the varied background of students; many have never used these programs and data before. When I conducted a seminar for a graduate glacial sediment course with a small class size, the general knowledge of the students was advanced so this was not a large issue. However, it was difficult to instruct a class of 30 undergraduate students having varied skills and backgrounds with the GIS program and data types. A significant amount of the lab time was spent teaching the basics of how to use the program, how to understand what students

were seeing on the screen, and how to manipulate the data to complete the analysis needed.

Increasingly, GIS and geospatial data are being incorporated into research projects, and providing students with the opportunity to work with these types of data is very valuable. The ability to understand and manipulate spatial data may help with future jobs or research in many disciplines. I have found it to be an incredibly valuable tool within my own research and courses, and I believe that having some basic skills would benefit students in most disciplines.

When I was an undergraduate student, the library was very helpful for finding data and providing useful resources for my projects. I now know where to find any data that I need without assistance from the library, which really shows how successful they were in teaching me how to find material on my own. The library is a great resource for finding datasets that can be used in classes by instructors and by students for research projects. I think that having people in the library who understand geospatial data and GIS programs in general is critical, as GIS is a continually evolving and growing component in many jobs that students might pursue. Though the library should be a resource for datasets and have the expertise to help students learn how to choose and find data, I think it comes down to the instructors to find methods of integrating geospatial data into instruction. As geospatial data and technologies become more common components of different jobs, it might be necessary to improve awareness of the ways to incorporate it into more classes, as well as to highlight the expertise in the library so that this valuable resource can be used and integrated within more classes.

Supriya Singh is an undergraduate student in the McMaster Integrated Science (iSci) Program and is scheduled to graduate in the spring of 2017. Because of the nature of the iSci Program (see https://www.science.mcmaster.ca/isci/), Supriya takes courses from many different programs and is the ideal person to assess the importance of spatial data from a student perspective.

Narrative #7—The Undergraduate Student Perspective

Supriya Singh, BSc Candidate, School of Interdisciplinary Sciences

As an undergraduate student completing an interdisciplinary science bachelor's degree with a focus on earth and environmental sciences, I have found that GIS and geospatial data have played a vital role in my education. The general concept of GIS was introduced to me through a guest lecture in my first-year earth science course. The guest speaker (Pat DeLuca) explained a case study where socioeconomic data were collected throughout a city and mapped to analyze trends. From this case study, I had a vague idea of what GIS could do, such as giving spatial context to a set of data. However, the value of knowing how to use GIS software to interpret geospatial data became more apparent as I continued to take higher-level GIS courses. These courses consisted of numerous assignments that required me to apply the theory of how

GIS works through navigating GIS software. For instance, my spatial statistics course taught me how to use GIS software in addition to basic statistics software in order to analyze trends in spatial data.

I have used my GIS skills and encountered geospatial data beyond GIS-focused courses. For instance, I used GIS as a tool in my honors thesis project to delineate drainage basin areas (watersheds) for discharge data I was collecting all summer. My water chemistry data were displayed using symbology across a map of my study area using GIS as well. We all know that figures better depict a story than words, and I am telling my thesis story throughout my maps. A few of my other courses, such as Wine Science, Glacial Sedimentology, and Environmental Assessment, have all incorporated a geospatial data component, stressing the importance and potential of GIS. For instance, a major assignment in my environmental assessment course is to use fire insurance plans to track the history of land use changes in a specific area in order to determine if the area is a viable option for future urban development. The integration of geospatial data was probably not necessary to deliver content, but it provided students, myself included, with an opportunity not only to mimic and experience what an environmental consultant does in an assessment, but also to learn about maps and their importance.

I have also had the opportunity to get involved with geospatial data at the Lloyd Reeds Map Collection as a map digitizer. I scanned topographic maps removed from copyright using powerful scanners with really high resolution and published these maps and their metadata online. The maps we scanned and published are accessed by students at and beyond McMaster. Individuals from engineering companies and consulting companies, business students, history students, law students, and science students all access these maps for various purposes. Throughout this job, I realized how GIS and geospatial data are so interdisciplinary in nature and can have limitless applications. As a student who has benefited from knowing how to operate GIS software and had experience working with maps, I believe that the knowledge I have gained would be valuable for all students to have through simple introduction to GIS and geospatial concepts.

Reflection and Discussion

The assembled narratives of the Map Collection users illustrates the range of applications and value of the Map Collection.

A number of common themes arise from these narratives; the first, and arguably most important, is *the need for expertise within the Map Collection*. While the centralized collection of varied and often rare cartographic materials provides scholarly value, it is apparent that instructors, researchers, and students also require guidance and instruction with spatial information in their activities. As such, there is a resounding need for map library staff to possess disciplinary knowledge and technical skills to support a wide variety of spatial information needs. As the collection development priorities of map libraries evolve from physical to digital material, the role of

the library professional will also need to evolve to accommodate this change. Additionally, with the expansion of disciplines using the map collection and its material (Youngblood 2006), it will be imperative that libraries offer expertise and relevant support to those disciplines that are new to spatial data and technologies (Scaramozzino et al. 2014).

There is a definite need for map libraries to commit to outreach within universities to meet and assess campus needs for evolving spatial technologies. While an anecdotal example, the narrative of Supriya Singh discussed guest lectures in her program as piquing her interest in spatial information. As data become available and technologies change, it is critical for the Map Collection to act as the hub of information for students, staff, and faculty by making them aware of resources and facilitating their access to them.

As their user bases increase, it will become increasingly important for map libraries to be at the forefront of teaching and learning innovation in relation to spatial literacy. The importance of spatial literacy has been well established, and the increased uptake of data and technologies has been well documented. What is unlikely to change in the near future are budgets representing the true costs of bringing this technology to as many students as possible. The use of online modules was deemed successful at McMaster University by the course instructional assistant, Julia Evanovitch, and also as evidenced by the traditional qualitative research of the student body (Vine et al. 2016). Discovering new approaches to technologies in conjunction with innovative pedagogical ideas, such as the rare map crowdsourcing project undertaken in John Maclachlan's Arts and Science class, will be necessary to increase data use in the classroom and enhance the student learning experience.

With the increased use of spatial data and technologies across university campuses, it is even more critical for the supporting resources and expertise to be housed in academically neutral areas, such as the library. As such, it is also important for map libraries to continue to provide the expertise and staff necessary to reach and support a broadening clientele of staff, students, and faculty. In addressing these requirements, map libraries have an opportunity to become teaching and learning hubs for users of varying disciplines and levels of expertise, as well as to be catalysts for research and pedagogical innovation across university campuses in the future.

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New Opportunities for Collaboration in the Age of Digital Special Collections

Erin Connelly, Anne Donlon, Dimitrios Latsis, and Dawn Schmitz

This essay explores the impact of digitized and born-digital special collections on teaching, learning, and research, and, through institutional case studies, considers the variety of collaborative opportunities made possible by the digitization of special collections. Given that there is likely to be an increasing demand for using special collections in learning and an increasing number of collections will be born digital, it would be advisable for academic libraries to determine methods to make learning with digital collections as engaging as learning with physical materials, and to create space and staffing to accommodate the greater use of physical collections. Both digital and physical collections offer their own particular opportunities for users to look closely at unique, primary source materials and engage with them in ways that support cross-disciplinary research and collaboration in teaching.

To begin, it is helpful to query what we mean by *special collections*. The term resists compact precise definition. It carries a variety of interpretations, some specific to individual institutions. Additionally, it may refer to either (or both) physical and digitized/born-digital collections (i.e., *digital collections)*. Donald J. Waters (2009), in reference to a working group report on special collections in Association of Research Libraries member institutions, summarized special collections as "those materials containing primary evidence for scholarship that require special treatment in their description or handling." Along those lines, some prefer the term *distinctive collections* in recognition of the features that set these collections apart from others (e.g., they are primary evidence, they are also vulnerable, require specific care and treatment, and are not readily available), as well as to encompass digitized materials and emerging born-digital materials (Association of Research Libraries 2009). It is beyond the scope of this essay to offer a comprehensive definition of special collections,

but we note certain shared themes in regard to physical and digital materials, including preservation, accessibility, innovation, and value as a bridge to research, scholarship, and pedagogy for a wide audience.

Inter-institutional Collaboration on Digital Collections

Collaborations between institutions to digitize materials can have the important benefit of bringing topically similar but geographically dispersed special collections together online. Such projects allow digital resources to be made available to scholars who may not be able to travel to multiple locations to conduct their research. CLIR's Digitizing Hidden Collections[1] grants seek to foster strategic partnerships of this kind. All types of collaborative initiatives that provide easier ways for researchers to discover and use materials—whether digital or physical—are crucial for the future of special collections research. The success of the metadata aggregator Digital Public Library of America (DPLA) depends on close collaboration between libraries, hubs, and the DPLA to harvest and submit metadata in ways that are as interoperable as possible given the disparate milieus in which it was created. A recent initiative from RightsStatements.org[2] seeks to standardize copyright statements among contributors to make them more understandable and useful for students and scholars.

An in-depth look at linked data and other metadata initiatives designed to help researchers discover materials, make connections between them, and understand relationships between them is outside the scope of this essay. However, the ability of researchers to use sophisticated but user-friendly and accessible tools and platforms to find materials on a given topic—and to find materials related to other materials by topic, creator, or format—could potentially transform research with manuscripts and archives. Given the complexity of archives and manuscript collections, these types of sophisticated data initiatives will allow what was never possible before, permitting scholars to understand during the discovery phase of their research the complex web of relationships between other individuals and institutions.[3] Additionally, linked open data and other metadata initiatives offer potential new ways to analyze and understand collections across institutions.

[1] https://www.clir.org/hiddencollections

[2] http://rightsstatements.org/en/

[3] One way in which linkages can be created between collections is through the use of emerging standards such as Encoded Archival Context: Corporate Bodies, Persons and Families (see http://socialarchive.iath.virginia.edu/). For an example of a highly collaborative project to create EAC-CPF records, see Addonizio and Case 2015.

Collaboration with Faculty and Students: Supporting Teaching and Learning

Special collections, both digital and physical, offer opportunities for collaborations between academic information professionals, teaching faculty, and students through their special capacities for engaging students in active learning experiences. While the use of archives, manuscripts, and rare books in college and university curricula is not a new phenomenon, the trend since around the turn of the century is toward an ever-increasing level of student engagement with special collections services and materials (Tomberlin and Turi 2012).[4]

Some attribute the increase in students' and researchers' exposure to special collections to digitization, which results in more demand for use of original physical materials as well as digital surrogates (Mitchell, Seiden, and Taraba 2012). Others credit an ethos of access, as opposed to an overwhelming emphasis on preservation, on the part of librarians and archivists (Seal 2012). These two explanations are closely linked, since the trend toward digitization is itself closely tied to the ethos of access.

Others point to the report of the Boyer Commission on Educating Undergraduates in the Research University (1998). The report recommended research-based and inquiry-based approaches to teaching that can be facilitated with unique primary source materials (Rockenbach 2011). Indeed, the distinctiveness of special collections materials and the thrill of discovery they facilitate make them ideal for approaches in which students are invited to engage their curiosity, ask questions, and learn through discovery, rather than absorbing static knowledge. In special collections, these processes often involve the use of original, physical primary sources, but this is not always the case. For some, encountering a web page preserved in 1996 can provide the feeling of being transported back in time just as an old letter does; for others—including some faculty members who bring their students to special collections—nothing compares to paper-based sources. In either case, students are often fascinated when they encounter primary sources in their original format and experience a sense of awe in the presence of a document that has survived over time and was once created and handled by a historical figure.

Trends in academic library instruction have encouraged efforts to identify a range of information-related literacies and competencies that pertain to archives and special collections. Many librarians and archivists embrace concepts such as *archival literacy*, *artifactual literacy,* and *archival intelligence,* in addition to subject knowledge, as ways of framing an understanding of the several types of knowledge and skills required for a person to interpret and contextualize original primary source materials—as well as to form and execute a research strategy using manuscripts and archives informed by a basic

[4] Writing in 2001, Marcus C. Robyns observed that many archivists did not see teaching as their role, but he already saw that attitude as beginning to change (Robyns 2001). However, as far back as 1972, archivists were addressing the use of archives by undergraduate students (Taylor 1972).

understanding of archival practice (Nimer and Daines 2012, Yakel and Torres 2003).

Recently, library and archival professional organizations have responded to these efforts by providing resources and compiling guidelines for primary source literacy.[5] Those who promote a common set of concepts and standards for teaching with primary sources do so in part out of a recognition that a framework shared by both librarians and teaching faculty makes collaboration easier (Carini 2016).[6] These guidelines pay attention not only to the use of physical originals but also to basic questions about how students and researchers can understand and profitably use primary sources in the digital age, distinguishing between online tools that provide information about sources versus those that contain the sources themselves, and suggesting ways of understanding the not-always-clear relationships of original sources to their physical or digital surrogates.

As noted earlier, the increased instructional use of special collections, both online and in the classroom, is related to greater attention in higher education to pedagogical approaches that incorporate theories such as constructivism, which is closely related to inquiry-based learning and is premised on the idea that students can create their own learning experiences under the guidance of a teacher. This approach involves engaging students in the learning process by providing hands-on experiences and inviting them to reflect on their learning. Special, distinctive collections can be powerful resources to engage students in classes that use this approach, inviting them to make connections between new information and prior knowledge, develop their skills of inquiry, contextualize knowledge by completing a real-world task, and reflect on their experiences (Vong 2016). Inquiry-based learning models can form the groundwork for close and fruitful collaborations between special collections librarians and teaching faculty. These collaborations provide the repeated exposure to research materials that allows students to model the iterative approaches that scholars take in examining and using primary sources. Moreover, librarians' familiarity with the materials and with information literacy concepts allow them to work with faculty on designing research-based exercises and assignments that further critical thinking skills and advance their disciplinary knowledge (Mazella and Grob 2011).

This realization has prompted many librarians and archivists to move beyond the most basic level of engagement between students and special collections in many libraries: the "show-and-tell" session,

[5] The SAA-ACRL/RBMS Joint Task Force on the Development of Guidelines for Primary Source Literacy was formed in 2015 to develop guidelines to provide competency standards for primary source literacy (see http://www2.archivists.org/groups/saa-acrlrbms-joint-task-force-on-primary-source-literacy). For a discussion of the ideas that went into the formation of the task force, see Daines and Nimer 2015.

[6] The volume *Teaching with Primary Sources*, edited by Christopher Prom and Lisa Janicke Hinchliffe, was published in 2016 by SAA as part of its series *Trends in Archives Practice*, and it was adopted by the organization as its One Book, One Profession offering for that year (Prom and Hinchliffe 2016).

in which students are brought to the reading room by their instructor to see materials and hear a librarian or archivist talk about them, sometimes with no related class assignment and no direct student interaction with the materials. At the same time, given the reality that, in many cases, one trip to special collections is all that will be provided for on the syllabus, teaching with special collections is becoming increasingly pedagogically grounded, whether or not the instruction is one-shot or course-integrated (Bahde, Smedberg, and Taormina 2014).[7] Archivists and librarians may offer activities such as "speed dating," in which students move from one station of special collections materials to another and at each they are given a few minutes to examine the materials and fill out a worksheet before coming together as a class to discuss what they have learned (for an example, see Walworth 2012).

At times, these types of activities are offered by archivists and librarians in response to requests for show-and-tell sessions by faculty who may not realize information professionals are prepared to provide more active learning experiences. Such sessions can sometimes serve as a gateway to discussions of richer collaborations down the road. These sessions can also lead to fruitful discussions about the learning objectives of a given assignment or class exercise using special collections, and whether these objectives can be aided by the digitization of relevant materials and perhaps the creation of an online learning resource featuring these digital surrogates.

While the creation of online learning resources has often been associated with support for K–12 teaching, collaborations between special collections librarians/archivists and university faculty have brought such resources into higher education classrooms. Course guides can link directly to digital resources or to relevant finding aids for students to use in particular assignments. Students can also be involved in the digitization of materials or other digital projects related to special collections, such as the creation of Wikipedia entries based on archival research (for an example, see Chute, Swain, and Morris 2016).

Course-integrated projects can include a range of types of assignments in addition to research papers and presentations. They can include the creation of physical or online exhibits, or other types of digital projects that may involve digital history websites, digitization of collections, or similar projects. Other types of digital and nondigital projects might involve students in collection development. Such projects can sometimes bring another level of collaboration with the community outside of the university. Whether helping individual community members or community groups digitize their materials or working with archivists and curators on the collection of physical or digital materials, these types of projects can provide meaningful service learning or community engagement experiences. They can also advance collection development objectives aimed at diversifying

[7] This volume addresses the need for creative and meaningful instruction in only one class session with exercises grounded in pedagogical theory.

the archival record when such activities involve collaborations with under-documented communities.

There is widespread need to digitize more collections in order to provide primary sources for students (both near and far), as well as for scholars, community historians, and other researchers. As more collections are born digital, there will also be a growing need to provide infrastructure for students who work on projects with born-digital collections, particularly collections that cannot be made openly available on the Internet because of copyright or other concerns. Whether through the provision of sufficient technology support in reading rooms or classrooms, through virtual reading rooms that limit access to particular researchers who agree to comply with copyright laws, or through other mechanisms, archivists and manuscript curators need to find ways to provide both open and restricted access for teaching and learning as well as research (Light 2014).

Expanding the capacity of academic libraries to collaborate on teaching requires an investment of resources in several key areas. New ways of accessing and using digital collections requires more sophisticated digital infrastructures. At the same time, libraries should anticipate increased demand for instruction using physical collections, not only because of the particular kinds of hands-on experiences they provide, but also because, in some courses, one of the learning objectives may be to teach students how to use and understand physical collections. Both physical and digital infrastructures will need expansion to accommodate teaching with digital collections as well as physical collections.

Even more importantly, libraries and archives must invest in professional development, not only in areas such as digital archives and digitization, but also in areas such as pedagogy and curriculum development. Libraries can help meet the demand for more collaborations with teaching faculty by providing professional development opportunities for special collections librarians and archivists to learn how to become better teachers.[8] Librarians and archivists should take advantage of opportunities offered by teaching and learning centers at their colleges and universities as well as through their own professional organizations. In addition to these efforts, libraries should use open positions as opportunities to enrich and diversify their special collections departments by recruiting and hiring candidates who have teaching experience with primary sources—whether or not this experience was gained in a library or in an academic department. The increased incorporation of special collections in the university classroom in a variety of disciplines suggests the value of advertising job postings where recent graduates with master's or doctoral degrees and teaching experience will see them. While a new member of a special collections department who lacks library or archival

[8] Beginning in 2015, as a way for librarians and archivists to share information, tools, and techniques related to their teaching responsibilities, an unconference on teaching with primary sources has been offered the day before the SAA annual meeting (see http://teachwithstuff.org/). ACRL's *Guidelines: Competencies for Special Collections Librarians* (2008, rev. 2017) lists the ability to engage in teaching and research among the core competencies.

experience will need help from current staff to understand these professions—including their administrative and bureaucratic components—an experienced teacher could return the favor by enriching the department in a host of ways. Expertise in pedagogy and experience in teaching should not be dismissed as a skillset that can easily be picked up on the side, nor can it reasonably be acquired in a two-year graduate degree in library science. Moreover, hiring a candidate with experience creating syllabi and teaching courses could enhance and ease collaborations with teaching faculty.

Increasing the amount of physical space, digital infrastructure, and expertise in the realms of both pedagogy and technology will require advocacy efforts by those who administer special collections units in academic libraries. To support these advocacy efforts, assessment programs will be essential in demonstrating to funding allocators the ways in which teaching with special collections achieves student success objectives for the institution. Assessment tools are currently being created and shared for just such purposes (Horowitz 2014).[9]

Although special collections are increasingly digital thanks to both the digitization of physical collections and the collecting of born-digital resources, librarians, archivists, and teaching faculty are collaborating as never before on the use of physical and digital materials alike. An increasing amount of digitized material has brought a greater appreciation of the physical aspects of books and manuscripts even while taking full advantage of the incredible affordances of the digital.

Collaborations on Community Archives

Manuscript curators, particularly in major academic and research libraries, are collecting born-digital manuscripts like never before, a process that can involve the application of digital forensics techniques, tools, and software to do so safely when working with obsolete file formats and media. Yet the special fragility of digital information—and the reality that preserving it requires ongoing attention—leads to a concern that some valuable papers may be lost before they can become part of a library's collections. In part to address this problem, archivists and special collections librarians offer training and workshops in personal digital archiving as part of their community outreach activities, an initiative that the Library of Congress began planning in 2009 (LeFurgy 2014). Such activities help raise awareness of archives and digital preservation while helping individuals and organizations meet their immediate needs. These

[9] See also TeachArchives.org, which exemplifies the trend toward assessment, as it included a range of evaluative measures showing increased rates of academic success among those students participating in a large, grant-funded project. Students and Faculty in the Archives (SAFA), a three-year, $750,000 grant project funded by the Department of Education from 2011–2014, was a multi-institutional close collaboration between an archivist, Robin M. Katz, and a historian, Julie Golia, that reached thousands of students (Katz 2015). TeachArchives.org offers best practices and resources such as model assignments and exercises.

initiatives can also help ensure that important records are preserved for future historical purposes.

Guidance with digital archiving can be part of community archiving initiatives as well. Many archivists and manuscript curators working in academic libraries see it as an ethical choice to work in partnership with communities documenting their own histories by preserving records both digital and physical. In some cases, this work requires ceding some level of control over the donor relations, acquisitions, and appraisal processes to members of those communities being documented. Most often, it also means that the records will stay within the communities themselves and not be transferred to a separate collecting institution at all. To some, this support of community archives is critical to an ethos of social responsibility, since it can permit traditionally marginalized communities to control how their own histories are documented and shared.[10] A related type of community archiving initiative is the provision of digitization resources and expertise to community organizations, families, and individuals; sometimes, an institution digitizes materials and adds the digital surrogates to its collections, then returns the originals to the community.

Case Studies

The Ancientbiotics Team: An Interdisciplinary Collaboration Between the Arts and Sciences Using Medieval Medical Manuscripts

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The rise of antimicrobial resistance and the lack of new drugs in development to combat this resistance has been called one of the most pressing threats to global health at the present moment (WHO 2016). In response to this threat, the Ancientbiotics team was formed in 2014, originally based at the University of Nottingham. The team is an interdisciplinary and international collaborative effort between the arts (medievalists and historians) and the sciences (microbiologists, parasitologists, medicinal chemists, and data scientists). The team, co-led by Christina Lee and Freya Harrison, found that a mid-tenth-century recipe, Bald's eyesalve, contained in a medieval medical manuscript (British Library Royal MS. 12 D XVII, f. 12v) kills one of the most common causes of modern eye infection, the bacterium *Staphylococcus aureus* (Harrison et al. 2015). Additionally, this 1,000-year-old remedy was shown to be a potent antibacterial agent with great potential for treating a range of antibiotic-resistant soft tissue pathogens, including the "superbug" Methicillin-resistant

[10] Archivists have been writing about community archives for at least 10 years (Flinn 2007). A recent event in this vein is *The Liberated Archive: A Forum for Envisioning and Implementing a Community-Based Approach to Archives*, held in conjunction with the Society of American Archivists annual meeting, Portland, Oregon, July 2017.

Staphylococcus aureus (MRSA) (Harrison et al. 2015, 2016). Relevant to our discussion in this essay is the team's use of a special collections document to bridge the disciplines and yield remarkable outcomes. This successful and ongoing cross-disciplinary and international collaboration yielded results greater than single disciplines acting in isolation could have accomplished; expertise from both the arts and the sciences was essential in the interpretation and testing of the eyesalve. The manuscript containing Bald's eyesalve was digitized and made available online by the British Library shortly after the results of the Ancientbiotics pilot study were published (British Library 2016).

The exact number of digitized medieval manuscripts from special collections is unknown. Quoting research by Tim Stinson, Jesse McDowell (2015) stated that "less than 2% of the entirety of medieval manuscripts in the world have been digitized."[11] Medieval scientific and medical manuscripts are often a low priority for digitization, making them difficult to access and creating a barrier to such collaboration as the Ancientbiotics project. The lack of priority accorded to medieval medical works is due in part to a longstanding assumption that these texts are irrelevant to present-day research (as shown by the popular label of the medieval period as an unscientific, irrational "Dark Age"). That many are not as beautifully illuminated or as well-known as medieval literary and religious works and may show signs of practical use (damage, staining, disordered folios) makes them less visually compelling to a wide audience. The digital world is extremely visually oriented. An encounter with a physical medieval manuscript engages other senses, but digital encounters rely upon the visual. It makes sense for institutions to prioritize their striking and heavily illuminated manuscripts before practical text-based medical manuscripts. However, from the perspective of the Ancientbiotics team and other researchers looking into the medical past to inform future research, the potential antimicrobial content of a medieval medical manuscript is far more beautiful than the objects traditionally considered to be the greatest treasures. Like *Bald's Leechbook*, which was not made available online until after the lab tests of the eyesalve, there may be other potent antimicrobial recipes in medieval medical texts. Digitization can aid the discoverability and accessibility of these data. A reconsideration of digitization priorities to emphasize the content of "un-beautiful" texts will be of great benefit for collaborative efforts sharing the ethos of the Ancientbiotics team.

Digitization at Scale: Unlocking Audiovisual Libraries

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If non-print materials have always formed an integral part of most university libraries' special collections, and librarians and conservators have always been aware of the particular needs and opportunities

[11] See also: DMMapp (http://digitizedmedievalmanuscripts.org/); Echard 2017; Fabian 2014; Scase 2015, 310–322 at 313.

offered by time-based media, the same cannot be said of the place that such materials have within the broader discourse of digital humanities (DH). Early DH projects were, by and large, text-based; even nowadays collaborations focusing on collections of a visual or aural nature are the exception rather than the rule. Yet CLIR, among other organizations, has started to promote a more inclusive interpretation of collections, skills, and tools that librarians and archivists (including in special collections departments) have to possess in a twenty-first century context. The Mellon Foundation-funded postdoctoral fellowships in data curation in visual studies,[12] the more recent program for the preservation of recordings at risk,[13] as well as numerous reports and relevant scholarship that the organization has commissioned in recent years in the field of audiovisual preservation, point the way forward with respect to the place of media within the broader conversation about digital methodologies in special collections libraries (for examples, see Pierce 2013 and CLIR 2010).

It is instructive to look at one such example of a DH project that aims to digitize more than 10,000 reels of educational, industrial, and amateur films and develop tools that facilitate pedagogical and research use of this collection. In doing this, the Internet Archive has striven to follow guidelines[14] and specifications[15] accepted within the archival community and consulted with partners on best practices and workflows in order to develop a more customized approach that best serves the needs of each project (figure 1).

A customized approach is necessitated by the fact that digitization of physical assets held by archives, libraries, and museums has thus far been construed as the production of *preservation-quality* digital surrogates that can serve a number of potential needs: restoration, exhibition, and online distribution among them. Setting the bar this high has understandably hindered progress and made archivists and librarians reluctant to invest the time, personnel, and equipment needed to plan such a complex project. The result has been enormous backlogs, widespread neglect—especially in genres and modes of filmmaking such as non-theatrical films where there is no immediate incentive for distribution and commercial exploitation—and overwhelmed grant makers (National Film Preservation Foundation, Council on Library and Information Resources) trying desperately to prioritize from a sea of equally worthy projects.

Granted, this situation cannot be solely attributed to the insistence for high standards and the costs of film preservation; nor is this a call for the bar to be lowered on these fronts. Instead, the

[12] Fellowships in Data Curation for Visual Studies–Council on Library Information Resources: https://www.clir.org/fellowships/postdoc/applicants/fellowships-in-data-curation-for-visual-studies.

[13] Recordings at Risk–Council on Library Information Resources: https://www.clir.org/recordings-at-risk.

[14] Motion Picture Film Scanning Projects: Audio-Visual Working Group–Federal Agencies Digitization Guidelines Initiative: http://www.digitizationguidelines.gov/guidelines/Motion_pic_film_scan.html.

[15] Motion Picture Preservation Lab–National Archives and Records Administration: https://www.archives.gov/preservation/products/definitions/mopix-lab.html.

archival community should replicate what has been a very successful and continuously updated set of guidelines for preservation into the realm of digitization, which currently lacks national, disciplinary, and scholarly guidance (Melville and Simmon 1994). We desperately need a set of shared practices that can serve a wide variety of institutions while keeping in mind the primary reason we are striving to preserve our shared audiovisual heritage in the first place: to put it (back) in the hands of the public, on as global and open-access a basis as possible.

The Internet Archive as a whole is driven by this philosophy[16] and thus it is no surprise that, in its film digitization activities, too, emphasis has been placed on scale and access.

Instead of following the example of other major archives that are frequently constrained by scanning a maximum of 100 reels of home movies a year out of a collection that numbers in the tens of thousands, the Internet Archive has chosen to take a nuanced approach into what the National Archives and Records Administration calls "distribution/reproduction" masters.[17]

Fig. 1. *Internet Archive Film Digitization Workflow, Tools and Partnerships (Also available at http://blog.archive.org/wp-content/uploads/2015/12/IA-Poster-page-001.jpg.)*

[16] Internet Archive: About IA: https://archive.org/about/.

[17] Digital Moving Images from Film-based Source Material–National Archives and Records Administration: https://www.archives.gov/preservation/products/reformatting/mopix-digital.html.

This digitization workflow is grounded on the following assumptions:

1. The Internet Archive's role is to provide digital surrogates of films that have long been unavailable, buried in archives, or destroyed through de-accessioning and chronic neglect.
2. The films in its collections are often many generations removed from camera originals and thus not fit to be used as preservation masters
3. Copies of most of these films exist in many other archives and libraries, nearly none of which has a plan or the resources to digitize them in the near future.
4. The Internet Archive aims to build an extensive collection (in breadth and depth) in a single genre—educational films—that can serve as a proof of concept and example for future work of a similar nature (in terms of digitization and metadata).
5. The Internet Archive does not want to restrict access to digitized films because of lack of clarity in rights issues; it rather aims for the widest availability possible.

In implementing these principles, the Internet Archive has for the past two years been digitizing, uploading, curating, and making publicly available (in most cases for the first time in many decades) upwards of 40 hours of content every week.[18] That corresponds to almost 100 reels of 16mm film and 1.5 terabytes of audiovisual files. This roughly corresponds to the amount of original programming that the NET (National Educational Television) was providing weekly to its viewers during its heyday. This is being accomplished with a limited staff, enthusiastic volunteers, one 16mm film scanner, and optimum coordination from the physical to the digital to the online curation realms.

While numbers do not tell the whole story, it is certainly hard to argue that an access-based model of digitization should not be part of the (inter)national conversation about the preservation of our audiovisual special collections.

Born-Digital + Instruction Pilot Project at Emory's Rose Library

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As a postdoctoral fellow at the Emory Center for Digital Scholarship and the Stuart A. Rose Manuscript, Archives & Rare Books Library, I worked on a pilot project with Dorothy Waugh, digital archivist, and Gabrielle Dudley, instruction archivist, to develop an assignment for undergraduate students to explore born-digital drafts of poetry from one of the collections, using the text analysis tool Voyant.

We had multiple goals for the pilot project: (1) to promote the use of born-digital materials, particularly among Emory students and faculty; (2) to explore what DH tools would provide interesting possible applications to born-digital materials; and (3) to assess what changes

[18] The collection can be found at https://archive.org/details/educationalfilms.

to policies and infrastructure would be needed to implement this pilot project in instruction and to extend the kinds of access the library might provide to researchers more broadly.

Whereas traditional paper materials need to be digitized and OCRed, or transcribed, to allow the use of digital text analysis tools, born-digital materials are already in an electronic form. Researchers could theoretically use DH tools to read and analyze these materials without much extra intervention. However, archives generally do not offer a level of access that would allow researchers to transform the files to the necessary data form and then apply their chosen tool. At Emory, researchers access born-digital files on a pared-down laptop or iPad. To preserve the files and keep them secure, researchers cannot run any programs or connect to the Internet on the device. The born-digital materials are normally made accessible to researchers as pdfs, images, audio files, and video files. Researchers interact with them similarly to their physical counterparts, looking at them one at a time. Most of the conversations about born-digital materials among archivists (understandably) have to do with the formidable technological challenges of processing and preserving born-digital archival materials (for an example, see Redwine et al. 2013). However, as born-digital materials become more familiar and established, archives may find ways to offer different kinds of access that would allow researchers to take advantage of the electronic form of these materials and to analyze and interact with them as data.[19]

For this pilot project, we chose a collection and selected a subset of the born-digital materials for students to work with—a folder from the poet's file directory that included a few hundred files. Then we created plain text versions from the pdfs for use with text analysis tools. We installed the Voyant Server locally (to avoid security risks associated with uploading files to a server we did not have control over) on laptops reserved for instruction.

Through this assignment, students would learn about the principles of text analysis, become familiar with the concept of born-digital materials, and practice literary analysis. In a class session, we would introduce born-digital materials and the types of text analysis the Voyant dashboard presents. Next, in groups, students would begin by loading the drafts into Voyant and exploring the dashboard to see what words were used most often. They would then make appointments to return to the reading room to explore the corpus individually. Based on the visualizations of word frequency across the corpus, before they have looked at the drafts in full, we ask students to speculate about what kinds of themes they would expect to see in the poetry. Then, students test their hypotheses, seeing how certain words appear in context, and

[19] Matthew Kirschenbaum's *Track Changes: A Literary History of Word Processing* (2016), which explores the impact of word processing technologies on writers' work, provides one model for what kinds of questions scholars might want to ask of born-digital personal archives. Another project I contributed to at Emory explored possible ways to analyze the text and metadata of poet Turner Cassity's born-digital materials, by isolating proper place names in the corpus and mapping them, and by creating a timeline of files according to each file's date of creation. See http://cassity.digitalscholarship.emory.edu/.

eventually choosing one poem to close read. The text analysis tool offers a different way to generate critical questions. Ultimately, we ask students to bridge the "distant reading" made possible by text analysis tools with traditional close reading and analysis skills.

The project is still underway, but already it has pushed the Rose Library to thoughtfully revisit its policies on providing copies of born-digital materials to researchers, to consider what kinds of access researchers may ask for in the future, and to think about what kinds of technological support can be offered within the reading room (from what programs can be safely installed on the reading room laptops or iPads, to future processing workflows, to training of staff to offer troubleshooting).

Conclusion

In 2002, Peter Hirtle wrote of the potential pitfalls of the drive to digitize special collections materials, suggesting on the basis of his own experience with such groundbreaking projects as The Making of America collection (University of Michigan and Cornell University) that scholars would find digital surrogates satisfying and fail to seek out original materials. His solution to this potential demise of special collections was fourfold. He advised libraries to (1) emphasize their holdings that are truly unique, such as manuscripts and archives; (2) stress the artifactual value of rare books and manuscripts; (3) take a leadership role in digitization efforts, rather than leaving for-profit enterprises to take the lead; and (4) look toward new collecting areas, including digital materials (Hirtle 2002).

Academic libraries have indeed changed in the ways Hirtle advised, or perhaps predicted, and special collections are increasingly a vital component of their scholarly and teaching missions. It is now widely understood that special collections allow academic libraries to distinguish themselves from their peers. Judging from the continued and growing interest in using physical and born-digital special collections in the reading room as well as those that are digitized and online in the curriculum, there is clearly an understanding that special collections have both artifactual and informational value. Special collections have begun to add new formats over the past 15 years as well, and, as this chapter has tried to demonstrate, special collections may act as a bridge between disciplines for new and unique collaborative and pedagogical enterprises.

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Shiny Things: 3D Printing and Pedagogy in the Library

Jennifer Grayburn, Veronica Ikeshoji-Orlati, Anjum Najmi, and Jennifer Parrott

Three-dimensional (3D) printing, also called additive manufacturing, is the process of creating a multidimensional, physical object from a digital file. While the technology originated in the 1980s as a means for quickly prototyping new industrial products, in the past decade, the advent of inexpensive and user-friendly 3D printers has made the technology increasingly accessible to individuals and institutions alike. In the process, 3D printers have become a key fabrication or "making" resource offered in schools and libraries across the country (Egbert 2016; Hamilton and Hanke Schmidt 2015; Willingham and de Boer 2015). While 3D printers in labs, studios, and workshops are generally specific to science, art, and engineering departments, college and university libraries—as central, academically "neutral" campus spaces with established funding—have become key venues for expanding 3D printing (often in designated "makerspaces") to new academic users in diverse departments and institutional environments. In June 2015, for example, the Association for Research Libraries (ARL) found that 27 percent of ARL member library respondents already offered makerspaces, with another 37 percent planning them in the future (Altman et al. 2015, 14). 3D printers are the most commonly used of available "making" technologies, including microcontrollers and laser cutters, and a 2013 survey found 3D printing to be among the most popular technology services in libraries, second only to computer workstations (Burke 2015, 498–99).

Despite their growing presence on campuses, 3D printers still represent the new "shiny thing," a trendy, if underutilized, resource for critical research and coursework. Y Soft Corporation recently sponsored an independent study on the use of 3D printers in schools and found that 87 percent of polled schools (including 50 percent from higher education) limit student access to the printers. Staff

inexperience with the technology, insufficient infrastructure to pay for and schedule printing, and confusion about how to fit 3D printing within established curricula were the primary reasons for these limitations (Y Soft 2017). Varying considerations for supervision, logistics, and application similarly appeared in many of the survey answers in the ARL Rapid Fabrication/Makerspace Services Spec Kit (Altman et al. 2015).

The fiscal and technical obstacles to integrating new technologies and workflows into learning environments may seem daunting, but 3D printers have become increasingly accessible to those with limited technological skills and budgets. Since the introduction of the open-access Makerbot almost a decade ago, the market for affordable desktop printers has only grown, resulting in more printer options at reduced prices. While larger and more expensive industrial printers offer more features and often higher-quality prints, companies like Ultimaker, LulzBot, and Makerbot offer reliable, if smaller, fused deposition modeling (FDM) printers ranging from a few hundred to a few thousand dollars. Printing material, while a recurring cost, has similarly decreased in price, and free and open-access software to prepare printable 3D models is more intuitive than ever.

The primary obstacle and institutional cost of offering 3D printing is expertise, not only in how to use and maintain a printer, but also in understanding the opportunities and limitations of 3D printing technology based on the needs and objectives of a particular community. As an example of the expertise needed, the selection of 3D printing material requires the consideration of cost, material properties, printer specifications, and user needs. The more traditional polylactic acid (PLA) and acrylonitrile butadiene styrene (ABS) plastics remain common, but materials like nylon, ceramic, and metal or wood composites are now both easy to use and inexpensive, expanding what instructors can do with the materials and how students interact with them. Even plastics offer a wider range of colors, characteristics, and effects designed to enhance the strength, conductivity, or appearance of the printed object. The 3D printing community remains dynamic; as practitioners continue to experiment with printing new materials like food, biomaterial, and lunar soil, they not only change the manufacturing process, but also shape the creative workflows of the future. While individual instructors often lack comprehensive knowledge of such new developments, staff members with robust 3D printing expertise could unlock new possibilities for teaching faculty and their students.

This chapter examines the pedagogical value of 3D printing using case studies from diverse disciplines, highlighting the variety of objectives met and staff support provided in the process. From student-run makerspaces to department-specific labs and studios, there are many communities and services that support 3D printing in higher education (Culpepper 2016). Each support model offers its own unique advantages and, as the following case studies show, can facilitate critical pedagogical use of the technology. Nevertheless, libraries and library staff are particularly well-suited to support

innovative applications of 3D printing for classroom use, especially in fields traditionally unfamiliar with making technologies.

3D Printing for Teaching and Learning

The use of 3D modeling and printing to enhance student learning may seem a novel, untested pedagogical approach, but the benefits of engaging students in experiential learning activities are well-established by numerous theories of teaching and learning. This section explores the theoretical basis for introducing 3D modeling and printing technology into the classroom, regardless of subject area or specialty. Educators (teaching faculty, library staff, and technical support specialists) are encouraged to think about the design of in-class 3D modeling and printing exercises within the broader context of interaction- and activity-based theories of teaching and learning in order to successfully engage students in the processes of experiential learning and, where possible, critical making.

The pedagogical theory of constructivism, and its implementation through active and kinesthetic learning activities in particular, is the most applicable model for fruitful integration of 3D modeling and printing activities in the classroom. A constructivist pedagogical approach is based on the idea that learning is contextual, and new information must be connected to students' pre-existing knowledge (Papert and Harel 1991). In addition, the constructivist theory of learning suggests that students learn best when they are the primary motivators and participants in building their own knowledge and finding the connections between new and already familiar ideas and concepts.

While there are multiple ways for instructors to help students take charge of their own learning, the common thread among all contemporary constructivist teaching methods is the incorporation of active learning into curricula (Holzer 1994). Fundamentally, active learning "requires students to do meaningful learning activities and think about what they are doing" (Prince 2004, 223). The goal of engaging in active learning activities is not only to facilitate mastery of a particular subject matter, but also to give students practice in different ways of approaching and working through problems.

One of the ways to engage students in active learning through 3D printing is to use the tools and teaching structures of problem-based learning (PBL). In PBL classrooms, students are presented with a question and given only the bare minimum of scaffolding to seek out the answer for themselves (Allen, Donham, and Bernhardt 2011; Savery and Duffy 2001). Collaborative 3D modeling and printing projects, such as those discussed in the Middle Eastern archaeology and Pulse Dress case studies that follow, frequently require students to bring together research questions and digital methods to craft thoughtful projects over the course of multiple weeks, much like other types of PBL activities.

In addition to presenting the opportunity to engage actively in the research process, 3D printing projects enable teachers and

students to work with class materials in a tactile, hands-on way. This type of learning frequently is called kinesthetic, and research in diverse fields of study suggests that students learn best when physical movement and hands-on activities are incorporated into the classroom (Snyder 2000). In medical school, for example, research suggests that students learn best when presented with the opportunity to gather information through "concrete, multi-sensory experiences" (Lujan and DiCarlo 2006, 15). When dealing with the abstract algorithms taught in computer science, students likewise benefit from modeling complex ideas in physical ways (Sivilotti and Pike 2007). 3D printing, by definition, is a physical and tactile pursuit and thus the activity, as well as its products, may help students bridge the gap between abstract ideas and concrete realities.

3D printing applications in the classroom can either focus on students' kinesthetic engagement with 3D-printed objects or the integration of active, process-focused teaching methods (such as PBL). This kinesthetically oriented interaction with digital and physical objects (namely, 3D printing) will be described herein by the term *critical making*. As defined by the originators of the phrase, "critical making is an elision of two typically disconnected modes of engagement in the world —'critical thinking,' often considered as abstract, explicit, linguistically based, internal and cognitively individualistic; and 'making,' typically understood as material, tacit, embodied, external and community-oriented" (Ratto and Hockema 2009, 52). In particular, critical making fosters experimentation or "tinkering." This tinkering culture creates an atmosphere of trial and error and discovery, rather than focusing on rules and "right" and "wrong" binaries. As a result, students engaging in the making process learn not only through kinesthetic, hands-on experiences, but also through the errors and obstacles they overcome during an iterative and collaborative workflow (Sayers 2011, 279). Critical making activities, like 3D printing, encourage students to experiment and collaborate, while introducing other modes of learning. In turn, these activities diversify students' skillsets and prepare them for success in a professional world that values collaborative problem solving and facility with diverse technologies.

When integrated into the classroom as critical making projects (Lipson 2007), 3D printing may benefit students on two levels. First, the incorporation of 3D printing activities enhances students' understanding of course materials. Since the learning outcomes addressed are subject specific, this is what will be referred to herein as "learning." For example, using Proto-pasta composite iron filament, it is possible to 3D print a full-scale Viking Age axe head, rust it using water and salt, and allow archaeology students to study it in class with a more authentic interaction than in a traditional lecture presentation (figure 1). While the students did not produce the 3D print, their interaction with it supplemented their learning of Viking Age artifacts, offering better approximation of size, material, and function than images.

Fig. 1. *3D-printed Viking Age axe head. 3D-printed with composite iron filament and post-processed with salt and vinegar to create a rusted finish. Viking axe 3D scan is by Snorri and is licensed under Creative Commons-Attribution license http://www.thingiverse.com/thing:1609633. Photograph and print by Jennifer Grayburn*

The second level of benefit comes from encouraging students to use 3D modeling software and printers to answer questions from diverse subject areas. It equips them with transdisciplinary problem-solving skills, referred to herein as *meta-learning* objectives. Meta-learning may be defined as "the process by which learners become aware of and increasingly in control of habits of perception, inquiry, learning, and growth that they have internalized" (Maudsley 1979). For the purposes of the current paper, meta-learning will be defined as the intentional cultivation of a suite of subject-agnostic, transferable research skills that are distinct from the subject matter investigated in the classroom. Like other research and critical thinking tools, 3D printing is a means for exploration, innovation, and knowledge creation; modeling the use of such tools in the classroom facilitates improved, firsthand understanding of how to formulate and answer novel questions.

As indicated by the preceding discussion, 3D printing activities can most effectively enrich the classroom experience if they are integrated into curricula with well-defined learning outcomes (Gilakjani, Leong, and Ismail 2013). By surveying successful classroom examples, their learning and meta-learning goals, and varying 3D printing support they received, the following sections present the next steps in conceptualizing the infrastructure for pedagogically rich 3D printing experiences.

Case Studies

There are surprisingly few systematic discussions of 3D printing assignments in higher education (see, for example, Moorefield-Lang 2014). This section aims to highlight the diversity of pedagogical projects and learning objectives within courses from a variety of fields, rather than provide an exhaustive list of assignments or disciplinary courses. Moreover, it highlights the different types of spaces where 3D printing occurs, including labs, classrooms, and libraries.

Going Atomic: 3D Printing Chemical Energy

3D models have long been used in physical and life science classrooms, allowing students to interact with biological systems, molecular structures, and other hard-to-visualize elements of the world around us. In chemistry, for example, the value of physical interaction with models of chemical chains is so well established that the advent of 3D printers spurred a floruit of projects intended to facilitate the reproduction of teaching models for wider distribution (Dori and Barak 2001; Ryan and Grubbs 2014). Beyond increasing the availability of chemical structure models, however, 3D printers also present an opportunity for exploratory visualization of other concepts relevant to the study of chemistry.

At Davidson College, for example, David Blauch and Felix Carroll used 3D printers for their introductory organic chemistry course. In addition to encouraging students to use their molecular model sets to understand static chemical compounds, Blauch and Carroll wanted to explore how to make tangible the conformational energies of propane

Fig. 2. *Students using 3D-printed potential energy surface models to explore reaction pathways for an SN1 reaction (left) and an SN2 reaction (right). Photograph by Felix Carroll*

and butane (Blauch and Carroll 2014; Carroll and Blauch 2016). Traditionally, chemistry students learn about potential energy through textbook graphs or, on occasion, computer visualizations, but as Blauch and Carroll observed, "recognizing the implicit 3D character of surfaces displayed on a monitor" is challenging for many students (2014, 1254). As a result, they developed a series of files that illustrated the full depth and extent of a potential energy surface (available to other educators as attachments to Carroll and Blauch 2016). The students used the 3D-printed objects not only to learn how potential energy works, but also to develop a deeper understanding of how to successfully "read" printed graphs and computer visualizations of the same information (figure 2).

In the case of Blauch and Carroll's organic chemistry course, the process of 3D printing was not integral to the class- or field-specific learning outcomes. In fact, it may be more appropriate to describe Blauch and Carroll's teaching as using 3D-*printed* objects, not the activity of 3D *printing* itself. The 3D-printed models served not only students' needs related to learning organic chemistry, but also enhanced students' fluency in the visual language of the profession as a whole.

While Blauch and Carroll had access to a 3D printer at Davidson's ITS-run Studio M Laboratory, they had more immediate access to two 3D printers in their own lab and taught themselves how to 3D print and maintain the machines themselves using manufacturer instructions and Youtube videos. While this control provided them with additional flexibility and opportunities to experiment on their own, they relied upon their instrument technician for further support (Felix Carroll, e-mail message to author, May 8, 2017).

From Research to Teaching: Kits for Cultural History

The Maker Lab (MLab) in the Humanities at the University of Victoria marries a "humanities research lab" with a "collaborative makerspace" to provide faculty and students with opportunities to create projects using the "knowing by doing" method (Sayers n.d.). One of the many projects produced by the MLab is the Kits for Cultural History project, led by Jentery Sayers and William J. Turkel (Western University). This project, developed by researchers from the departments of English, History, Visual Arts, and the Cultural, Social and Political Thought program at the University of Victoria, uses new media to explain the histories of "media, technologies and science" (Belojevic 2014). The kits are created using physical computing and digital fabrication (including 3D printing) for the purpose of encouraging "audiences to consider how the material particulars of historical mechanisms are embedded in culture, without presuming that, in the present, we can never experience the world like 'they did back then'" (Belojevic 2014). To date, the project has generated four different types of kits: early wearables (nineteenth-century electric jewelry) (figure 3), early video games, early magnetic recording, and early optophonics. By 2018, the MLab plans

Fig. 3. *The early wearables culture kit. The historical skull cravat pin was carved, 3D modeled, and printed based on the design of Gustave Trouvé. Kit produced by Nina Belojevic, Tiffany Chan, Nicole Clouston, Katherine Goertz, Shaun Macpherson, Kaitlynn McQueston, Danielle Morgan, Victoria Murawski, Jentery Sayers, and the Maker Lab in the Humanities. Photograph by Danielle Morgan*

to circulate some of the kits, which will be "archived, peer-reviewed, and distributed online and by post" (Belojevic 2014).

It is notable that the MLab Kits for Cultural History do not use the 3D *printing process* as a pedagogical tool. Rather, the investigatory value of the process of 3D modeling and printing historical artifacts goes to the researchers investigating the topics, and the products of their research subsequently may be printed and interacted with for pedagogical purposes. Moreover, the heavily interdisciplinary nature of the kits is reflected in their uniquely diverse infrastructure and emphasis on innovation. Supported by the Canada Foundation for Innovation, the British Columbia Knowledge Development Fund, and the Social Sciences and Humanities Research Council, MLab facilities include a computer lab housed in the English department and a fabrication studio housed with Visual Arts (Jentery Sayers, e-mail message to author, May 6, 2017). While the learning outcomes (improved comprehension of specific time periods or historical activities) of the kits themselves are thereby distanced from meta-learning outcomes (how to apply 3D modeling and printing to a research question), the production of the kits is nevertheless part of a larger educational endeavor to apply these new technologies to nontraditional fields.

Reproducing Memory: 3D Printing the Archeology of the Middle East

While 3D printed objects can assist course objectives and outcomes, active 3D printing allows students to examine both historical and

modern trends through critical making. For her Archaeology of the Middle East course at James Madison University, Sue Ann McCarty used JMU 3SPACE, a general education classroom, to teach the history, destruction, and preservation of Middle East art and architecture. Inspired by real-life applications of 3D scanning and 3D printing of destroyed ancient monuments, McCarty designed a course in which "student 'excavation teams' would each be responsible for printing objects from a specific damaged site and would present an 'excavation report' in the style of a conference paper describing its history and damage" (McCarty 2016). These group assignments aimed to mimic the authentic work of scholars in the field and, consequently, introduce complicated—and at times political—themes related to Middle East archaeology.

Although McCarty ran into a few logistical obstacles regarding limited access to and cost of the 3D printing, she successfully adjusted the assignment such that students selected pre-existing models of monuments they studied and 3D printed them at a smaller scale (figure 4). In the end, the students not only explored these monuments from a new perspective, but also thought critically about the generation and distribution of those monuments through 3D models and prints. As they produced their models, the students considered how 3D printing could

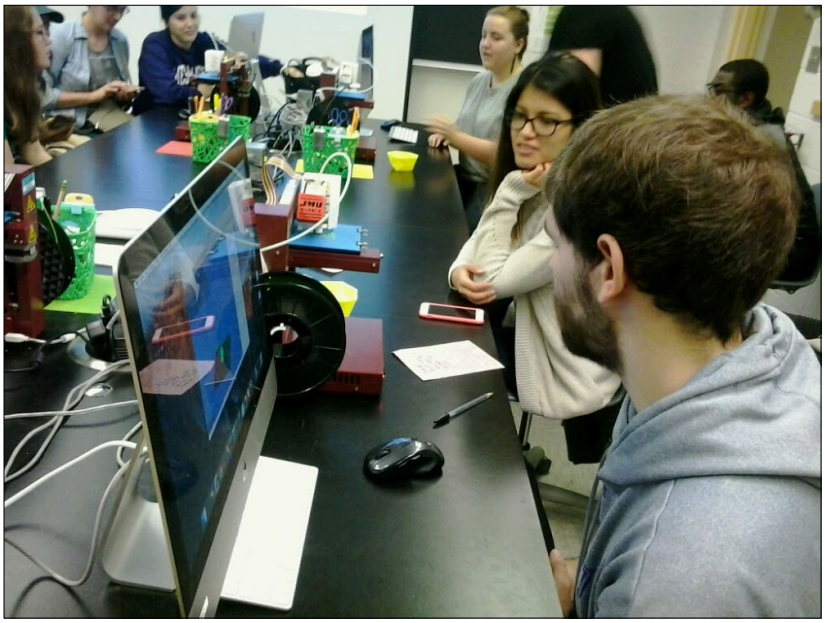

Fig. 4. *Archaeology of the Middle East students David Szady, Ximena Calvo, and Catherine Grimes 3D printing ancient monuments in the JMU 3SPACE Classroom. Photograph by Sue Ann McCarty*

enhance other aspects of archaeology, including comparative analysis and community engagement (McCarty 2016).

McCarty, moreover, notes that the act of making the ancient monuments generated memory in two ways. First, it created and reinforced the students' own memory of the course content, where the 3D prints are "mnemonic devices, acting as tactile, visceral, ontological connections to their progenitors while also incorporating something new: the labor of the student who reproduces, remembers, touches and observes these objects, physical phantoms of their former selves" (McCarty

2016). Second, the students experienced new technologies and methodologies currently changing archaeology; by adopting these practices, the students were able to participate directly in a highly charged dialog of iconoclasm and preservation currently occurring in the field (McCarty 2016). McCarty's students' only regret was that they did not have *more* time in the lab to experiment with their prints in the context of the course.

While McCarty taught the course at James Madison University, she nevertheless relied heavily on the more accessible 3D printing resources available at the Scholars' Lab in the University of Virginia's Alderman Library to experiment and test run her assignment before giving it to her students. McCarty worked with 3D printing graduate consultants to try different filaments, test new models, and learn basic 3D printing troubleshooting so she could help her own students (McCarty 2016).

3D Printing Wearable Technology: Fashion Design as Biological Reflection

Outside of the context of the traditional college classroom, library makerspaces themselves may offer robust educational programs in methods of critical making using 3D printers. At North Carolina State University (NCSU), for example, a fruitful collaboration between senior design student Jazsalyn McNeil from the College of Textiles, the Nano-EXtended Textiles Research Group (NEXT), and the university libraries produced the

Fig. 5. *The Pulse Dress. Photograph by Jazsalyn McNeil*

innovative Pulse Dress (figure 5). Integrating fashion design, biological sciences, and an array of new and experimental technologies, the dress is designed to blink with the user's heartbeat. While many technologies are used in the dress, the project is dependent upon sensors screen-printed in conductive ink and woven into the fabric. Using embedded lights, circuit boards, and custom 3D printed enclosures, the dress visually represents the wearer's biological rhythms (Di Monte 2016).

McNeil describes the dress as "visually portray[ing] the evolving era of wearable technology and the mysterious evolution of bioluminescence" (Di Monte 2016). The NCSU D. H. Hill Library makerspace staff and resources were critical to such exploratory integration of fashion design, 3D printing technology, and biological reflection and visualization in one project. McNeil had no experience with 3D printing, Arduino, or other makerspace technologies prior to the project, and she learned to use and adapt them to her research and creative interests under the guidance of the NCSU makerspace staff. The problem-solving and technological skills that McNeil gained during the project have contributed to her current work with galleries, museums, and apparel companies (Di Monte 2016). With the Pulse Dress, the meta-learning goals of conceptualizing and successfully executing a 3D printing project have themselves become the subject of learning.

Gendering Words: The Inkwell Project

To many, 3D printing and traditionally text-based coursework do not appear complementary, especially because 3D printing by definition creates material objects and most language courses emphasize reading, analyzing, and writing about texts (tangible and intangible). This work is oriented toward literary criticism and is, for the most part, individually driven. Students interact with a variety of texts and may seek guidance from their instructors and members of the library staff during the research and writing process, but they are rarely encouraged to collaborate with peers on their projects. However, as technology and our access to it evolves, so do these individual, text-based approaches to learning in the humanities, as evidenced by exciting and collaborative research like the Inkwells Project. This project exemplifies how 3D printing could enhance student learning by providing a tangible product that allows for a kinesthetic interaction between students and the object of study.

Unlike the Kits Cultural for Cultural History project, which involves a team of researchers, expensive equipment, and a great deal of time, smaller 3D printing projects that involve fewer resources can still prove pedagogically valuable. The Inkwells Project at the University of Wisconsin–Madison Institute for Discovery offers just such a model for small-scale, technologist-subject matter expert interaction in designing and executing a 3D printing project. Researchers Carrie Roy (Living Environments Laboratory), Catherine DeRose (Department of English), and Fred Boehm (Department of Statistics) analyzed 20 Victorian

Fig. 6. *Literary "his" and "hers" inkwells. Photograph by Carrie Roy*

novels written by men and 20 novels written by women and considered how diction varied between the sexes (Knisely 2013). Next, they used 3D printing technology to create "his" and "hers" inkwells, the walls of which are constructed of the most common words used by authors of each gender (Figure 6). The inkwells allow audiences (researchers or students) to interact with this knowledge in new and even collaborative ways, as the knowledge becomes tangible.

The inkwells, displayed as part of the Victorian Eyes exhibition at the University of Wisconsin–Madison, serve dual purposes. On the one hand, they make the complex statistical analyses of the texts and vocabularies more comprehensible to specialists, allowing researchers to interact with this knowledge in an immediate, physical way. As Roy herself states, "being able to 'read the numbers'" was an integral component of the project, and through this concrete visualization of abstract analyses, the researchers were able to better comprehend the implications of the gender-based vocabularies used by Victorian authors (Knisely 2013). In addition, the inkwells served as an entrée into the research for exhibit visitors, allowing them to connect with the research kinesthetically and interpret these texts and authors in new ways. With proper scaffolding and instruction, students and instructors could generate these (or similar) objects to examine various texts and themes relevant to their courses.

The Inkwells Project developed out of a collaboration between Roy and a personal contact at a privately funded lab focused on medical device fabrication next to a university lab where she worked. The lab's expert technician helped Roy refine the model, suggesting more advanced software and helping her get the model started so she could execute the rest of the project herself. Interestingly, the inkwells were the most complex modeling project both Roy and the lab had worked on, providing a "win for both of us in terms of pushing technology" (Carrie Roy, e-mail message to author, May 5, 2017).

Conclusions

Whether 3D printers are used to create alternative visualizations of potential energy or are harnessed to recreate historical objects to handle and study, the technology may play an important role in increasing accessibility to objects that facilitate kinesthetic learning. The intended outcomes of the 3D printing projects cited in this chapter vary widely and most examples are intensely subject-based, using the technology to enhance comprehension of a particular issue or topic. Still, the common thread among all of them is the benefit to students and researchers of interacting with physical objects.

In some cases, including Sayers and Turkel's Kits for Cultural History, designated digital humanities labs and centers can provide the funding, staff, equipment, and collaborative mentality to develop projects through playful experimentation. In other cases, as with Blauch and Carroll's chemistry models, instructors can gain access to the knowledge, skills, and equipment necessary to embed 3D printing into their courses within their own disciplinary spaces. For fields where funding or making experience is limited, however, the library makerspace provides an accessible, interdisciplinary, and collaborative space to learn and experiment outside the traditional scope of disciplines.

The library of the twenty-first century has been re-imagined as a place beyond the book, a site of "creativity, innovation, and 'making'" of knowledge (Lucia 2017, 10). Library makerspaces, typically with 3D printing as the sole or dominant resource, are only the most literal manifestation of this new making mission, which includes efforts to foster academic collaboration, expand digital collections, and re-envision scholarly publishing. Adam Rogers, author of "The Librarian's Role in Academic Makerspaces," argues that libraries are ideal locations for makerspaces because librarians already embrace many of the values makerspaces promote, including the American Library Association's Core Values of Librarianship: access, democracy, diversity, education, and lifelong learning (Rogers 2016, 124). More importantly, within this context, members of the library staff can be re-imagined as "making-oriented" professionals, creating or making knowledge in their communities and offering the necessary scaffolding to apply new technologies to diverse subjects in critical and innovative ways (Lucia 2017, 12). The twenty-first century library, then, with its focus on staff expertise and knowledge creation, is poised not only to support education in the classroom, but to help make and shape it.

As libraries continue to adapt to the needs and challenges of the twenty-first century, library staff members and the technology they use will increasingly influence the creation, curation, and circulation of knowledge in both education and research. Citing Conversation Theory, R. David Lankes argues, "the mission of librarians is to improve society through facilitating knowledge creation in their communities" (Lankes 2011, 31). But conversations are only the start; knowledge is also created by the dialog of doing and making,

and librarians in new positions, including innovation or emerging technology librarians, already act as conduits to connect academic communities with technology to better meet course objectives and generate student knowledge. Indeed, such outreach by experienced staff members is necessary to curate and prompt critical engagement, especially for users unfamiliar with the equipment and methods (Barniskis 2016, 8).

It is the cross-disciplinarity and meta-learning focus of 3D printing consultancy that makes the library a logical home for this type of support. A dedicated space in the library, as well as staff who can partner with faculty or students to both develop and execute these types of projects, makes critical making with 3D printers a reality for all members of the university community. By placing 3D printing and other makerspace resources within the library and positioning library staff as experts in the application of diverse tools for answering research questions, two things happen. First, library staff can both help determine whether a project is viable and anticipate potential learning opportunities and roadblocks. This logistical collaboration allows faculty to focus their efforts on defining clear learning outcomes for active and kinesthetic learning experiences, thereby making the most of the pedagogical potential of makerspace activities (enabling learning). In anticipation of her Middle East archaeology assignment, for example, McCarty relied on the 3D printing services and graduate consultants available in the Scholars' Lab at the University of Virginia's Alderman Library to learn about and troubleshoot 3D printing her assignment. Second, library staff can serve as teaching collaborators by providing expertise in research tools and methods, thereby enabling meta-learning regardless of subject matter or disciplines. Not limited to formal courses, the accessible equipment and expert support and workshops in the library provide students such as McNeil, designer of the Pulse Dress, the opportunity to experiment with technology in innovative and nontraditional ways.

Libraries have long served as sites of meta-learning and critical making, facilitating the development of transferable, subject-agnostic research skills and identifying new ways to engage with challenging subjects. By locating 3D printing resources in the library, the technology becomes one of many tools teachers and students across campus can use to explore a wide array of questions and a way to foster interdisciplinary dialog between otherwise disparate fields and research interests. While interdepartmental relationships can develop organically between individual researchers, as with the Inkwells Project, the library and its staff can facilitate and foster these 3D printing collaborations. In addition to offering access to these resources to a larger audience, library makerspaces situate critical making within broader research and educational objectives of the university. Instead of functioning as a specialized machine for exclusive, technical inquiries, the identity of the 3D printer is fundamentally shifted to that of a vehicle for design-thinking and for investigating diverse questions and ideas. Likewise, the 3D printing consultant joins the ranks of the library staff who shepherd

researchers and students through the ever-evolving landscape of resources for thoughtful inquiry into a plethora of subjects. Libraries are by no means static institutions; their missions and services have been changing since antiquity. 3D printing, as an anchor of the twenty-first century library's makerspace, can continue to cultivate the library as an interdisciplinary nexus of print, digital, and human resources.

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Afterword

Lauren Coats and Elliott Shore

The intellectual devouts who founded Harvard University knew the power of the word. That the first printing press in British America quickly came under Harvard's purview is no coincidence: with access to the books past and control over books future, world and Word might come closer. Indeed, the school received its name from the man who donated his library, and part of his estate, to the fledgling university. This scene of the library at the heart of impassioned learning is not singular: From Aristotle's Lyceum to Morocco's Al-Qarawiyyin University (founded in 859, with the library still in existence) to the modern-day university, the library has long been at the center of higher education.

Every summer, CLIR Postdoctoral Fellows spend a week at Bryn Mawr College, learning together at this most famous institution of women's education. When it opened in 1885, it was the first women's college in the United States to offer PhDs. Alongside the classrooms and administrative offices, the college's first building also housed the library: for how could you offer a quality education without access to books? If the library has long been central to learning, the founders of Bryn Mawr knew that the knowledge contained therein is not always accessible to all and that the library is central to the configuration of who can read, teach, and learn, where they can do so, and for what ends.

As the essays here demonstrate, we have been moving rapidly toward a post-secondary landscape in which the scenes of teaching and learning are reoriented, with the library returning as one pivot of this reorientation. The authors point toward a world in which teaching and learning take place throughout the institution. Education does not just happen in a classroom where there is a professor and students. Even within that classroom, still the dominant form, professors and students teach and learn from one another rather than knowledge being dispensed unilaterally. The faculty member's research informs her teaching, and the good professor learns from his students—and it is extremely difficult to draw a clear line between those teaching and learning, researching and teaching. Indeed, we contend that the rubrics of research and teaching, as well as service, are all interwoven in spite of the post-World War II regimen of strictly demarcated boundaries between these aspects of post-secondary education. They are not and were never separable and are as immensely flexible as they are profoundly connected.

Every summer during the Postdoctoral Fellows' orienting seminar, surrounded by green lawns and stone walls, we visit the Bryn Mawr library to admire the astounding collection of incunables, the new digitally sophisticated library classrooms, the study spaces scattered throughout. We see the history and futures of the materials and spaces built to advance knowledge. As these essays demonstrate, the authors engage these formations—as they exist in universities and colleges across North America—with ingenuity, deep expertise, and dedication to finding how, like the college's founders, the scenes of learning might be productively shifted. This world that we are collectively building toward does not care so much about the where or the who, nor necessarily about titles and degrees or disciplines, nor about keeping research, teaching, and service distinct. The authors sense the excitement of blending these dissolving categories into one another, using the library as a laboratory, lever, and sense-making space for the teaching, learning, and research environment that we should all expect for, and from, twenty-first century institutions of higher education.

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