FORGING OUR CULTURAL COMMONWEALTH: THE IMPORTANCE OF DIGITAL CURATION IN THE DIGITAL HUMANITIES

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A dissertation submitted to the faculty at the University of North Carolina at Chapel Hill in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the School of Information and Library Science.

Chapel Hill
2015

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ABSTRACT

Alex H. Poole: Forging Our Cultural Commonwealth:
The Importance of Digital Curation in the Digital Humanities
(Under the direction of Helen R. Tibbo)

New forms of digital data and tools or methods, for instance those that cross academic disciplines and domains, those that feature teams of scholars instead of single scholars, and those that involve individuals from outside the academy, can enable new forms of scholarship and teaching in the digital humanities. Such scholarship can promote reuse of digital data, provoke new research questions, and cultivate new audiences. Digital curation, the process of managing a trusted body of information for current and future use, can help maximize the value of research in the digital humanities.

This exploratory qualitative study centered on the salience of digital curation to the digital humanities. A case study predicated upon semi-structured interviews, it explored the creation, use, storage, and planned reuse of data by 45 interviewees involved with nineteen Office of Digital Humanities Start-Up Grant (SUG) projects. Similarly, the study sought to determine what digital curation skills had been employed in these projects and what digital curation skills project personnel felt were most important in doing such work. Interviewees grappled with challenges surrounding data, collaboration and communication, planning and project management, awareness and outreach, resources, and technology.

This study sought to understand the existing practices and needs of those engaged in digital humanities work and how closely these practices and needs align with the digital curation literature. It established a baseline for future research in this area and suggested key skills for

digital curation work in the digital humanities. Finally, it provided a learning model for guiding such education.

ACKNOWLEDGEMENTS

I am deeply grateful to my committee: Helen R. Tibbo (chair), Christopher A. Lee, Sandra Hughes-Hassell, Ryan Shaw, and Costis Dallas. I am particularly grateful for Helen Tibbo's mentorship over the past five years. I also appreciate Helen R. Tibbo and Christopher A. Lee's allowing me to work on the DigCCurr II project (2010-2013). Other SILS faculty from whose wise counsel I have benefited include Denise Anthony, the late Deborah Barreau, Jane Greenberg, Stephanie Haas, Diane Kelly, Gary Marchionini, Richard Marciano, Barbara Moran, Jeffrey Pomerantz, and Barbara Wildemuth. Finally, I thank my doctoral student colleagues at the University of North Carolina at Chapel Hill's School of Information and Library Science.

For my parents.

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A revolution in digital information is occurring across all realms of human endeavor.

-National Research Council of the National Academies (2015), 7.

We swim in a sea of data…and the sea level is rising rapidly.

-Anderson & Rainie (2012)

Virtually no one in academia perceives that they have a professional responsibility or mandate for research data management functions.

Council on Library and Information Resources (2013), 6.

Introduction

"Contemplating the digital universe is a little like contemplating Avogadro's number," claim Gantz and his colleagues (2008). "It's big. Bigger than anything we can touch, feel, or see, and thus impossible to understand in context" (3). One study concludes, "Every day, we create 2.5 quintillion bytes of data—so much that 90% of the data in the world today has been created in the last two years alone."[1] In 2014, there existed 1.7 megabytes per minute for every inhabitant of Earth (EMC Digital Universe 2014). The amount of research data in the sciences alone increases by as much as 30% per year (Pryor 2012). The data deluge is truly upon us.

[1] http://www-01.ibm.com/software/data/bigdata/what-is-big-data.html

Data is “notoriously fragile, short-lived, and easy to manipulate without leaving obvious evidence of fraud” (American Council of Learned Societies 2006, 18). It is also unprecedentedly vast in scale and scope. “In almost every laboratory,” Bell et al. (2009) report, “‘born digital’ data proliferate in files, spreadsheets, or databases stored on hard drives, digital notebooks, Web sites, blogs, and wikis” (1297). Haendel et al. (2012) contend, “Where researchers once managed discrete, controllable building blocks of knowledge, they must now contend with a tsunami of information that paradoxically feeds the growing scientific output while simultaneously crushing researchers with its weight” (1). Yet “data icebergs” persist (Hey, Tansley and Tolle 2009).

The data deluge presents unprecedented challenges with regard to preserving digital assets. Rothenberg (1995) offers an apothegm: “Digital objects last forever—or five years, whichever comes first” (42). Other scholars worry about the potential loss of important data, identifying “A Public Trust at Risk” (Heritage Preservation 2005), data’s “shameful neglect” (Data's Shameful Neglect 2009), or the specter of a “digital dark age” (Bollacker 2010).

Yet the data deluge also offers immense possibilities. The American Council of Learned Societies (2006) contends, “The emergence of the Internet has transformed the practice of the humanities and social sciences—more slowly than some may have hoped, but more profoundly than others may have expected” (1). New forms of digital data and tools or methods can enable new forms of scholarship and teaching, for instance those that cross academic disciplines and domains, those that feature teams of scholars instead of single scholars, and those that involve individuals from outside the academy. Such scholarship can promote reuse of digital data, provoke new research questions, and cultivate new audiences. Digital curation can play a central role in these explorations.

Beagrie (2006) asserts, "For society and individuals, it can be argued that digital knowledge if it is to be useful and usable must be continuously updated, maintained, and accessed" (12-13). An umbrella term, digital curation manages a trusted body of information for current and future use. Predicated upon a lifecycle approach, digital curation helps to safeguard data's longevity, integrity, authenticity, and accessibility (Higgins 2008) (Higgins 2012). Digital curation can benefit data creators by increasing the data's and the research's visibility, by increasing the number of citations received by the work, and by helping creators develop risk management strategies, and by assisting creators demonstrate compliance to funding and legal bodies and to publishers (Harvey 2010).

Digital humanities work focuses on "what it means to be a human being in the networked information age and to participate in fluid communities of practice, asking and answering research questions than cannot be reduced to a single genre, medium, discipline, or institution" (Burdick, et al. 2012, vii). Digital humanities may be conceived of as a continuum: a discipline of its own, on one end, or as shorthand for digitally-enabled humanities work, on the other. In any case, digital tools and methods pervade humanities study and scholarship.

In this vein, the digital humanities embrace a wide variety of work practices. Scholars may work on cultural criticism, archives, mapping, text markup, encoding, and analysis, digitization, data mining, aggregation, visualization, gaming, databases, and code and software studies. Given the depth and breadth of its scope, the digital humanities can serve as "*a laboratory, innovation agency, portal and collaborative initiator for the humanities, and as a respectful meeting place or trading zone for the humanities, technology and culture, extending across research, education and innovation*" (Svensson, Envisioning the Digital Humanities 2012).

Two programs exemplify innovative digital humanities research that pivot on digital curation: 1) those projects funded as Start-Up Grants by the National Endowment for the Humanities's Office of Digital Humanities (ODH); and 2) those projects sponsored by the National Endowment for the Humanities under the auspices of the three "Digging into Data" challenges (2009-present). Both of these initiatives dovetail with the National Science Foundation's efforts to promote digital curation through its grant-making process. In fact, the ODH adopted much of its agenda from the NSF's instantiation of a data management plan requirement beginning in 2011.

First, between the first round of awards in 2006 and the ninth round in 2014, 2,057 scholarly teams have applied for Start-Up Grant awards and 280 (13.6%) have succeeded. The Office's 2010 report reflected, "Like a basic research grant program in the sciences, the guidelines were designed to encourage applicants to propose innovative projects that had long-term potential but in the short term needed finds to do preliminary work, to test out ideas, to develop prototypes, to get their planning in order, and perform other tasks necessary for the successful implementation of a digital project" (National Endowment for the Humanities, Office of Digital Humanities 2010, 5). More important, the ODH added a provision in 2011 that mandated the inclusion of data management plans in each grant application.

Second, the three Digging into Data challenges represent more advanced digital humanities work than that pursued in the Start-Up Grants. They feature more mature projects, larger teams, an international focus, and more funding than the Start-Up Grants. Round one (2009) featured eight international projects supported by four research funders in the United States, Canada, and the United Kingdom); round two featured fourteen 14 projects supported by eight funders in the US, Canada, the UK, and the Netherlands; and round three featured fourteen

projects supported by ten funders from the US, Canada, the UK, and the Netherlands. Such projects suggest "a digital ecology of data, algorithms, metadata, analytical and visualization tools, and new forms of scholarly expression" (Williford and Henry 2012, 2). They may even hint at a "new era" in which "revelatory explorations of our cultural heritage that will lead us to new insights and knowledge, and to a more nuanced and expansive understanding of the human condition" (Williford and Henry 2012, 1).

But despite the promise of Start-Up Grants and Digging into Data projects, practical and methodological challenges abound. The, the full scholarly potential of work in the digital humanities depends upon digital curation.

Digital curation in the digital humanities typically focuses on a wide range of work products, e.g. scholarly editions, text corpora, marked-up text, thematic research collections, data accompanied by annotation or analysis, and finding aids or information maps such as bibliographies (Flanders and Munoz 2012). Tasks may include translating or migrating data into new formats, adding contextual information or markup, or linking datasets (Flanders and Munoz 2012). Digital curation helps ensure long-term access; facilitate discovery, retrieval, use, and reuse; and maximize the usefulness of the curated digital content (Harvey 2010). By making data as functional as possible, digital curation can enable better research in the digital humanities.

Digital curation and the digital humanities share concerns, practices, and objectives. Both digital curation professionals and digital humanists add value to digital assets: they help encourage reuse, develop new research questions, and bring in new audiences. Second, both areas rely upon interdisciplinarity and collaboration. Third, work in both areas often depends upon short-term, project-based grant funds. Fourth, digital curation and digital humanities struggle with some similar challenges: sustainability, project management, institutional position,

and the valuation of their work as scholarship. Finally, digital curation and digital humanities are both areas of practice and research. Henry (2014) notes, "Humanities data is some of the richest information available and provides some of the greatest challenges for digital curation" (370). The potential symbioses between the two areas, particularly in fostering education, training, and skilling up, merits study. Digital curation can contribute much to the digital humanities—and vice versa.

Digital Curation Education: The Current Landscape

Digital curation is a burgeoning area of interest in Library and Information Science given job opportunities, funding, and new programs. This dissertation focuses on digital curation education for three reasons. First, examining digital curation education efforts allow us to discern how the field and its knowledge, skills, and competencies are presently defined by key stakeholders. Second, an examination of digital curation education permits us to determine possible needs and opportunities in the field. Third, although digital curation is expanding its reach, it is only partially addressing the needs of digital humanities researchers.

As of 2012, 22% (13 of 58) of accredited Library and Information Science programs in North America offered courses in digital curation (Creamer, Morales, et al. 2012). In March of 2015, I found that 21 (36.2%) schools currently offer such a course, a marked increase. (Nine of 58 programs offer digital humanities course, suggesting potential for collaborative digital curation and digital humanities work in Library and Information Science.)

In addition to LIS courses, digital curation has gained traction through curriculum development, Master's degrees, specializations, certificates, and workshops. Thirty-three

initiatives stand out: ten capacity-building programs,[2] two Master's degrees,[3] four specializations,[4] ten certificates (graduate, professional, or both),[5] and six workshops.[6]

Despite these efforts, digital curation remains an immature field that lacks coordination overall (Dallas, An Agency-Oriented Approach to Digital Curation Theory and Practice 2007). A recent report noted, "Although the benefits of digital curation are poorly understood and not well articulated, significant opportunities exist to embed digital curation deeply into an organization's practices to reduce costs and increase benefits" (National Research Council of the National Academies 2015, 2). LIS programs not only can train librarians and archivists to engage in digital curation work, but also can teach digital humanists how best to curate their own data. Digital curation of digital humanities data can facilitate the sharing and reuse of data, thereby promoting new research questions and new audiences as well as justifying the public investment in the digital humanities.

[2] Catholic University's Cultural Heritage Information Management (CHIM), University of Illinois at Urbana-Champaign's (UIUC's) Data Curation Education Program (DCEP), UIUC's Data Curation Education Program-Humanities (DCEP-H), University of North Carolina at Chapel Hill's (UNCCH's) DigCCurr I, UNCCH's DigCCurr II, University of North Texas's Information: Curate, Archive, Manage, Preserve (iCAMP), Pratt Institute's Cultural Heritage Access Research and Technology (CHART), University of Tennessee-Knoxville (UTK) and UIUC's Data Curation Education in Research Centers, UTK's Science Links2, and UTK's SciData.

[3] King's College's MA in Digital Curation and San Jose State University Master's in Archives and Records Administration (MARA).

[4] UIUC's Specialization in Data Curation, University of Maryland's Specialization in Archives and Digital Curation, University of Michigan's Specialization in Preservation of Information, and Wayne State University's Specialization in Digital Content Management.

[5] University of Arizona's Digital Information Graduate Certificate (DigIn), Dominican University's Certificate in Digital Curation, Kent State University's Certificate of Advanced Study in Digital Curation, Johns Hopkins University's Certificate in Digital Curation, University of North Carolina's Master's Certificate in Digital Curation, University of North Carolina's Post-Master's Certificate in Data Curation, University of Maine's Digital Curation Graduate Certificate, San Jose State University's Post-Master's Certificate in Digital Curation, Simmons College's Digital Stewardship Certificate, and Syracuse University's Certificate of Advanced Study in Data Science.

[6] University of Massachusetts-Amherst and Worcester Polytechnic Institute's New England Collaborative Data Management Curriculum (NECDMC), University of Minnesota, University of Massachusetts-Amherst, University of Tennessee-Knoxville, University of Washington, and the Digital Humanities Data Curation (DHDC) Institutes.

Research Questions

Digital humanists likely have much to gain from working with digital curator in their training and education efforts as well as in their daily work (Poole 2013). In an effort to establish a baseline of current practice, and to suggest areas of pedagogical coordination and collaboration between digital curation and digital humanities, this dissertation centers on four research questions:

- What types of data have digital humanists (whether faculty, "alternative-academics,"[7] (alt-acs) or graduate students) created, reused, stored, and planned to reuse in their SUG project?
- What (if any) digital curation skills did they employ and how did they acquire them?
- Are these digital humanists interested in acquiring skills to help curate their data and if so, what content would they like to learn?
- What sort of educational framework would be useful to help them learn more about curating their data?

These questions will be addressed by an examination of selected awardees of Start-Up Grants from the National Endowment for the Humanities's Office of Digital Humanities. These projects represent seminal examples of current and emergent digital humanities work; they will be contextualized, moreover, in the broader literature of digital curation and digital humanities.

[7] As Bethany Nowviskie puts it, "The #alt-ac label speaks to a broad set of hybrid, humanities-oriented professions centered in and around the academy, in which there are rich opportunities to put deep—often doctoral-level—training in scholarly disciplines to use." See http://chronicle.com/blogs/profhacker/the-alt-ac-track-negotiating-your-alternative-academic-appointment-2/26539

The National Endowment for the Humanities's Office of Digital Humanities

Established in 2007 by the National Endowment for the Humanities, the Office of Digital Humanities (ODH) propounds, "The ways we read, write, learn, communicate, and play have fundamentally changed due to the advent of networked digital technologies. These changes are being addressed in fascinating ways by scholars from across the humanities, often working in collaboration with scientists, librarians, museum staff, and members of the public."[8]

Consonant with this evolution, the ODH began offering Start-Up Grants in 2007 "to support the initial phases of projects offering innovative approaches to the use of emerging technologies in the humanities."[9] Head of the ODH Brett Bobley (2007) remarks, "I chose the name 'start-up grant' because it reminded me of the tech world, a tech start-up like the two Apple Computer guys in their garage."

Of the "high risk, high reward" variety, ODH-funded projects foreground research innovation. The ODH sponsors two types of Start-Up Grants, each of which may run up to eighteen months in duration. Disbursing up to $30,000, Level I grants underwrite brainstorming sessions, workshops or conferences, alpha-level prototypes, or initial planning. Likely outcomes include reports, position papers, or plans for future work. Level II grants support more mature projects, generally those that prepare for implementation or that show proof of concept. Receiving up to $60,000, these grants produce more concrete deliverables than Level I grants, for instance prototypes, test beds, or demonstration projects.

All Start-Up Grants grant applications require Data Management Plans. Plans focus on the types of data the project will produce and the grantee's plan for managing that data during

[8] http://www.neh.gov/divisions/odh/about

[9] http://www.neh.gov/files/grants/digital-humanities-start-faqs_2014.pdf

and after the grant.[10] The ODH defines data broadly: "Many variables govern what constitutes 'data' and the management of data, and each discipline has its own culture regarding data."[11] The ODH classifies data as materials generated or collected such as citations, code, algorithms, digital tools, documentation, databases, geospatial coordinates, reports, and articles. Conversely, it excludes materials such as drafts or preliminary analyses, plans for future work, peer-review assessments, communications with colleagues, and confidential or private material. The ODH expects grantees to disseminate their findings and their data to scholarly and public audiences.

The ODH's efforts since 2011 suggest the possibilities of digital curation work in the digital humanities. Humanists increasingly realize that they reuse and create "data" and thus can profit by making this data sharable and reusable, especially when their work depends upon public monies. The Start-Up Grant projects examined in this study illustrate the potential for coordination, communication, and collaboration among digital curation professionals and digital humanists. They provide a useful way of studying the practices of key stakeholders.

Structure of the Dissertation

Including this introductory chapter, this dissertation comprises seven chapters. Chapter two describes the landscape of digital curation in six parts. First, it discusses the definition of digital curation and the roles and responsibilities of digital curators. Next, it probes the definition

[10] http://www.neh.gov/files/grants/data_management_plans_2014.pdf. Data management plans comprise four areas. First, the plans spell out data rights and obligations, relevant legal or ethical issues, costs, and roles and responsibilities. Second, plans deal with expected data, namely its types and formats, the ways in which it will be managed and maintained until shared, and its level of aggregation. Third, plans address sharing, primarily the mechanisms in place for sharing, how the data was generated, procedural information, and metadata. Fourth, plans address dissemination. Dissemination issues include strategies to promote public access, formats, resources, any privacy, confidentiality, security, or intellectual property issues, the archival storage location of data, and the period of retention.

[11] From application instructions for applications due in 2012 (projects starting May 2013). I have relied on these instructions because they are the instructions to which my sample population adhered when they applied for their SUGs.

of data and examines Big Data, the data lifecycle and data lifecycle models, metadata, and data sharing and reuse. Third, the chapter considers digital curation in the context of scholarship, focusing on cyberscholarship, citation, and copyright. Fourth, it turns to institutions that play a foundational role in digital curation: archives, centers, libraries, and institutional repositories. Fifth, the chapter looks at higher-level concerns such as governance and policy, planning and data management plans, planning tools, trust, risk management, metrics, standards, and sustainability. Finally, it stresses the need for examining actual researcher practices and conducting outreach and raising awareness.

Chapter three explores the digital humanities, also in six parts. It first sets forth the historical trajectory of the digital humanities. Second, it examines the definition, scope, and inclusivity of the field. Third, it addresses digital humanities work as scholarship. Digital humanists often struggle to demonstrate the scholarly worth of their work to more traditionally-minded colleagues, just as do digital curation professionals. Fourth, the chapter tackles the institutional position of digital humanities, highlighting the importance of libraries and centers as well as the notion of the "alt-ac" career. Like digital curation, digital humanities often operates in an insecure position on campus. Fifth, the chapter describes further the types of work digital humanities scholars do. Data used in such work needs to be curated. Finally, it stresses the overarching importance in digital humanities of sustainability, collaboration, and project management. All three of these areas, too, are vital to successful digital curation.

The fourth chapter addresses the current state of education in digital curation and the digital humanities. The chapter addresses 30 recent initiatives in digital curation education, parsed by type: capacity-building, specialization, certificate (graduate, professional, or both), and

workshop. Both structurally and conceptually these initiatives provide helpful suggestions for educational model and program development.

The fifth chapter offers an overview of the dissertation's methodology, unpacks qualitative and naturalistic approaches. It then covers research design, research questions, and data collection. Next, it addresses research methods, primarily the affordances of a case study approach, semi-structured interviewing, purposive sampling, and documentary evidence. Finally, the chapter discusses grounded analysis and open coding. Overall, this study sought "a nuanced, expressive and information-rich understanding of scholarly practices and needs" (Benardou, Constantopoulos and Dallas 2013, 106).

Chapter six discusses the results of the study. First, it describes the nineteen projects. Next, it provides demographic information about the 45 interviewees. Third, it focuses on education, training, and skilling up experiences, both formal and informal, undertaken by the interviewees. Fourth, it discusses challenges faced by interviewees during the projects and lessons learned. Data, collaboration and communication, planning and project management, awareness and outreach, resources, technological issues—all were key issues for interviewees.

The seventh chapter addresses the four research questions that steered the study. First, it discusses the types of data that digital humanists—whether faculty, "alternative-academics," or graduate students—created or reused in their SUG projects. Second, it describes the digital curation skills (if any) they used in their projects and the ways in which they learned them. Third, it considers whether digital humanists are interested in learning about digital curation skills and if so, the ways in which they might learn them. Fourth, it sets forth a pedagogical framework that suggests how digital humanists might learn about curating their digital content

appropriately. Fifth, the chapter describes implications and limitations of the study. Last, the chapter suggests directions for future research. Three possibilities stand out.

A first set of questions centers on refining the proposed learning framework. First, how can the proposed learning framework be converted into a full-fledged curriculum model? Second, how can such a curriculum subsequently be propagated across social science and natural science disciplines? Third, how can such a curriculum be implemented at diverse types of institutions?

Second, future work might sample other types of scholars doing digital humanities work. Given the apparent similarity of many of the participants' affiliations in this study (only four of 29 Carnegie classification categories were represented), what other digital humanities populations' digital curation practices would be useful to study? For instance, what are the digital curation practices (and education practices) for digital humanities scholars at liberal arts colleges, traditionally women's colleges, Historically Black Colleges and Universities (HBCUs), community colleges, and Master's level institutions? Along these lines, what activities are happening at institutions that have not received grant funding? This issue of sampling channels into a final question: what digital curation skills are employed by personnel pursuing digital humanities projects more advanced (i.e. involving more data and data of greater complexity and variety) than the Start-Up Grants?

Third, future work might assume a longitudinal approach. First, what is the fate of the nineteen SUG projects examined in this study? Have they been sustained? Has their data been reused and if so, by whom? Second, is digital curation education for digital humanists becoming more formalized or systematic or both? What are the best ways of measuring the outcomes of digital curation education programs? Third, do stakeholders view data management plans

(DMPs) as more important than they did before? How can we measure DMP improvement (or lack of improvement)? Finally, have the roles of librarians' and archivists' roles in digital curation evolved or increased?

This study seeks to understand the existing practices and needs of those engaged in digital humanities work. It intends to discern how closely these practices and needs align with the digital curation literature. Therefore, it hopes to establish a baseline for future research and to suggest key skills for digital curation work in the digital humanities. It also seeks to provide a framework for guiding such education. As one interviewee commented, digital curation education in the humanities remains a "greatly unexplored area." This study is an early step to redress such neglect.

Chapter 2: The Conceptual Landscape of Digital Curation

> Data becomes dark because nobody is paying attention.
>
> -Heidorn (2008), 290.

> Fulfilling all of these research data management tasks is a complex sociotechnical challenge that all stakeholders, whether they are research funders, higher education institutions publishers, researchers or regulators, are currently ill prepared to meet.
>
> -Proctor, Halfpenny, & Voss (2012), 135.

Introduction

Ross (2000) reflects, "Increasingly, our culture and its by-products are represented as binary digits" (23). Tibbo (2003) puts the matter more bluntly: "Society as we know it is dependent upon digital data" (42). According to the American Council of Learned Societies (2006), "Digital technology can offer us new ways of seeing art, new ways of bearing witness to history, new ways of hearing and remembering human languages, new ways of reading texts, ancient and modern" (16). But such rich cultural data demands new strategies of curation. Technical obsolescence or fragility, lack of resources or of understanding of good practices, uncertainty over appropriate organizational infrastructure—all these factors represent serious risks to data (Harvey 2010).

This chapter first defines digital curation and sets out the roles of curators. Second, it defines data and then proceeds to discuss Big Data, the data lifecycle, metadata, and sharing and reuse. Third, it addresses scholarship, namely the possibilities inhering in cyberscholarship and complicating issues such as citation and copyright. Fourth, it considers the place of institutions in digital curation, focusing on archives, centers, libraries, and institutional repositories. Fifth, it turns to high-level concerns: governance and policy, planning and data management plans, planning tools, trustworthiness, risk management, metrics, standards and best practices, and sustainability. Finally, it addresses the importance of actual researcher practices and of raising awareness.

Digital Curation

Though preserving electronic records harkens back to the early 1960s at the National Archives, the notion of the digital preservation of data came about only in 1990 (Hirtle 2007). Digital preservation constitutes "the planning, resource allocation, and application of preservation methods and technologies necessary to ensure that digital information of continuing value remains accessible and usable" (Hedstrom 1998, 190). As a result, digital curation, a notion that crystallized in 2001, "carries with it the traditions, research subject, and objects of enquiry of digital preservation; indeed, digital preservation is considered to a necessary—and immediate—if not sufficient condition for achieving the goals of digital curation" (Dallas, An Agency-Oriented Approach to Digital Curation Theory and Practice 2007, 5). Indeed, digital preservation represents an important stage in the digital curation lifecycle model (Higgins 2008).

The Digital Curation Center posits that digital curation "is about maintaining and adding value to a trusted body of digital information for current and future use." a definition this

dissertation adopts.[12] Digital curation thus centers on "planned, systematic, purposeful, and directed actions that make digital information fit for a purpose" (National Research Council of the National Academies 2015, 10).

Digital curation bridges disciplines and surmounts temporality and geography. It holds forth "the promise of linking research, practice, and education relating to digital resources in all forms and disciplines, as well as the potential for better aligning data management across all types of repositories, from science data centers to cultural heritage organizations" (Ray 2009, 367). Curation activities are "highly interconnected within a system of systems, including institutional, national, scientific, cultural, and social practices as well as economic and technological systems" (A. Gold 2010, 3).

Given the diversity of its stakeholders and the environments in which it is conducted, digital curation has many definitions and includes many stakeholders (Winget, et al. 2009). Digital curation potentially involves anyone who interacts with digital information during its lifecycle (Dallas, An Agency-Oriented Approach to Digital Curation Theory and Practice 2007). Dallas (2007) elaborates:

> The generality of essential conceptual tools underlying digital curation advocacy—information lifecycle stewardship; multidisciplinary scope including financial, scientific, technical, legal and sociological points of view; primacy of future 'fitness of use'—as well as the perceived need to deal with problems of great magnitude, dependent on universal infrastructures, tools and procedures, and equally applicable to the curation of information resources in diverse fields…produced a motive to unite in the short term,

[12] Digital Curation Centre Glossary: http://www.dcc.ac.uk/digital-curation/what-digital-curation

> under the digital curation banner, a broad cross-sectoral and multi-disciplinary community of researchers and practitioners (4).

One recent study found that more than 90% of doctoral supervisors and more than 90% of their students see digital curation as moderately or extremely important to their research work (Abbott 2015).

Despite the long-term importance of digital curation, researchers tend to postpone it as "that extra burden…in the queue behind meeting the conference deadline and writing the grant application" (Rusbridge 2007). Digital curation projects have developed at an "alarmingly fast rate, producing a useful but bewildering array of theoretical frameworks, diagrams, software and services" (Prom 2011, 142). Complicating matters, researchers may not discuss digital curation, so they have no way of comparing their practices with other researchers (Alexogiannopoulos, McKenney and Pickton 2010). The vocabulary of digital curation seems both abstruse and technical to many stakeholders (Pryor 2013). Finally, lack of standards, authority control, hardware and software, and storage space complicate the digital curation endeavor (Latham and Poe 2012). Researchers' need for assistance with digital curation persists: digital curation represents "a community, a set of practices, and a field of theoretical and policy concern still in its infancy" (Dallas, An Agency-Oriented Approach to Digital Curation Theory and Practice 2007, 15).

Digital Curators

Digital curation describes "an interoperable role with a blend of traditional principles and LIS domain skills and competencies and skills belonging to other specific non-LIS domains, including both technical and interpersonal skills" (Vivarelli, Cassella and Valacchi 2013). Both digital humanists and digital curators require non-technical skills, namely project management,

negotiation, team-building, and problem solving (Harvey 2010). People skills are at a premium (Swan and Brown 2008).

Digital curators constitute "the human element of a knowledge infrastructure supporting contemporary scholarly practices and are key to developing and sustaining a global system of interoperable digital data and tools across the natural, physical, and social sciences, as well as the humanities" (Weber, Palmer and Chao 2012, 307). Harvey (2010) calls attention to a dearth of such professionals. Educational programs should cultivate "professional allrounders like a [sic] Swiss army knife" (Osswald 2013).

Digital curators embrace a wide variety of duties.[13] Digital curation work may seem "a service-oriented back office activity with high requirements concerning functionality and perfection" (Osswald 2013). But digital curators ensure long-term access, facilitate discovery, retrieval, use, and reuse, and help users maximize the usefulness of the curated digital content (Harvey 2010).

Data

Defining Data

Data is "A reinterpretable representation of information in a formalized manner suitable for communication, interpretation, or processing."[14] It represents "the output from any systematic investigation involving a process of observation, experiment or the testing of a hypothesis, which when assembled in context and interpreted expertly will produce new knowledge" (Pryor 2012,

[13] They manage digital information (ideally) from its point of creation and advise the information's creators; develop and implement policies, plans, and services; negotiate donor agreements and ensure submission of objects; maintain links between digital objects and publications; ensure data quality; perform archival activities such as selection, appraisal, and retention while maintaining archival principles such as authenticity, integrity, and provenance over time; promote interoperability; effect preservation activities; manage risk; and ensure destruction of deaccessioned objects (Harvey, 2010).

[14] Digital Curation Centre Glossary: http://www.dcc.ac.uk/digital-curation/glossary#D

3). “Data is a mundane idea,” Cole (2008) notes, “but fundamental to disciplinary knowledge, as well as central to an understanding of information streams” (240). It constitutes “the raw stuff of the scientific record, and the basis for verifiability” (Rusbridge 2007).

The definition of data is heavily contextual, reliant upon “a multiplicity of distinct vocabularies of data-related terms [and] associated with various communities of practice and disciplinary traditions” (Cole 2008, 240). It is hardly surprising that “considerable confusion exists as to what ‘counts’ as data” (Steinhart, Chen, et al. 2012, 67). Indeed, “Researchers are often unaware, or minimally aware, of what their partners consider to be valid and reliable data” (Borgman, Wallis and Mayernik. 2012, 519). Hence “data, like beauty, exist in the eye of the beholder” (Borgman, Wallis and Mayernik. 2012, 517). The Office of Digital Humanities defines data as “Materials generated or collected during the course of conducting research,” the definition this dissertation uses.[15] Data in the ODH’s view can thus include citations, software code, algorithms, digital tools, documentation, databases, geospatial coordinates, and publications.

Big Data

Big Data appears “the next frontier for innovation, competition, and productivity” (Manyika, et al. 2011); as the World Economic Forum states, “big data, big impact” (World Economic Forum 2012). Yet Big Data “is less about data that is big than it is about a capacity to search, aggregate, and cross-reference large data sets” (Boyd and Crawford 2012, 663). It has different degrees of “bigness” based on its size, its long-term significance, and its descriptive challenges (Lynch 2008).

[15] http://www.neh.gov/files/grants/data_management_plans_2014.pdf

Nonetheless, Big Data is not necessarily better data. Taken out of context, Big Data loses its meaning. Big Data also triggers new ethical issues, e.g. new digital divides (Boyd and Crawford 2012). "One of the most persistent, unresolved questions," Bollier (2011) opines, "is whether Big Data truly yields new insights—or whether it simply sows more confusion and false confidence." (14). At the least, though, Big Data "enables more people to crunch the same numbers and come up with their own novel interpretations" (Bollier 2011, 15).

Along these lines, the first Digging into Data challenge (2009-2010) introduced "a new paradigm: a digital ecology of data, algorithms, metadata, analytical and visualization tools, and new forms of scholarly expression that result from this research" (Williford and Henry 2012, 2). The projects demonstrated that data management and organization cannot be separated from data analysis. Rather, they are "deeply interdependent and that work in both is iterative and cyclical rather than sequential" (Williford and Henry 2012, 25). Whether big data's promise will be fulfilled remains an open question.

The Data Lifecycle and Lifecycle Models

Tibbo (2015) asserts, "Never before in the history of librarianship or archivy has there been such a clear notion of the need to curate content over its entire lifespan" (151). Digital curation follows a lifecycle approach, which involves numerous components: appraisal, ingest, classification, indexing, cataloging, knowledge enhancement, presentation, publication, dissemination, use experience, repository management, preservation, goal and usage modeling, domain modeling, and authority management (Constantopoulos and Dallas 2007)—hence the importance of stakeholder involvement early or even before data creation (A. Ball 2012).

The use of lifecycle models to guide the curation of data can benefit creators, archivists, and reusers (Harvey 2010). They promote "the maintenance of authenticity, reliability, integrity

and usability of digital material" (Higgins 2008, 135). Lifecycle models comprise three types: individual, organization, and community. They describe how maintaining or preserving data as well as adding value to it can be effected throughout the lifecycle (Pryor 2012). Models allow researchers to map their work against the lifecycle, to determine vulnerabilities, to encourage documentation, to develop standards, and to identify tools and services.

Eight research lifecycle and digital curation models[16] merit consideration by digital curation stakeholders: the Digital Curation Center Curation Lifecycle Model (Higgins 2008), the I2S2 Idealized Scientific Research Activity Lifecycle Model,[17] the DDI Combined Life Cycle Model,[18] ANDS Data Sharing Verbs,[19] the DataONE Data Lifecycle,[20] the Research360 Institutional Research Lifecycle,[21] the Capability Maturity Model for Scientific Data Management,[22] and the UK Data Archive Data Lifecycle.[23]

In developing or following an appropriate lifecycle model, designers might consider issues such as scope (what level of services will be offered and to what audiences), best practices and community standards, and how best to represent real world activities (J. Carlson 2014). Lifecycle models constitute vital resources for digital curation work.

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[16] While not a lifecycle model per se, the Open Archival Information System Model has been a key influence on other lifecycle models (C. A. Lee 2005) (C. A. Lee 2009).

[17] http://www.ukoln.ac.uk/projects/I2S2/documents/I2S2-ResearchActivityLifecycleModel-110407.pdf

[18] http://www.ddialliance.org/Specification/DDI-Lifecycle/3.2/

[19] http://www.ijdc.net/index.php/ijdc/article/view/133

[20] http://www.cell.com/trends/ecology-evolution/pdf/S0169-5347%2811%2900339-9.pdf

[21] http://www2.le.ac.uk/services/research-data/images/new_institution.PNG/view

[22] http://www.asis.org/asist2011/proceedings/submissions/36_FINAL_SUBMISSION.pdf

[23] http://www.data-archive.ac.uk/create-manage/life-cycle

Metadata

Metadata "addresses data attributes that describe, provide context, indicate the quality, or document other object (or data) characteristics" (Greenberg 2005, 20). Increasingly expansive in definition, it constitutes "the sum total of what one can say about any *information object* at any level of aggregation" (Gilliland 2008, 2). Indeed, Riley (2014) insists that metadata "drives virtually all of the…steps in the curation life cycle…from preservation actions to access and reuse" (150). Because metadata captures all levels of a digital object's properties, it is tantamount in importance to data itself (Levine 2014).

More specifically, metadata provides stakeholders not only with a controlled vocabulary, but also with information on related objects, on intellectual property, on user information, on versioning, on integrity checks, and on preservation actions (Harvey 2010). It may prove a "Rosetta stone that will make it possible to decode information objects and their transformation into knowledge in the cultural heritage information systems of the future" (Gilliland 2008, 19). Evolving over time and with use, metadata is foundational in enabling use, sharing, and reuse of data.

Table 1: Typology of Data Standards (Gilliland 2008)

Type	Examples
Data structure standards (metadata element sets, schemas); are "categories" or "containers" of data that comprise a record or other IO	MARC fields; EAD; Dublin Core Metadata Element Set (DCMES); Categories for the Description of Works of Art (CDWA); VRA Core Categories
Data value standards (controlled vocab, thesauri, controlled lists); are terms, names, other values used to populate data structure standards or metadata element sets	LCSH; LC Name Authority File (LCNAF); LC Thesaurus for Graphical Materials (TGM); Medical Subject Headings (MeSH); Art and Architecture Thesaurus (AAT); Union List of Artist Names (ULAN); Getty Thesaurus of Geographic Names (TGN)
Data content standards (cataloging rules and codes); are guidelines for format and syntax	AACR; Resource Description and Access (RDA); International Standard Bibliographic

of data values used to populate metadata elements	Description (ISBD); Cataloging Cultural Objects (CCO); DACS
Data format/technical interchange standards (metadata standards expressed in machine-readable form); this type of standard is often am infestation of a particular data structure standard encoded or marked up for machine processing	MARC21; MARCXML; EAD XML DTD; METS; MODS; CDWA Lite XML schema; Simple Dublin Core XML schema

Sharing and Reuse

Sharing

Sharing data allows scholars to reproduce or verify research findings, to make findings generated by publicly-funded research available, to permit other researchers to ask new questions, to facilitate meta-analysis, to increase citation, to reduce loss, to promote teaching and learning, and to foster economic development (C. Borgman 2012) (Faniel and Zimmerman 2011) (Lyon 2009) (McLure, et al. 2014) (Organisation for Economic Co-Operation and Development 2007) (Parsons and Duerr 2005) (Ray 2014) (Tenopir, Allard, et al. 2011) (Whitlock 2011). Sharing and reuse allow researchers to obtain "new knowledge from old data" (Zimmerman 2008).

Rationales for sharing vary. Perhaps most important, trust nurtured through personal relationships and collaborations often undergirds sharing (Akmon, et al. 2011) (Cragin, et al. 2010); (Faniel and Jacobsen 2010) (Kroll and Forsman 2010) (Pryor 2009) (Sayogo and Pardo 2013). Such personal exchange renders documentation and tacit knowledge more effective in transfer (Birnholtz and Bietz 2003) (Wallis, Rolando and Borgman 2013). Still, trust alone cannot ensure effective sharing (Zimmerman 2008).

Researchers can share data through deposit in a data center, archive, data bank, or Institutional Repository; through submission to a journal as part of publication; through making

it available online through a personal, project, or institutional website; and through peer to peer exchange (Van den Eynden, et al. 2010).

Policy and enforcement practices, infrastructure, credit mechanisms, rights and licensing, data usage agreements, best practices, educational modules—all facilitate sharing (M. Smith 2014). But stakeholders who consider sharing must know which data can be shared and why, by and with whom and under what conditions, and to what effect (C. Borgman 2012). Before sharing, moreover, data must be gathered and structured (Haendel, Vasilevsky and Wirz 2012). Even with considerable data management and documentation, sharing remains difficult at best (Akmon, et al. 2011). Indeed, making data accessible is not equivalent to making it usable (Wallis, Rolando and Borgman 2013).

Personnel involved in sharing may include the project director; the staff who collects, processes, and analyzes the data; external contractors or collaborators; support staff; IT staff; reviewers; meta-analysts; students; and external data centers or web services archives (Van den Eynden, et al. 2010) (Whitlock 2011). Kroll and Forsman found that direct contact among faculty and other professionals remains the elemental precondition for collaboration (Kroll and Forsman 2010). Community buy-in is essential (Haendel, Vasilevsky and Wirz 2012).

Conversely, disincentives to share data persist. First, researchers fear they will not receive credit for such labors. What is more, writing data documentation is time-intensive. Third, creators of data worry about misuse, primarily about misinterpretation, but also about intellectual property. Fourth, confidentiality or privacy concerns play a role (C. Borgman 2012). Researchers deal with "the carrot of the continued vitality of the community and relationships between partners, and the stick of obligation to other group members." (Davenport and Hall 2002, 191).

One strategy is to allow original authors to review any publications that make extensive reuse of their original dataset (Whitlock 2011).

In one study, researchers wanted the right to publish the results of their work before sharing. They also stressed the importance of proper attribution, the amount of effort prerequisite to sharing, and the role of funder's expectations. Finally, they preferred to be familiar with the potential re-user (Wallis, Rolando and Borgman 2013).

Another study found that 95% of respondents thought they would be able to share their data at some stage in their research. But more than two thirds (68%) wanted to wait at least six months after their data analysis to do so. Reasons not to share included researchers' concerns regarding privacy and confidentiality (54%) or their sense that their data is of little use to others (48%) (Steinhart, Chen, et al. 2012).

A third study found the vast majority of its participants willing to share data, but nearly half of those participants prefer not to share their data with project funders. The most common form of sharing overall is through emailing data on request (Akers and Doty 2013).

But disciplinary variations regarding sharing behaviors prevail. For example, arts and humanities researchers are less willing overall than basic science researchers, medical science researchers, or social science researchers to share their data. On the other hand, arts and humanities researchers are the most willing of the four groups to share their data with the general public.

Akers and Doty (2013) determined that medical and social sciences are least likely to share due to personal or sensitive information contained in their data. Basic sciences and arts and humanities researchers are most likely not to share because they fear not receiving credit.

Finally, basic and medical sciences are least likely to share because of patent or commercial issues.

Methods of sharing also vary across disciplines. For example, social sciences researchers are least likely to share data via email. Meanwhile, medical science researchers are least likely to mount their data on personal websites. Third, basic science researchers are most likely to share their data by linking it to journal articles or posting it on department or university websites. Finally, no arts and humanities researchers share their data via repositories or databanks. Perhaps most important, many researchers struggle to imagine future reuse possibilities of their data (Wallis, Rolando and Borgman 2013). Unsurprisingly, they are not familiar with documenting or creating metadata to enable others to understand their data as a result (Akers and Doty 2013).

In deciding whether to prepare their data for sharing, stakeholders need first to discern data's potential reuse value and subsequently to determine how many resources should be allocated to ensure future fit for purpose (Palmer, Weber and Cragin 2011). Most problematic, a "stated 'willingness to share' may bear little relationship to actual release of data" (Wallis, Rolando and Borgman 2013, 12). Small wonder sharing can seem "a thorny, almost byzantine concept" (Carlson, et al. 2011, 647). Complicating matters, Lynch (2014) postulates, "The vast majority of faculty will, at least in the near term, see little real benefit for making their data available for sharing" (397).

Reuse

Reuse may include migrating data, creating new visualizations of data or enhancing existing data, aggregating data, or applying new analytical techniques to examine it. (McLeod, Childs and Lomas 2013). But reuse of shared data invites further challenges: first, the provenance of the dataset may be ambiguous. What is more, reusability necessitates not only

additional policies, but also mechanisms for policy enforcement and compliance. Third and most important, potential reusers must be able to understand the data in order to reuse it; describing their methods may be creators' best strategy to enable reuse (Zimmerman 2008).

It can be tough to enforce or to align terms of use or data usage agreements (M. Smith 2014). Hence both a discipline's history and the configuration of its research community are key variables in contextualization and documentation (Carlson and Anderson 2007). Guidelines and policy stipulations cannot always ensure data deposit and sharing occurs in practice (Schofield, et al. 2009). Researchers often defer to disciplinary norms or conventional wisdom. The greatest uptick in sharing will occur in communities that realize direct benefits in sharing or in situations in which infrastructure is in place (S. Jones 2012).

Nicholson and Bennett (2011) conclude, "While informal paths to data access and sharing may serve some members of a research community, it seems that maintaining…a haphazard and idiosyncratic system of data sharing—especially when better methods are available—is contradictory to fundamental principles of scholarly practices supported by sound and consistent methodologies" (513). Wallis et al. (2013) report:

> The originating investigator bears the cost of data preparation. Other entities such as data repositories, universities, libraries, and funding agencies are likely to bear the cost of curating those data for sustainable access. Unknown—and often nonexistent—reusers reap the benefits. This equation is not viable in economic or social terms (15).

Scholarship

Cyberscholarship

Cyberscholarship features collaborative resource discovery, analysis, discussion, and argument; in addition to texts it relies upon formats such as images, moving images, sound

recordings, maps, and GIS (Green and Roy 2008). Its promise inheres in its potential for fluid access to and sharing of digital data (Green and Roy 2008). Cyberscholarship therefore allows new forms of research such as building digital collections of information for further analysis, developing tools for collection-building and for analysis and study of such collections, and creating new intellectual products by leveraging those tools (American Council of Learned Societies 2006). It also allows for further peer review or auditing of research work. Waters (2007) comments:

> Although the systematic exploration of large quantities of information is not a new scholarly practice, what does seem new is the formalization of the very traditional interpretive activities of data-mining, pattern-matching, and simulation in powerful algorithms that represent large and complex sets of data in terms of multiple features and variables that can be analyzed, tested, replicated, and changed at the scale and speed afforded by advanced computation" (8).

The development of infrastructure for cyberscholarship may depend upon national, international, and interdisciplinary coordination (Arms and Larsen 2007). Additionally, it requires domain and computational knowledge and a common language to transcend these boundaries (Bowker and Star 2009). A substantial shift in scholarly culture is wanting (Green and Roy 2008). Lack of expertise may prove the most notable hindrance to the maturity of cyberscholarship (Arms 2008).

Citation

Brase et al. (2014) note, "The primary purpose of citation has been to support an argument with evidence, though…it also has become a mechanism for attribution, discovery, quality assurance, and provenance" (170). Advantages of citation include allowing identification,

retrieval, and attribution of data and incentivizing sharing and reuse, thus promoting overall scholarly productivity (Mooney and Newton 2012).

Though increasingly common, data citation remains exceptional. Mayernik (2012) discerns "strong cultural inertia against data citations within many research communities" (24). Researchers may not know that they should cite data; they might not know how to cite data even if they are aware that they should do so. Journals' author instructions seldom provide guidance on data citation. One study found data citation both "infrequent and haphazard" (Mooney and Newton 2012).

Digital curation stakeholders should follow ten "first principles" (Brase, et al. 2014). First, data citations should get the same cachet as traditional citations. Second, citations should give credit and legal attribution to appropriate parties. Third, citations should be persistent. A persistent digital identifier should have clear referencing and cross-referencing, authentication, and validation. Fourth, citations should enable access to data, metadata, and documentation.

Brase et al.'s other six principles concentrate on accessibility: citations should help users discover data and documentation, establish provenance, support granular description for identification purposes, permit unambiguous identification of data, rely upon widely embraced metadata standards, and be sufficiently flexible not only to deal with different domain practices but also to allow communication across domains (Brase, et al. 2014).

Requisite infrastructure involves the marriage of law, computer science, informatics, and policy and systems research (Brase, et al. 2014). "At a minimum," Smith (2014) concludes, "publications should cite data in a similar manner to related publications, and…include statements about the data's availability and metadata for where to access it, and terms and

conditions" (52). In the end, as an incentive recognition may well outstrip federal or funder mandates in effectiveness (Haendel, Vasilevsky and Wirz 2012, 3).

Ultimately, citations constitute "one step toward more integrated and transparent data collections and supplement parallel movements promoting linked data approaches to digital information provenance tracking" (M. Mayernik 2012, 27). They represent a "necessary corollary" to data publication (Mooney and Newton 2012). Ball and Duke (2012) offer useful guidance on the mechanics of data citation and linking.

Copyright

Copyright law seems both "ubiquitous and yet not at all intuitive" (Levine 2014, 140). Nonetheless, as Smith (2014) sums up, "Copyright law, while complex and nuanced, is largely harmonized (in the sense that it is structured, interpreted, and enforced in the same way) worldwide, unlike other types of intellectual property law (e.g., sui generis database rights or patent rights)" (46).

Four legal issues are interwoven in digital curation work. First, technological change always outstrips legal change. Second, different countries' copyright laws vary. Third, disciplinary practices vary. Fair use necessitates case-by-case scrutiny; what is more, stakeholder familiarity and comfort with openness remains far from uniform (Levine 2014).

Overall, copyright "is usually framed as a 'problem,' but the real impediment seems more diffuse: a disincentive to share, difficulty in credit and attribution, low value in the tenure process, and the essential complexity of managing data are more likely factors" (Levine 2014, 134). Potential legal tools for protecting and sharing data include contracts, public licenses, and waivers (M. Smith 2014). Digital curation professionals would benefit from being well-versed in these areas.

Institutional Sites for Digital Curation

At least four classes of institution have crucial roles to play in digital curation: archives, centers, libraries, and institutional repositories (Poole 2015).

Archives

"Records such as email, spreadsheets, digital photographs, blogs and other informal or unpublished materials," states Prom (2011), "are heirs to the analog records formats that have long constituted the stock in trade of archives and special collections libraries" (143).

Archivists have much experience selecting records, preserving records' context, and making records interpretable and usable (Akmon, et al. 2011) (Prom 2011). In fact, the National Archives became concerned with machine-readable data as early as 1964, first appraised machine-readable records in 1969, and developed the first general records schedule for such records in 1972 (Alldredge 1972) (Dollar 1978) (Fishbein 1972) (Peterson 1985). But digital materials have traditionally been acquired by archives incidentally (Redwine, et al. 2013). Notwithstanding the complexity of digital curation tasks, archivists already face existing backlogs of paper materials (Prom 2011). Indeed, 34% of repositories in one study had more than half of their holdings unprocessed (Greene and Meissner 2005). Moreover, archivists often see data as not useful for historical research; they favor placing data with possible long-term value in discipline-specific repositories maintained by the government or laboratories (Akmon, et al. 2011).

Yet the archival principles are increasingly relevant to various academic fields and to digital curation (Manoff 2004) (Poole 2015). Researchers working with data need basic archival skills, for instance the ability to create good metadata and documentation (Jahnke and Asher

2012) (Shankar 2007). Wallis and her colleagues (2008) stump for implementing archival practices as early as possible in the data lifecycle.

Archivists can serve as digital curation participants or consultants or both. A repository's mission statement and collection development policy should determine its involvement (Noonan and Chute 2014). A recent survey of university archivists who work at ARL member institutions found 57% of respondents involved in campus conversations about curation. Nearly half of respondents, moreover, reported collecting institutional or research data. Nonetheless, institutional size mattered: the largest institutions featured the most archivist involvement. The vast majority of participants (86%) believe archivists should be involved with digital curation on some level, whether on a continuous or a case-by-case basis, but only 54% of these respondents felt capable of fulfilling their perceived roles (Noonan and Chute 2014). Prom (2011) concludes, "The need is great and the archival community is receptive" (148).

Centers

Centers can improve research efficiency, increase return on investment, enable data discovery, create data or store reusable data, and raise awareness of data's disciplinary importance (Collins 2012). They can advocate for humanities scholarship and teaching, serve as intellectual sandboxes, promote interdisciplinarity, attract new audiences, engage professional communities, stimulate collaborations, and extend services to scholarly communities (D. Zorich 2009). The Digital Curation Center, for example, offers two workshop series throughout the United Kingdom (Digital Curation 101 and Tools of the Trade) and a visualization tool for constructing curricula (Moles and Ross 2013). The DCC maintains the "dual aim of assisting growth in research data management proficiency within the higher education community whilst coordinating the development of institutional services in a way that allows national and

international infrastructure to build on, interoperate with and support those services" (Pryor 2013, 182). Yet centers struggle to sustain themselves. Collins (2012) laments, "The value of research data centers is perhaps brought into its clearest focus when the services that they offer are no longer available" (169).

Research Libraries

Research libraries have a pivotal role to play in supporting and educating researchers, as numerous scholars suggest.[24] Abram (2014) insists, "The most popular buzzword in library land these days is *curation*" (25).

"Responsible stewardship is at the heart of professional librarianship" note Price and Smith (2000, iv). Corrall (2012) elaborates:

> Powerful synergies exist between the longstanding library commitment to open access and the philosophy of open science, between the principles underpinning library collection management and emerging protocols for curating digital data, between the track record of libraries and in technology adoption and systems development and the complex demands for integrated infrastructure and novel workflows, and between the teaching mission of librarians and the educational agenda for e-research (126-127).

Consulting with researchers about their data represents an opening wedge, given its similarity to the reference interview (Brandt 2014). Librarians are well-familiar with metadata creation, collection management, information literacy, scholarly communication, open access, and institutional repositories as well (Corrall, Kennan and Afzal 2013). Subject specialists,

[24] Key readings include: (Akers and Green 2014) (J. Carlson 2012) (J. Carlson 2013) (Corrall, Kennan and Afzal 2013) (Eaker 2014) (Erdmann 2013) (Fox 2013) (Giarlo 2013) (A. Gold 2010) (Haendel, Vasilevsky and Wirz 2012) (Hey and Hey 2006) (Lage, Losoff and Maness 2011) (Latham and Poe 2012) (Lyon 2012) (McLure, et al. 2014) (Mitchell 2013) (Muilenberg, Lebow and Rich 2014) (Nicholson and Bennett 2011) (Ovadia 2013) (Shaffer 2013) (Starr, et al. 2012) (Tenopir, Birch and Allard 2012) (Walters 2009) (Walters and Skinner 2011) (Wang 2013) (Witt 2008).

metadata librarians, institutional repository coordinators, data curators, systems or IT librarians, copyright specialists, collection managers, and acquisitions librarians—all can be involved. But librarians need competencies: knowledge of disciplinary and domain cultures, research methods, workflows, lifecycles, technology, relationship building and institutional contexts (Corrall 2012).

Librarians who work with data may do so more or less in isolation (Steinhart 2014). Even so, they have made much progress in supporting course- or department-specific information literacy programs (Carlson, Johnston, et al. 2013). Purdue University Libraries's Digital Information Literacy effort, for instance, balances workshops and semester-length courses while aligning outreach with current disciplinary research practices (Carlson, Johnston, et al. 2013). DIL is "grounded in the culture of the discipline in which it is embedded…but certainly imbued with the greater, communal perspective possessed by an inter- or extra-disciplinary librarian" (Carlson, et al. 2011, 653).

Yet the commitment of libraries to digital curation is inconsistent (Council on Library and Information Resources 2013). Price and Smith (2000) note, "Most libraries have traditionally focused more on the costs of acquiring and maintaining collections than on their potential as assets that are vital to institutional productivity" (1). Moreover, determining data's place in the library's operations is hardly intuitive (Steinhart 2014). Assuming a research life cycle approach, for example, represents a sea change for libraries. Similarly, "the prospect of providing specialized services to selected researchers collides with deeply rooted professional values of equal service and access to information for all" (Steinhart 2014, 320).

Finally, the scholarly literature evinces little consensus regarding the application of librarians' skills—much less what additional skills they need to cultivate (J. Carlson 2013). More localized studies can determine the appropriate mix of skills needed by librarians (McLure, et al.

2014). Ultimately, "The involvement of academic libraries in e-science/e-research has been seen as a natural extension of their electronic resource management and digital stewardship responsibilities but also questioned because of the level of technical know-how and domain understanding required" (Corrall, Kennan and Afzal 2013, 666).

Complicating matters, though researchers lament their inability to create sharable metadata and to manage their data efficiently, they show little awareness that libraries and librarians can help (Kroll and Forsman 2010). They see the library only as a "dispenser of goods," not as a support system (Jahnke and Asher 2012, 4). There remains "much concern that researchers will *not* think to consult librarians—which could lead to inaccuracies, misinformation, or unrealistic expectations in the plans themselves" (Hswe and Holt 2011, 15).

Ideally, as loci of support for and education of researchers, libraries will evolve into "vibrant knowledge branches that…provide curatorial guidance and expertise for digital content" (Walters and Skinner 2011, 5). "Research libraries cannot provide RDM services alone, and it is essential to be proactive in working with the full range of stakeholders and interested parties," claims Westra (2014, 385). Libraries and librarians can increase awareness of digital curation's importance, can provide archiving and preservation services, and can cultivate new professional practices (Swan and Brown 2008). Perhaps most important, digital curation facilitates librarians' further embedding themselves in research processes (Nicholls, et al. 2014). Partnering with disciplinary data repositories such as Dyad is one strategy for doing so (Akers and Green 2014).

One study concludes, "Work in identifying and addressing the educational needs of students with data has just begun and…there are many possible avenues for librarians to explore in this area" (Carlson, Johnston, et al. 2013, 215).

Digital Curation Profiles (DCPs)

Developed at Purdue University Libraries, Digital Curation Profiles are a key resource for librarians (Witt, Carlson, et al. 2009). DCPs represent digital curation needs from the perspective of the data creator using her own language. They provide information about data creation or use, data management, and the curation needs of the researcher. As important, DCPs are easily comprehensible to non-specialists and are amenable to comparison across fields and disciplines (J. Carlson 2013).

A recent study reported on twelve workshops geared toward training librarians to use DCPs. Of 259 participants, 237 had data responsibilities of some sort, whether formally assigned or fortuitously acquired. All the same, these participants encountered barriers to digital curation work, primarily organizational support, time, staffing, and resources. The workshops successfully boosted attendee's digital curation confidence levels, but their levels of engagement remained "relatively stagnant" (J. Carlson 2013, 24). Therefore, librarians have yet to parlay their stated investment in digital curation into action (Carlson, Johnston, et al. 2013). As Carlson (2013) queries, "how does one actually 'do data?'" (30).

The DCP initiative also developed a Digital Curation Profiles Toolkit (DCPT). In the end, "Most respondents feel they can understand the DCPT well enough to use it but would like support in adapting and customizing it for their own purposes" (Zhang, et al. 2015, 57). But aside from the time investment necessary to use the DCP Toolkit, attendees expressed concerns about the tool's applicability, about getting training and help, and about the DCP Toolkit's extensibility. They also found it challenging to articulate the DCPT's value to researchers or library colleagues. Responding to criticisms that the DCP Toolkit is cumbersome, time-

consuming, insufficiently modular, and too heavily science- and engineering-inflected in its lexicon, Purdue personnel are developing a new version (Brandt and Kim 2014).

DataNet

Also building on libraries' potential for digital curation work, the National Science Foundation's 2008 DataNet initiative[25] funded Data Conservancy[26] and DataONE[27] (Lee, et al. 2009) (Sandusky, et al. 2009). First, Data Conservancy constitutes a template "that could be emulated or even replicated verbatim to create a distributed network of human and technical infrastructure" (Treloar, Choudhury and Michener 2012, 197). Unfortunately, Data Conservancy was defunded in 2013. Second, DataONE represents "an interdisciplinary, multi-institutional, multinational project that supports the data life cycle in the biological, ecological, and environmental sciences" (Allard 2014, 255). Its work continues.

In 2011, three DataNet projects succeeded Data Conservancy and DataONE. First, Sustainable Environment through Actionable Data (SEAD) (2011-2016) enables "sophisticated management of heterogeneous data while dramatically lowering the cost and effort required to curate and preserve data for long-term community use."[28] Second, the DataNet Federation Consortium[29] (2011-2016) employs the integrated Rule-Oriented Data System (iRODS) to offer nationally federated data grid infrastructure and to encourage collaborative research among and

[25] http://www.nsf.gov/pubs/2007/nsf07601/nsf07601.htm

[26] https://dataconservancy.org/

[27] https://www.dataone.org/what-dataone

[28] http://sead-data.net/

[29] http://datafed.org/about/

between scientists and engineers. Third, *Terra Populus*[30] (2011-2016) provides tools for data integration across the domains of social science and environmental data.

Institutional Repositories

Often associated with libraries, institutional repositories (IRs) fuse human intervention and institutional commitment (Kunda and Anderson-Wilk 2011). They contain the intellectual products of faculty and students, including research and teaching materials, as well as relevant institutional documentation (Lynch 2003). Therefore, IRs are "part of a larger set of strategies emerging across academic institutions, and nations, to provide for the stewardship of scientific research data and mobilize data for 'e-research' and 'e-Learning'" (Cragin, et al. 2010, 4036). They can help nurture interdisciplinary researcher communities and attend to the data lifecycle. If repositories involve themselves early in the lifecycle, they can serve as "platforms" where datasets can be reviewed and annotated. Thus they can help disseminate competencies, assessments, and interpretations within research communities (Walters 2014).

IRs often support project conception, proposal development, scheduling, documenting, meeting, and communication. They can manage not only scholarship and data, but also software, tools, and code. Walters (2014) reports, "Digital repositories are maturing into content and asset management components of broader ecosystems, ones that support communication and documentation, in addition to the research process itself and its associated results" (190). Librarians play a central (if still unsettled) role in IR development and operation.

Given the scale and complexity of the digital curation mandate, there are potential roles for IRs, libraries, centers, and archives. Whyte (2012) concludes, "Whoever provides data management, curation and preservation services will be expected to cater for cross-disciplinary

[30] http://www.terrapop.org/

virtual communities, while drawing their capabilities from regional innovation networks based around clusters of institutions and the physical facilities and tacit expertise in their vicinity" (220).

Scale notwithstanding, institutions and organizations face the challenge of balancing different disciplinary perspectives, negotiate tensions among local and global research communities, and determine the role of funding agencies (Lynch 2014). In the end, however, institutional repositories "can play a vital role in bridging the gap between the vast amounts of research data that are currently hidden in personal hard drives and university servers, and the small amounts of research data that are placed in national and international disciplinary data repositories" (Akers and Green 2014, 128-129).

Overarching Concerns

Governance and Policy

Data governance represents "the system of decision rights and responsibilities covering who can take what actions with what data, when, under what circumstances and using what methods" (M. Smith 2014, 45-46). Governance ensures that data can be trusted and that stakeholders stay accountable. Components of governance include business processes, risk management, legal and policy issues, attribution and citation concerns, archiving and preservation, discovery and provenance, data schema or ontology discovery and sharing, and access to necessary infrastructure (M. Smith 2014).

In digital curation, policy vacuums surrounding copyright, database rights, and other intellectual property issues abound. Other challenges involve creating discipline-neutral policies and centralizing policy (M. Smith 2014). For example, researchers face Institutional Review Board requirements, professional ethical codes, funding agency conditions, and international or

cultural differences regarding data work (Council on Library and Information Resources 2013). In some cases, policies are diametrically opposed.

According to the DataRes project,[31] the majority of American universities have not implemented institutional research data management policies. Only 18% have publicly available policies requiring retention and sharing of research data; the policies that exist are weak. But the vast majority (87%) of respondents agree or strongly agree that a data management plan is important (Council on Library and Information Resources 2013).

Another study developed eighteen criteria to analyze the policies of ten funders. Data policies lacked many of those criteria (Dietrich, Adamus and Steinhart 2012). Four findings were particularly salient. First, "while many policies stated that grant recipients were required to make their research data available and include a data management plan in grant proposals, more focused language, such as how to budget for data management or requirements to conform to standard data and metadata formats was less commonly mentioned in policies" (Dietrich, Adamus and Steinhart 2012). Second, policies tended to emphasize access to data more than preservation. Third, funders by and large neglected to address open access. Finally, policies often stipulated that data be made available but failed to include details for implementation (Dietrich, Adamus and Steinhart 2012).

Overall, at least four sectors would benefit from policies: storage, management, security, and disaster recovery (Harvey 2010). Optimal policies likely focus on the long-term and are periodically reviewed and refurbished. Accountability, organizational protection and legitimacy, acceptable practice, monitoring and review, and links to other relevant policies and materials are some useful components of a good policy (Harvey 2010). Though institutional policies ideally

[31] https://datamanagement.unt.edu/datares

align with funding agency mandates, both institutional inertia and the still-ambiguous status of data as a research product undercut such efforts (Council on Library and Information Resources 2013).

Planning and Data Management Plans (DMPs)

Building on the stipulation for data management plans issues by the National Institutes of Health in 2003, in May, 2010, the National Science Foundation mandated that all grant applications beginning in 2011 include data management plans—the first step in ensuring that federally-funded research would be made available to the general public (Mervis 2010). The Office of Digital Humanities borrowed much NSF language in instantiating their own data management plan requirement, also formulated in 2011.

Sallans and Donnelly (2012) suggest, "It is neither necessary nor appropriate for all stakeholders to become experts in every facet of the endeavor, but the planning process provides an opportunity to clearly stake out the roles and responsibilities for each stage of the process and to keep them up to date as requirements change over time" (128).

On the other hand, "planning at its best is a process that reacts to change, and that no plan benefits from being set in stone or blindly adhered to regardless of changing circumstances" (Donnelly 2012, 90).

Ray (2014) contends, "A good data management plan will not only satisfy grant application requirements, but will also serve as a blueprint for instituting good practices for managing active data and facilitating long term access" (9). Van den Eynden et al. (2010) similarly insist, "A data management plan should not be thought of as a simple administrative task for which standardized text can be pasted in from model templates, with little intention to

implement that planned data management measures early on, or without considering what is really needed to enable data sharing" (6).

Key considerations regarding a DMP include the data to be generated and shared, funder or publisher requirements, project stakeholder roles and responsibilities, disciplinary and domain standards and best practices, deposit location and provisions for back up, internal requirements, research groups, legal and ethical obligations toward participants, colleagues, funders, and institutions, and costing (Donnelly 2012) (Van den Eynden, et al. 2010). A DMP should address stakeholders ranging from researchers, librarians, and center or repository managers, to support staff such as grants officers, specialists such as archivists, and technical and laboratory staff (Donnelly 2012).[32]

According to one source, a data management plan should undergo at least three iterations (Donnelly 2012). First, at the beginning of the project or at the grant application stage, a DMP should be minimal. Second, once funding is in place a core data management plan that tackles a wider range of issues and does so in greater depth can be crafted. Finally, a full plan should focus on the long-term. Nonetheless, planning can be "misunderstood and underappreciated" (Donnelly 2012, 83). Small wonder that many researchers neglect to develop DMPs unless compelled by funding agencies (Jahnke and Asher 2012).

DMP requirements reflect pressure on funders to show positive economic and societal impact (Lynch 2014). One study found "a great deal of uncertainty among PIs about what the

[32] Useful guides include the DCC's DMPT Online: Data Management Planning Tool (http://dmponline.dcc.ac.uk/), Martin Donnelly and Sarah Jones. "Checklist for a Data Management Plan" (http://www.dcc.ac.uk/sites/default/files/documents/data-forum/documents/docs/DCC_Checklist_DMP_v3.pdf), the ICPSR's "Guidelines for Effective Data Management Plans" (http://www.icpsr.umich.edu/icpsrweb/ICPSR/dmp/index.jsp), the California Digital Library's "DMPTool: Guidance and Resources for Your Data Management Plan," and the UK Data Archives's "Managing and Sharing Data" (http://www.data-archive.ac.uk/media/2894/managingsharing.pdf).

new NSF requirement means and how to meet it, and…researchers welcome offers of assistance—both with data management planning, and with specific components of data management NSF asks them to address in their plans" (Steinhart, Chen, et al. 2012, 77). Nearly two-thirds (62%) of respondents wanted help writing DMPs; only 13% expressed no interest in support (Steinhart, Chen, et al. 2012).

Another study found a distinct lack of awareness of what a DMP was. Moreover, responses showed "varied perspectives on what a DMP entails and whether it is only a formal plan or may also name procedural workflows that for many researchers are embedded in their research process" (McLure, et al. 2014, 152). Librarians can assist by conducting workshops to disseminate best practices for writing DMPs, developing common language for certain sections of DMPs, and promoting tools such as DMPTool 2 (discussed below) (Nicholls, et al. 2014).

Although ultimately Hswe and Holt (2011) counsel, "Funder requirements cannot be ignored," there remain few ways of tracking DMP compliance (11). Lynch (2014) remarks, "Either such mechanisms will need to be developed, or there will be reliance on occasional spot audits by funders, probably accompanied by increasingly draconian punishments in order to encourage compliance" (400). Perhaps a better strategy is within reach.

Planning Tools

Though the importance of planning seems to be gaining a foothold among researchers, tools as well as practices lag. Researchers' current practices appear desultory largely because funding agencies propagate broad requirements and provide few resources (Sallans and Lake 2014).

Moreover, current services appear "rather limited in nature, often focusing foremost on the language and interests of the given funders, and less so on the idealistic or most pure aspects

of data management best practices" (Sallans and Lake 2014, 88). Hence a "vicious cycle" prevails: not only do most disciplines lack standardized procedures for managing data, but they have yet to train researchers (Sallans and Lake 2014, 88). Tools such as DMP Online and DMPTool can allay these concerns.

Both DMP Online and DMPTool provide a structured environment for data management planning and explicitly link to funder requirements (Sallans and Donnelly 2012). Sallans and Donnelly (2012) conclude, "While the development paths of the tools have diverged, both groups retain a broader vision of a joined-up tool…that serves as a coordinating hub for the management of data across many disciplines, many funding agencies, many institutions and many countries, with shared good practice as a common goal" (128).

In the United States, the DMPTool is especially promising: it constitutes "a straightforward and easy way for libraries to become more active and engaged in the DM conversation" (Sallans and Lake 2014, 104). More recently, the six original partner institutions, recognizing that the "overall quality and success of DMPs are likely to be higher if they are created using commonly accepted standards and practices based on requirements and recommendations of funders, institutions, librarians, and research communities," developed DMPTool 2 (Strasser, Abrams and Cruse 2014, 327). Goals for DMPTool 2 included settling upon best practices, allowing local adaptation of the tool, cultivating an open source community of users, promoting the sharing of institutional resources, and supporting the data lifecycle (Strasser, Abrams and Cruse 2014).

Trustworthiness

To take full of data's reuse value, researchers prefer "that the preservation practices of the source of the data are adequate: that archive media are routinely verified and refreshed, that

the facilities are secure, the processes to verify and ensure the fixity of the data are operational, the geographically distributed copies of the data are maintained as a protection against catastrophe, and that disaster recovery plans and procedures are in place" (Duerr, et al. 2004, 113). Criteria for trustworthiness include sustainability, compliance with OAIS criteria, pledging responsibility to long-term preservation, adopting organizational standards, and employing audit processes (Harvey 2010).

"Despite tremendous advantages offered by digital access and networking," Kroll and Forsman (2010) report, "the stellar productivity of U.S. researchers continues to be built on a foundation of direct human connection, researcher to researcher" (5). If data is shared beyond a researcher's colleagues, the processes of data management and documentation must engender trust (Ray 2014). Elements of such documentation include context of the collection, collection methods and dataset structure, information on provenance and the chain of custody, information concerning validation, checking, proofing, cleaning, and quality assurance, the measures taken to avoid or mitigate loss or corruption or both, and information on access or use conditions or confidentiality (Ray 2014) (Van den Eynden, et al. 2010).

Outreach and engagement with actual user behaviors seems imperative: "Exploring the stakeholders' needs and the process of matching repository operations against those needs has to date never failed to yield new insights into how the repository can better serve its community" (Reilly and Waltz 2014, 125).

Risk Management

Within the context of digital curation, risk management constitutes "a continuously developing arena whose ultimate goal is to define preservation and control mechanisms to address the risk attached to specific activities and valuable assets, where risk is defined as the

combination of the probability of an event and its consequences" (Barateiro, et al. 2010, 6). Risk assessment procedures include defining potential risks, conducting interviews and walk-throughs, settling upon controls and compensating for their weaknesses, assessing the degree of risk and parsing risks into acceptable and unacceptable, reporting the results, and developing action plans (Price and Smith 2000).

Data are subject to numerous risks: viruses, faulty backup, storage media failure, technology obsolescence, insufficient metadata, and physical disaster (Harvey 2010). Combatting these risks involves ensuring persistent access, regular backup, multiple copies, a delimited number of file formats, secure and stable storage, disaster recovery, and community watch (Harvey 2010).

Choosing a backup strategy involves assessing local conditions, the perceived value of the data, the systems on which the data is stored, and the acceptable levels of risk. Stakeholders need to consider whether to backup particular files or the whole system and how often to do so. Finally, they need to decide how best to organize and label backup data (Van den Eynden, et al. 2010).

Meanwhile, storage of data revolves around employing non-proprietary formats, regular integrity checks, periodic migration, relying on at least two different forms of storage, creating digital versions of paper documentation, organizing and labeling data, and ensuring storage areas remain fit for purpose (Van den Eynden, et al. 2010). Last, security measures should address physical, network, and system and file issues (Van den Eynden, et al. 2010).

Evaluation is crucial in fostering "an institutional culture of improvement, inquiry, responsibility, and…quality" (Lakos and Phipps 2004, p. 349). Audits allow precise definition of

the designated communities and identification of previously unnoticed risks (Reilly and Waltz 2014).

For instance, the *Trustworthy Repositories Audit & Certification: Criteria and Checklist* targets infrastructure, digital object management, and security. The tool helps a repository transparently tackle risks (Center for Research Libraries 2007) (Reilly and Waltz 2014). Similarly, the Planning Tool for Trusted Electronic Repositories (PLATTER) constitutes "a basis for a digital repository to plan the development of its goals, objectives and performance targets over the course of its lifetime in a manner which will contribute to the repository establishing trusted status among its stakeholders" (DigitalPreservationEurope 2008, p. 6). Third, the Digital Repository Audit Method Based on Risk Assessment (DRAMBORA) grew out of a collaboration between the Digital Curation Center and DigitalPreservationEurope (DPE). DRAMBORA allows repositories to self-assess their risks and make them quantifiable (McHugh, et al. 2008). Finally, the Consultative Committee for Space Data Systems (CCSDS)'s *Audit and Certification of Trustworthy Digital Repositories* enables "a process of continuous improvement" (2011, p. 1-6). It was codified in ISO 16363 (2012).

But such tools cannot inoculate an organization against risk. "No situation or environment can ever be totally risk-free," Price and Smith (2010) report, "and reducing risk costs money, whether in the form of additional insurance coverage or of funding to implement tighter controls" (17). Measurement is a critical part of dealing with risk.

Metrics

Measurement is as integral to evaluation as it is to research. Evaluation facilitates learning, decision making, alerting stakeholders to risks, and stimulating reflection (Whyte, Molloy, et al. 2014).

Stakeholders would benefit by addressing two questions. First, what can or should be measured? Second, what criteria or metrics should be used? Similarly, evaluation may profitably focus on two contexts: developing institutions' research support services and infrastructure and judging their economic impacts (Whyte, Molloy, et al. 2014).

Despite these guidelines, Whyte et al. (2014) warn, "measuring benefits is often quite challenging, especially when these benefits do not easily lend themselves to expression in quantitative terms (286). Hence a mix of strategies is likely beneficial. Even so, "Not all impacts can be captured and quantified" (Whyte, Molloy, et al. 2014, 292): perhaps data's value cannot be tabulated merely by the "accountant's abacus" (Pryor 2012, 4).

Standards

Standards are "mechanisms of coordination that facilitate the exchange and comparability of information and practices in the global community" (Yarmey and Baker 2013, 157). Key in transforming local into public knowledge, they can help ensure the authority of the material, its authenticity, its reliability, its integrity, and its usability; they smooth the way, too, for technical integration, collaboration and community participation, interoperability, discoverability, accessibility, and long-term preservation (Higgins 2009) (Lyon 2007) (Zimmerman 2008). Ideally, standards are open, publicly propagated, created by a vendor-neutral body, and functional across competing platforms (Harvey 2010).

Many disciplines and domains lack standards and are ill-informed about standards' benefits (Lyon 2007) (Tenopir, Allard, et al. 2011). Disciplinarity provides further complications, as do broader political, cultural, scientific, and technical issues (Griffiths 2009) (Zimmerman 2008). One study discerned that lack of standards proved a roadblock for graduate

students trying to manage, describe, organize, and sharing their data (Carlson and Stowell-Bracke 2013).

Absent incentives, researchers appear "apt to misunderstand and resist" adhering to standards (Edwards 2004, p. 827). Despite its potential costs financially and temporally, Yarmey and Baker (2013) advocate for standard-making as "an evolving, continuing design process, as opposed to a set of defined steps leading to a solution in the form of an enduring standard" (158). Standards, after all, can consistently justify their costs (Lynch 2008). Most notably, they can facilitate the development of local best practices (Yarmey and Baker 2013).

Sustainability

The National Research Council of the National Academies (2015) propounds, "The benefits of doing digital curation are increasingly evident, but so are the actual and, often hidden, costs" (17). Sustainability hinges on technical, social, and economic facets. "Identifying the 'what,' 'when,' and 'who' of the value proposition is an aspect of communicating the benefits of preserving research data to funders, administrators and other decision makers," claims Lavoie (2012, 72). Though Lavoie argues that sustainability cannot be divorced from economics (Lavoie 2012), the Repository Task Force insists that sustainability "is not merely about money; it is about organizational commitment and the ability to build persistent collaborations to address the ongoing needs for repository services and infrastructure" (Repository Task Force 2009, 8).

Diverse incentives promote sustainability; the best option is to attract diverse revenue sources (Lavoie 2012). Optimal sustainability plans feature leadership, precise value propositions, minimization of direct costs, varied revenue streams, and commitments to accountability (Maron, Smith and Loy 2009).

Projects may assume one of two approaches to costing. First, the project can price all activities and resources for the entire lifecycle, thus determining the total cost of data generation, sharing, and preservation. Second, the project can determine the additional expenses necessary to allow the data to be sharable (Van den Eynden, et al. 2010).

For example, the LIFE Project improved planning, comparison, and evaluation of digital lifecycles (LIFE Project Team 2008). The Keeping Research Data Safe (KRDS) project constructed an activity model and a TRAC-based resource template (Beagrie, Chruszcz and Lavoie 2008). Keeping Research Data Safe 2 reviewed and extended KRDS's activity model and crafted a benefits framework based on case studies (Beagrie, Lavoie and Woollard 2010).

More recently, the European Union funded 4C: Collaborating to Clarify the Cost of Curation project (2013-2015).[33] "Designed to help public and private organizations invest more effectively in digital curation and preservation through the development of useful and usable resources, the [4C] project aims to sustain the long-term value of all type of digital information" (Kilbride and Norris 2014, 45). The project sought to receive community input on and to encourage "sharing as you go." The project team received input from memory institutions, data-intensive research groups, and industry and commerce. It focused on conducting a gap analysis and a stakeholder needs survey, on developing the Digital Curation Sustainability Model (DCSM) and the Curation Cost Concept Model, and on building a Curation Costs Exchange (CCEx).

In addition to these four endeavors—gap analysis, stakeholder survey, the DCSM, and the CCEx—the 4C project set out the 4C Roadmap providing guidance for the next five years. It

[33] http://4cproject.eu/

also sponsored an international conference, two workshops, and four focus groups before its end in early 2015 (Kilbride and Norris 2014) (Middleton 2014).

Ultimately, the sustainability of digital curation work should focus on making decisions that are optimal for current needs and yet will not preclude future users from making optimal decisions of their own (Kunda and Anderson-Wilk 2011).

Conclusion

"We are at the early stages of a genuine systemic and systematic response to the data stewardship challenges framed by the emergence of e-research, and to seizing the opportunities promised by more effective, broadscale sharing and reuse," Lynch (2014) posits (406). But basic challenges such as providing for documentation, helping faculty write data management plans, developing platforms for sharing, preserving bits, and publishing data persist (Lynch 2014). More exigent tasks for stakeholders include complying with funder requirements and minimizing risk and liability (Lynch 2014). But studying researcher practices and conducting outreach and raising awareness are perhaps most pressing.

Researcher Practices

"Within or across disciplines," says Prior (2012), "members of that workforce will over time combine, disperse and recombine with seeming fluidity; the research undertake will rarely follow an exclusive and linear path and as a community they will exhibit changing patterns of allegiance and interests" (9). Researchers can profit by examining the prevailing data practices in disciplinary cultures, transdisciplinary domains, and collaborative work groups (Palmer and Cragin 2008) (Palmer, Teffeau and Pirmann 2009).

Curation services would likely benefit by embracing a range of disciplinary, subdisciplinary, and domain traits and sharing practices (Cragin, et al. 2010) (Karasti, Baker and

Halkola 2006) (Lage, Losoff and Maness 2011) (Lyon, Rusbridge, et al. 2009) (Myers, et al. 2005) (Shankar 2007). Akers and Doty (2013) report, "Different disciplines vary widely in their research funding, technical infrastructures, collaboration networks, source materials, subject populations, methodologies, ethical considerations and types of research outputs" (14). One recent study found disciplinary culture—in this case agronomy—a key impediment to sharing (Carlson and Stowell-Bracke 2013). In any event, translating materials developed for generic purposes into discipline-specific training persists as a central challenge (Molloy 2012). The "domain disconnect" looms large (Lyon and Brenner 2015, 116).

Outreach

The DataRes project (2013) concludes soberly: "*virtually no one in academia perceives that they have a professional responsibility or mandate for Research data management functions*" (6). Many faculty members feel that funding agencies, publishers or professional societies have yet to extend sufficient support (Carlson, Johnston, et al. 2013). Digital curation professionals can fill this lacuna. One study's participants emphasized their interest in attending digital curation workshops and in receiving help preparing data management plans (Akers and Doty 2013).

Though raising awareness risks "alarming an institution by revealing the scale of the challenge facing it" (Pryor 2013, 187), outreach "requires a cooperative audience and time but no additional infrastructure or financial investment" (Shorish 2012, 270).

Jones (2012) maintains, "A considerable culture change is required to sustain the shift to sharing and reusing data, and more incentives are needed to speed this along" (63) (Mooney and Newton 2012) (Whitlock 2011). "Researchers," conclude Patrick and Wilson (2013), "are not rebellious schoolchildren who need to be bullied into working harder; they are generally highly

motivated and highly skilled individuals who take a great deal of pride in what they do, and thus are more likely to embrace digital curation as a worthy goal if persuaded of its merits." Digital humanists are just such researchers who may be persuaded.

Chapter 3: The Trading Zone, the Meeting Place: the Digital Humanities

> Certain questions are especially insistent: How do we sustain the life of these digitally-organized projects; how do we effectively address their institutional obstacles and financial demands; how do we involve the greater community of students and scholars in online research and publication; how do we integrate these resources with our inherited material and paper-based depositories; how do we promote institutional collaborations to support innovative scholarship; how do we integrate online resources, which are now largely dispersed and isolated, into a connected network.
>
> -McGann (2010), 1.

> During a period of transition it may be particularly difficult to determine where we are in the unfolding of that transition.
>
> -Greetham (2012), 442.

Introduction: the Digital Humanities and the Humanities

Renear et al. (2009) maintain, "The humanities are an information-based domain in a double sense: both the development of data on the one hand, and its exploitation in new scholarship, education, and culture on the other, are intrinsic to these disciplines, and thoroughly

intertwined" (191).[34] So too are the digital humanities (DH). But the relationship between traditional humanities and digital humanities scholarship over seven decades generally has been strained.

Digital humanities scholars stress the manifold opportunities for symbiosis between the two forms of scholarship (D. Parry 2012) (Reid 2012) (M. N. Smith 2004) (Warwick 2004). Even the Head of the Office of Digital Humanities remarks, "You can tackle the 'traditional' humanities topics and questions while still using the latest digital tools if you find it adds value to your work" (Gavin and Smith 2012, 64). But Huggett (2012) points out, "From a traditional humanities perspective, it can often seem as if Digital Humanities is not only the new kid on the block, but also the monster that is garnering all the attention and sucking up available research funding" (86).

Turf wars aside, two issues span humanities and digital humanities scholarship. First, both synthesize digital and traditional publication to facilitate wide circulation of knowledge (Woodward 2009). Second, despite the tension between them, both areas face questions of belonging and legitimacy in the university and society (Piez 2011).

But among digital humanists, optimism abounds. The digital humanities seem in a "boom time" (Alexander and Davis 2012, 368), as suggested by new books, more positions advertised, new funding, an increased number and range of projects and institutes, and heightened administrative interest (Greetham 2012) (Svensson, Beyond the Big Tent 2012). Waltzer (2012) deems the DH "a destination in and of itself, a jumping-off point for the building of a scholarly

[34] According to the National Foundation on the Arts and the Humanities Act (1965), as amended, "The term 'humanities' includes, but is not limited to, the study and interpretation of the following: language, both modern and classical; linguistics; literature; history; jurisprudence; philosophy; archaeology; comparative religion; ethics; the history, criticism and theory of the arts; those aspects of social sciences which have humanistic content and employ humanistic methods; and the study and application of the humanities to the human environment with particular attention to reflecting our diverse heritage, traditions, and history and to the relevance of the humanities to the current conditions of national life" (http://www.neh.gov/about).

identity" (339). Digital humanists seem close to "full partners" with other humanists (Liu 2012, 492).

Yet in the midst of this triumphalism, Alvarado (2011) reminds us: "To a disconcertingly large group of outsiders, the digital humanities qua humanities remains interesting but irrelevant." Ayers (2014) similarly cautions, "I'm not sure you're a pioneer if nobody follows you."

This chapter first addresses the antecedents of the digital humanities. Next it deals with the digital humanities' definition, scope, and inclusivity as well as their relationship to cultural criticism. Third, it situates the digital humanities in the context of the academy, discussing scholarly communication (social media, publication, and open) and institutional position (centers, libraries, and alt-ac careers. Fourth, it analyzes digital humanities work: curation, editing, modeling, analysis, and tool use. It concludes by suggesting the importance of sustainability, collaboration, and project management, issues especially relevant to digital curation work. Above all, digital humanities work demands curation; digital humanists require education in the area.

Computing in the Humanities and Humanities Computing, and the Cradle of the Digital Humanities

Setting a foundation for the digital humanities, humanities computing focused on textual data from its effective gestation with Roberto Busa's Aquinas concordance (started in 1949). Though the military, scientists, and business firms first embraced computers, some scholars soon exploited computing power for textual and alphanumeric manipulation (Deegan and Tanner 2004) (Rockwell and Mactavish 2004). Perhaps most important for scholars, texts were "*massively addressable at different levels of scale*" (Witmore 2012, 325).

Humanities computing (HC) casts a long shadow over the digital humanities. Though the digital humanities grew "specifically out of an attempt to make 'humanities computing,' which sounded as though the emphasis lay on the technology, more palatable to humanists in general" (Fitzpatrick, The Humanities, Done Digitally 2012, 13), there persists a close link between HC and DH (D. Parry 2012).[35] McCarty (2012) laments, "Since the beginning [digital humanities] has kept far back, absorbed with technical concerns, with its place in the academic world and with the enormity of its task" (The Residue of Uniqueness, 27).

Following Busa's pioneering work, concordance tools gained cachet as techniques for tackling questions of style and authorship. Reverend John W. Ellison produced a concordance for the Revised Standard Version of the Bible in 1957. Some philosophers gravitated toward computers (Ess 2004); some historians followed suit (W. G. Thomas 2004).

In 1963, the National Commission on the Humanities promulgated a vision for a humanities equivalent to the National Science Foundation (established in 1950). Yorktown Heights hosted one of the first conferences focusing on computers and literature in 1964. Yale and Purdue each hosted a similar conference in 1965; the journal *Computers and Humanities* debuted in 1966.

In the fall of 1965, President Lyndon B. Johnson signed the National Foundation on the Arts and the Humanities Act of 1965 (P.L. 89-209) into law. "Democracy demands wisdom and vision in its citizens," the Act maintains. "It must therefore foster and support a form of

[35] Despite their longtime loyalty to text, HC scholars have shown some interest in multimedia and non-textual representation, e.g. metadata systems and GIS. But the "visual turn" has not (yet?) exerted an important impact on HC; new media studies work in HC has been "relatively marginal." Svensson argues this marginality stems from the lack of interaction occurs between these communities and the difficulty of developing tools for these frameworks (Svensson, Humanities Computing as Digital Humanities 2009).

education, and access to the arts and the humanities, designed to make people of all backgrounds and wherever located masters of their technology and not its unthinking servants."[36]

The National Council on the Humanities convened in March, 1966. The Council awarded its first grant that July (it funded at least five digital humanities projects during its first year of operation). In 1967, digital humanities grants comprised four percent of non-fellowship and stipend grants; the NEH also funded the EDUCOM Symposium. Computers appeared "more than a passing curiosity" (Hindley 2013).

In the early and mid-1960s, the combination of available data and computing power allowed Mosteller and Wallace to resolve longstanding authorial disputes over twelve *Federalist Papers* (Hockey 2004). Some archaeologists meanwhile welcomed databases to synthesize large quantities of data collected from multiple excavations (Eiteljorg II 2004). A number of historians coevally embraced social science methods to study "ordinary" people (W. G. Thomas 2004).

Refining techniques of counting, sorting, and storing, some humanities scholars applied new methods from mathematics, logic, and linguistics to their data (Lieb 1966). But stakeholders recognized the limits of technology, especially with respect to character sets, input-output devices, and batch processing (Hockey 2004).

The 1970s, the 1980s, and the first half of the 1990s witnessed consolidation (Hockey 2004). An increasing number of scholars employed common methods and applications. Centers, conferences, journals, and courses on computing in the humanities proliferated. The Oxford Text Archive was opened in 1976.

Beginning in the middle of the 1980s, personal computers, primarily through word processing and email, attracted new acolytes. Advances included DOS-based text analysis

[36] http://www.neh.gov/about/history/national-foundation-arts-and-humanities-act-1965-pl-89-209.

programs, the advent of the Macintosh and its graphical user interface, the development of Standard Generalized Markup Language (SGML) in 1986, and the 1987 gestation of the Text Encoding Initiative's (TEI's) Guidelines for Electronic Text Encoding and Interchange (published in 1994) (Hockey 2004).

Literary scholars continued to focus on pattern or theme studies (Rommel 2004). "The 'golden age' of linguistic corpora began in 1990" (Ide 2004). Conversations about editorial method and theory and about electronic archives and editions converged (Kirschenbaum 2010). Historians wrestled with the intersection of computing tools and historical interpretation (W. G. Thomas 2004).

Computing also penetrated performance arts, art history, and history. Computers could deal with textual and numeric data such as dialogue, criticism, and names, locations, and dates (Saltz 2004). Pulling images from scanners and video, art historians populated text databases. But obstacles included the number of records involved, the cost of digitization, and concerns about image resolution and about hardware and software longevity (Greenhalgh 2004). Personal computers, networking, and markup imprinted historians' practices, though concerns about information overload, authenticity, and commercialization lingered (W. G. Thomas 2004).

Ushered in by the Mosaic graphical browser in 1993, the Web seemed a useful tool for locating information but not necessarily one amenable to research per se (Hockey 2004). Still, it allowed scholars some control over the digitization and presentation of their materials (Earhart 2012). As in the case of personal computers, the Web attracted new stakeholders. They sought to publish their work, to expand their audiences, and to promote collaborative efforts such as editing.

Multimedia also debuted in the early 1990s, though technical issues rather than new research possibilities pervaded discussions. Henceforth, electronic resources became objects of study themselves. Concomitantly, more academic programs and professional outlets were established (Hockey 2004). Born-digital objects such as hypertextual maps and oral histories piqued historians' curiosity, as did the emergence of historical GIS (W. G. Thomas 2004).

Predicated upon database tools, the "first wave" of initiatives in the digital humanities began in the late 1980s and persisted into the early 2000s. Aside from migrating material into digital forms, projects focused on textual analysis, cataloging, linguistic features, and pedagogy (Hockey 2004). Buoyed by interface innovations, mushrooming bandwidth, and multimedia affordances, stakeholders in the late 1990s developed visualizations and geospatial representations, simulations, and network analyses (Burdick, et al. 2012).

Archaeologists, literary scholars, performance arts scholars, art historians, and philosophy and religion scholars benefited from new data management affordances. Rommel notes, "The variety of approaches used to come to terms with heterogeneous textual objects, the multitude of theoretical backgrounds and models of literature brought to bear on studies that share as a common denominator neither one single technique nor one 'school of thought,' but the application of a common tool, are the strong points of studies of literature carried out with the help of the computer" (Rommel 2004). In performance, computing blurs boundaries among disciplines, scholarship, creativity, and media (Saltz 2004). While computing for art historians became simpler, its problems still center on communication, expertise, and resources (Greenhalgh 2004). Last, philosophers and religion scholars attained a better understanding of computing's affordances and limitations (Ess 2004).

By the early 2000s, many humanists had used computers in their work. Busa (2004) calls developments "enormously greater and better than I could…imagine." The digital humanities "has broadened its reach, yet it has remained in touch with the goals that have animated it from the outset: using information technology to illuminate the human record, and bringing an understanding of the human record to bear on the development and use of information technology" (Schreibman, Siemens and Unsworth 2004).

But most observers show nothing akin to unalloyed optimism. Traditionally-trained scholars may remain leery of those they see as "wild-eyed technocrats who play with computers and digital resources because they can" (Warwick 2004). Scholars in various disciplines also express reservations. Ess (2004) questions whether computing edifies debate, scholarship, or insight in philosophy or religion: computers facilitate certain paths of inquiry but foreclose others. Similarly, Rommel (2004) points out, "No final result, let along an 'interpretation' of a text, can be obtained by computing power alone; human interpretation is indispensable" (Rommel 2004). Though Greenhalgh (2004) characterizes the computer as "a speedy idiot obeying a set of precise instructions," many art historians view it as "a black and magical (or black-magical) box."

Despite these concerns, Web 2.0 introduced new tools and promoted relationships among producers and consumers. Increased interactivity and user participation ensued, along with a reinforced investment in networking, customization, and collaboration (Davidson 2012). Both Web 1.0 and Web 2.0 projects are salutary—they may prove symbiotic (Rockwell 2012). Digital culture is both globalized and decentralized (Bartscherer and Coover 2011).

The importance of the development of the Web can scarcely be overstated. Its evolution seems akin to "the emergence of an economy defined by social structures, modes of production,

and cultural formations that alter the way information is produced and exchanged, enabling a global and networked world of decentralized sharing, collaboration, and diffusion, with the caveat that it also creates the conditions for violent backlash and newer forms of surveillance and control" (Burdick, et al. 2012, 80). Nonetheless, digital humanities work shows considerable continuity: for seven decades, it has remained committed both to employing information technology to shed light on the human past and to using an understanding of the human record to influence the development and use of information technology (Schreibman, Siemens and Unsworth 2004).

Despite its long history of creating, sharing, and reusing data, the digital humanities's relationship to digital curation remains curiously overlooked. Who will preserve, manage, and add value to these assets?

The Digital Humanities: Definition, Scope, Inclusivity, and Criticism

Definition

Defining digital humanities remains a "known rabbit-hole problem" (S. Jones 2014, 7). The digital humanities "sometimes seems to exist only in a state of self-definition" (Fyfe 2011). Warwick and her colleagues (2012) sum up, "this question [what is digital humanities?] seems to be repeatedly asked, but seldom answered to anyone's satisfaction" (xiii). Thus Bartscherer and Coover (2011) muse, "The deeper one probes, the more one realizes the need to clarify—and also to enrich—the lingua franca" (7). Thaller (2012) warns, "We pay a price for this narrowness of many definitions on a very practical level, as it seems to be next to impossible to transfer solutions from one project defining itself in a narrow context to another one within a context defined equally narrowly" (13).

Yet scholars agree on certain definitional characteristics of the digital humanities and this dissertation follows these commonalities. Inherently collaborative, the digital humanities expand the public sphere and the notion of scholarship. A "global, trans-historical, and transmedia approach to knowledge and meaning-making," they hint at "a reinterpretation of the humanities as a generative enterprise: one in which students and faculty alike are making things as they study and perform research, generating not just texts…but also images, interactions, cross-media corpora, software, and platforms" (Burdick, et al. 2012, vii, 10). The digital humanities represent "a hybrid domain, crossing disciplinary boundaries and also traditional barriers between theory and practice, technological implementation and scholarly reflection" (Flanders, Pietz and Terras 2007). In particular, digital humanities work includes such topics as open access, intellectual property, tool development, digital libraries, data mining, digital preservation, multimedia, visualization, GIS, study of impact of technology on scholarly teaching and learning, and media studies (Gavin and Smith 2012).

The complexity of the digital humanities stems from their disciplinary and institutional diversity and from their multiple modes of engagement with information technology (Svensson 2010). But like all the human sciences, the digital humanities are hermeneutical, intertextual, idiographic, realist, and narrative (Constantopoulos and Dallas 2007) (Dallas 1999).

Scope

In constant flux, the digital humanities seem an "enormously complex, multifunction, distributed system that is largely undocumented" (Edwards 2012, 224). "A broadly conceived digital humanities," Svensson (2009) contends, "would necessarily include the instrumental, methodological, textual and digitized, but also new study objects, multiple modes of engagement, theoretical issues from the humanities disciplines, the non-textual and the born

digital." Kirschenbaum (2010) views the term digital humanities as "a free-floating signifier": "digital humanities is more akin to a common methodological outlook than in investment in any one specific set of texts or even technologies" (60, 56). Alvarado (2011) concurs: "the digital humanities is in principle associated with as many methods and tools as there are intersections between texts and technologies." Digital humanists may engage more in methodological than in theoretical debates and posits that the former may be more easily resolved than the latter (Scheinfeldt, Sunset for Ideology, Sunrise for Methodology? 2012) (Scheinfeldt, Why Digital Humanities is 'Nice' 2012).

Scholars engaging in digital humanities work do not necessarily call themselves digital humanists. "I have very little to no desire to label myself a digital humanist," insists Parry (2012, 437). "Neither critical cyberculture studies, nor internet studies, nor initiatives such as new media studies and critical digital studies, which all come from cultural studies or art theory backgrounds, typically make frequent use of the term *digital humanities*" (Svensson 2010).

Some scholars embrace this fluidity. Fitzpatrick (2012) views DH as "not the specific subfield that grew out of humanities computing but rather the changes that digital technologies are producing across the many fields of humanist inquiry" (The Humanities, Done Digitally, 13). Kirschenbaum (2012) maintains, "on the one hand…digital humanities is a term possessed of enough currency and escape velocity to penetrate layers of administrative strata to get funds allocated, initiatives under way, and plans set in motion. On the other hand, it is a populist term, self-identified and self-perpetuating through…contemporary social media" (417). Hence Parry (2012) argues, "What is the essence of the digital humanities? is an impossible question to answer, as if there is an ideal form of digital humanities out there to which one can point, a central Platonic ideal from which all other digital humanities can be judged in relation" (429).

Inclusivity

Other scholars show trepidation about the field's potential lack of inclusivity. "Even as the digital humanities (DH) is being hailed as the 'next big thing,'" Spiro (2012) observes, "members of the DH community have been debating what counts as digital humanities and what does not, who is in and who is out, and whether DH is about making or theorizing, computation or communication, practice or politics" ('This is Why We Fight': Defining the Values of the Digital Humanities, 17).

Though Scheinfeldt (2012) facetiously refers to digital humanists as "the golden retrievers of the academy," others disagree. Parry (2012) notes, "As much as the 'big tent' definition and narrative is iterated, the practice of what actually occurs points to a different reality" (434). Pannapacker (2012 finds the field unprecedentedly exclusive and cliquish. Bianco (2012) muses, "What quick, concatenating, and centrifugal forces have so quickly rendered the many under the name of one, *the* digital humanities?" (97).

Spiro (2012) suggests, "Rather than debating who is in and who is out, the DH community needs to develop a keener sense of what it stands for and what is at stake in its work" ('This is Why We Fight': Defining the Values of the Digital Humanities, 17). She propagates values such as openness, collaboration, collegiality, diversity, and experimentation—all ideal for a "meeting place." According to Edwards (2012), "Our field's current focus on qualification, on boundary setting, is unnecessary and that the choice between emptying the term 'digital humanities' of meaning on the one hand and defending it as a specialist redoubt on the other is a false one" (228). Svensson (2012) advocates for a "'no tent' approach" and suggests that "'trading zone'…or 'meeting place' may be useful, alternative structuring devices and ideational notions" (Svensson, Envisioning the Digital Humanities 2012, 36).

Nonetheless, there remain "tensions between a technologically oriented and tool based approach and a cultural or media studies oriented approach, where the digital is primarily an object of analysis rather than a tool" (Svensson, Envisioning the Digital Humanities 2012). Friction obtains among veterans and newcomers, among configurations of interdisciplinarity, and among notions of making and interpreting (Fitzpatrick, The Humanities, Done Digitally 2012).

Criticism

Criticism in the digital humanities seems immature (Liu 2012). Activities as seemingly banal as keyword searching remain "fraught with interpretive baggage" (Drucker and Nowviskie 2004). As a result, "everyday politics with a small 'p' frequently intersects with epic politics with a capital 'P'" (Losh 2012, 181). Liu lobbies for digital humanists to embed advocacy into their daily work.

But Hall (2012) deems avoiding theoretical and critical engagement as at once conservative and moralizing. DH tools cannot presume that every user possesses the same abilities and can employ the same methods (Williams 2012). Digital humanists should bring theory to technology as well as to scholarly content (Earhart 2012).

For some, the digital humanities risk coalescing around "unrecognized inequities" (Edwards 2012, 224). Bianco (2012) warns, "Recently we've seen a winnowing of what was an experimental and heterogeneous emergence of computational and digital practices, teaching and theorization from within and across disciplines to an increasingly narrow highly technical, and powerful set of conservative and constrained areas and modes of digital research" (101). Parry (2012) worries, "A digital humanities that replaces an ivory tower of bricks and mortar with one of supercomputers and server farms crunching large amounts of textual data and producing more and more textual analysis simply replaces one form of isolationism with another" (433).

Diversity remains a concern. McPherson (2012) argues, "Certain modes of racial visibility and knowing coincide or dovetail with specific ways of organizing data" (143). Digital humanities also fosters "a distinct gendering of work and product, as well as a significant gender gap in participation" (Wernimont 2013). Calling for an "opening out," Wernimont (2013) insists, "However 'open,' 'collaborative,' and 'connected' Digital Humanities purports to be, if computational tools are wielded in ways that continue old patriarchal privileges of expertise and authority and create merely receptive users, then we miss an opportunity to leverage digital tools to transform literary scholarship in meaningful ways."

Cultural criticism—what there is of it—in the digital humanities presages the decolonization of knowledge. Burdick et al. (2012) encourage digital humanists to model cultural difference. Indeed, digital humanists would do well to scrutinize Web 2.0's participatory culture (Ensslin and Slocumb 2011). Davidson (2012) elaborates: "Hybridity, exchange, flow, and cultural transaction are all explored more responsibly and adventurously when the resources of many nations, in many languages, have been digitized, made interoperable, and offered for research by scholars around the world" (479).

The Digital Humanities and/in the Academy

Scholarly Communication

Digital humanists gravitated toward alternative modes of scholarly communication as early as 1987 (e.g. the Humanist listserv); they later embraced chat and blogs. High spots include the Humanities, Arts, Science and Technology Advanced Collaboratory (HASTAC) (established in 2002), *Companion to Digital Humanities* (2004), the Alliance for Digital Humanities Online (ADHO) (2005), the Office of Digital Humanities at the National Endowment for the Humanities

(ODH-NEH) (2006), MediaCommons (2007), the City University of New York (CUNY) Academic Commons (2009), and the annual Digital Humanities Conference (first held in 1990).

Flanders (2012) observes:

> [Digital humanists] are committed to encoding our data in a standard way so that it can be shared, so that it will remain comprehensible: in fulfillment of an implicit contract with unknown scholars of the future who need to know what we know and understand what we have done. But at the same time…we know that a crucially important dimension of that representation is precisely the disciplinary norm that we adopt, and these we know to be founded on debate rather than on straightforward agreement (Collaboration and Dissent: Challenges of Collaborative Standards for the Digital Humanities, 74-75).

Digital humanists participate in "an always-changing online ecosystem of blogging, microblogging, and more complicated forms of open-access and comment-friendly platforms for reviewing and publishing," Jones (2014) reflects (148). Multimedia and Web 2.0 propel new types of publication. Nonetheless, scholarly publishing traditions hinder digital publishing, many digital publications go effectively unnoticed, and establishing credibility and sustainability are stumbling blocks (Maron and Smith 2008). "The social contract of the book," Cohen (2012) contends, "is profoundly entrenched and powerful—almost mythological—especially in the humanities" (Cohen 2012, 319). Some humanists may "continue to operate not in an implicate but in an isolate order…all the while pledging allegiance to 'globalization'" (McGann 2010, 4).

Social Media

Scholarly communication in the digital humanities revolves around social media and thus more broadly upon Web 2.0 (O'Reilly 2007). Social media constitute "particularly generative spaces for questioning the academic status quo, exchanging ideas about radical scholarship and

pedagogy, and creating spaces for democratic exchanges" (Potter 2014). Social networking similarly represents both a technique and an object of study (Friedlander 2009). Perhaps most important, few if any provisions have been made for curating such ephemeral data. Blogs and Twitter are cases in point.

Blogs represent "publishing platforms by another name" (Cohen 2012, 322) and blogging implicates "a set of skills worth cultivating" (Owens 2012, 411). Cohen (2013) characterizes blogs as "perfect outlets for obsession" (29).

An "invaluable ready-made network," Twitter steers daily conversation (Kirschenbaum, Hacking the Academy: New Approaches to Scholarship and Teaching from Digital Humanities 2013, 139). It represents "the backchannel and professional grapevine" (Kirschenbaum 2012, 417) and has "inscribed the digital humanities as a network topology…lines drawn by aggregates of affinities, formally and functionally manifest in who follows whom, who friends whom, who tweets whom, and who links to what" (Kirschenbaum 2010, 59). Twitter seems akin to a cocktail party: "One does not have to be present for the entire time, or participate in every conversation, but can check in and out of the party and move between different conversations as appropriate" (D. Parry 2011, 159).

Cohen's Web publication, *Digital Humanities Now*, aggregates tweets and disseminates the most-discussed items (Cohen 2012). The publication "combines the conceit of a scholarly journal with the real-time automated aggregation enabled by Twitter's open Application Programming Interface" (Kirschenbaum 2012, 422).

On the other hand, Edwards (2012) worries, "the lack of mutuality in Twitter relationships can simply replicate or 'reify' the offline hierarchies of DH": newcomers and those with limited Web risk marginalization (222). Alas, even on social media "celebrity economies

and reputation metrics" cannot be dodged (Kirschenbaum 2012, 423). Nowviskie (2013) elaborates, "I have heard the technology the Twitter community embraces and explicitly figures as democratizing and personalizing described in terms of alienation, invasion, and exclusion" (127).

Publication

Publication dovetails with scholarship writ large. Anyone with hardware, software, and a network connection can publish—a newfound "promiscuity" (Fitzpatrick, Beyond Metrics: Community Authorization and Open Peer Review 2012, 452). The digital humanities can upend traditional modes of scholarship: "The existence of the digital transforms the very meaning of the word 'scholarship'" (D. Parry 2012, 435), though the "idols" of scholarly publishing remain (Cohen 2010). Craig (2004) states: "A remarkable range of studies has been built up; methods have been well calibrated by a variety of researchers on a variety of problems; and even if some studies have proved faulty, the vigorous discussion of their shortcomings is a resource for those who follow."

Burdick and her colleagues (2012) assert, "A book is not simply 'finished' and 'published,' but is now part of a much more dynamic, iterative, and dialogical environment that is predicated on versioning, crowd-sourced models of engagement and peer review, and open-source knowledge and publication platforms" (85). Waters (2008) recommends focusing on the assembling and curation of data. In this sense, as Lynch (2010) reports, "scholars will need to learn when and how to fully adapt the transmission of sustained argument that characterizes monographs to the digital environment, rather than today's practice of simply using the digital environment to store and transmit what are still, in an intellectual sense, printed monographs."

Open Access

Waters (2008) advocates for open data: "economic, intellectual property, and other barriers must be low enough to permit an easier flow of information, especially into rich computational environments that helps readers locate and, indeed, discover new information."

Much misinformation persists regarding open access. Fitzpatrick (2013) expounds, "Opponents of open access alternatively argue that making all scholarship available for free will destroy the economic model of the publishing industry, making it impossible for anything to get published, and that doing so will simultaneously undermine peer review" (35). But open access will not necessarily spur plagiarism.

Humanities scholars appear complicit in the relative lack of momentum in open access. Ramsay (2013) criticizes, "Open access…is effectively shut down by our own behavior" (45). For instance, peer review remains pivotal and hampers open access. Davidson (2012) maintains, "The very concept of peer review needs to be defined and interrogated": who is a "peer"? (Humanities 2.0: Promise, Perils, Predictions, 481) Richardson (2013) concludes, "In many cases we are asking those tasked with setting standards for multimedia-based research to create fair and impartial rubrics to assess the quality of non-traditional faculty scholarship when they do not adequately understand the technologies and industries from which these digital professionals have originated." Fitzpatrick (2012) advocates for crowdsourced peer review; Kelly (2013) avers that peer review is simply obsolete. But the most formidable obstacle to a "global cultural commons" remains copyright, that "badly broken" mechanism (Burdick, et al. 2012, 113).[37]

[37] Tim Hitchcock goes further: "what really needs to break down is the silo that suggests that information itself is something to be consulted and collected; that it is an unchanging object of study, rather than a pool of constantly changing stuff that can be interrogated from any angle, and pursued along any trajectory" (Hitchcock 2011).

Institutional Position

"Emergent professional communities will struggle to have their codified, or explicit knowledge, accepted," argue Davenport and Hall (2002, 177). The digital humanities are no exception.

Universities legitimate knowledge in a privileged way (Burdick, et al. 2012). Disciplines accrue influence as they embed themselves in the "university subject roll-call" (Terras 2012, 215). Although disciplinary affiliation vouchsafes a sense of identity and belonging, it may militate against change (Watrell, Fitzpatrick and Parry 2013). Indeed, universities uphold a firm line of demarcation between faculty members and staff (Bradley 2012). Some administrators remain skeptical of digital humanities (Maron and Pickle 2014). Younger scholars involved in DH work may feel "ghettoized and even disadvantaged" regarding grants, tenure, or promotion (Friedlander 2009, 2).

The institutional status of the digital humanities remains ambiguous. They "advance not uniformly but unevenly…from certain academic positions to specific niches" (Alexander and Davis 2012, 368). Centers, libraries, and alt-ac careers can help digital humanists further embed themselves institutionally.

Centers

The center, "a central (physical or virtual, or both) area where a suite of activities is conducted by individuals dedicated to a common mission," is among the campus loci of the digital humanities (D. M. Zorich 2008, 4). Centers date from the early 2000s and fall into two classes. First, resource-focused centers foreground one resource or project, occupy a virtual space, and serve a specific constituency. A second group of centers occupy a physical space and host diverse projects. Most centers follow the latter model (D. M. Zorich 2008).

Centers' key activities include digital collection- and tool-building, research, public outreach, internal and external support, training, collaboration, and storage (D. M. Zorich 2008). Constituents include disciplinary, professional, university, and education communities, corporate bodies, and the public. Ideally, centers promote entrepreneurship and experimentation (Maron and Pickle 2014) (Ramsay and Turner 2013).

But centers hardly represent a panacea. Their establishment often reflects unstructured, short-term planning. According to Zorich (2008), "The classic DH business model starts with a relatively simple portfolio of funding contributed by a foundation or university, and migrates over time to a complex mix of monies obtained from myriad sources that change yearly because of the short-term nature of grants, state and university budget fluctuations, and an absence of any (or any significant) revenue-generating resources" (37-38). Exacerbating this uncertain funding model, centers often neglect to track their resource use.

Moreover, whether individual centers are sustainable remains an open question (D. M. Zorich 2008). Local commitments can undercut external collaborations or even awareness of complementary projects (Fraistat 2012). Paradoxically, some aspects of centers may in fact obviate scholarship: their silo-like character, their struggle to leverage resources, and their potential inability to erect cyberinfrastructure. One study found that 78% of centers experienced at least one unsuccessful partnership (D. M. Zorich 2008).

Leading centers in the United States include the Maryland Institute for Technology in the Humanities (MITH), the Stanford Humanities Lab, the Rosenzweig Center for History and New Media (CHNM), and the University of Nebraska's Center for Digital Research in the Humanities. Smaller initiatives of note include those at the University of Richmond, Hamilton College, and Occidental College.

Centers offer the possibility of melding digital humanities and digital curation in one location, physical or virtual. Combining forces this way increases the likelihood of providing return on investment that could appeal to funders and administrators.

Libraries

Not only centers, but libraries and librarians can nurture digital humanities work. "Libraries…have taken real strides in developing plans to sort and prioritize and to seek scale solutions for hosting and preservation" (Maron and Pickle 2014, 57). At the least, libraries can foster collaborations by providing space and technological infrastructure (Svensson 2010). In one study, three quarters of responding libraries partnered with other campus units (often with IT) and more than half (56%) partnered with other institutions (Bryson, et al. 2011). Yet many libraries cobble together resources to support digital humanities work. Approximately half of Bryson et al.'s sample receive funding from academic departments, library IT, or special one-time funds and approximately one third receive funding from endowments. Libraries would do well to reframe their DH work as a complement to their existing efforts (Bryson, et al. 2011, 14).

Many so-called traditional librarians have skills that are amenable to digital humanities work. Bryson et al. found that library staff most often provide high-level support such as consultations or project management advice. But only 35% of responding libraries allocate staff specifically to DH projects and only 8% maintain a designated center located in the library. On the other hand, nearly all (94%) provide some digital scholarship services, whether scanning, image, video, and audio editing, bibliographic management applications and content management systems, or GIS software and data management tools (Bryson, et al. 2011).

Libraries appear somewhat inconsistent regarding preservation and sustainability. More than half (59%) of Bryson et al.'s (2011) sample preserve DH projects in-house; what was more,

51% develop grant proposals to ensure sustainability, 37% work with project planners to integrate sustainability costs into project cost estimates, and nearly one third (31%) audit projects for sustainability. Perhaps most problematic, most do not assess their services formally. Perhaps libraries could shore up their position by demonstrating return on investment vis-à-vis their digital humanities work. Combining DH and digital curation work may be a promising way of doing so.

Alt-ac Careers

The notion of "alt-ac" to Nowviskie (2010) connotes "a broad set of hybrid, humanities-oriented professions centered in and around the academy, in which there are rich opportunities to put deep—often doctoral-level—training in scholarly disciplines to use." Some digital humanists have a double appointment (academic department- and campus center-based). On the other hand, many digital humanities scholars occupy "liminal and academically precarious" institutional positions (Flanders, Time, Labor, and 'Alternate Careers' in Digital Humanities Knowledge Work 2012, 292).

Flanders (2012) insists that "'alternative' or 'para-academic' jobs within the academy have a great deal to teach us about how academic labor is quantified, about different models of work and work product, and about the ways that aptitude, skill, expertise, and productivity are weighted in assessing different kinds of work" (Time, Labor, and 'Alternate Careers' in Digital Humanities Knowledge Work, 293). More formal "anxieties of digital work" center on whether digital humanities work constitutes conventionally-weighed and rewarded "scholarship" (Ramsay and Rockwell 2012, 75). Employers seem cautious about alt-ac hires (Nowviskie 2010) and Richardson (2013) calls for an overhaul of the tenure and promotion system. Yet neither

Svensson (2012) nor Waltzer (2012) sees appreciable change in the academy's labor or reward structures.

According to Sehat and Farr (2009), faculty members should bear ultimate responsibility for training students. Yet apprehensiveness persists among teachers. DH's volatility undercuts more experienced scholars' efforts to prepare graduate students and graduate students themselves may be unprepared to develop new scholarly practices (Reid 2012). This uncertainty may deter young scholars from entering the field (Greetham 2012). Brier (2012) queries, "Where's the pedagogy?"

Notwithstanding debates over professional status and teaching, the digital humanities' institutional presence remains circumscribed to a handful of large research institutions. Community colleges, most state and regional institutions, small schools, and private schools are marginalized (Alexander and Davis 2012).

Liberal arts and teaching-focused institutions may have advantages over research universities given their shallower administrative hierarchies, reputed intellectual flexibility, lower faculty publication requirements, and potentially greater faculty/student collaboration (Pannapacker 2013) (Svensson 2010). Initiatives at Hope College, Carleton College, Dickinson College, and Wesleyan University augur well for the spread of DH.

Conversely, the affordances Pannapacker (2013) mentions—small institutional size, pedagogical focus, varying institutional missions—may prove drawbacks. Small institutions lack visibility in the larger digital humanities milieu and they are often geographically isolated. Finally, their digital humanities work may fail to interoperate with other complementary projects.

Digital Humanities Work

Digital humanities work thrives on experimentation and risk-taking (Burdick, et al. 2012) (Moretti 2003) (Spiro, 'This is Why We Fight': Defining the Values of the Digital Humanities 2012). Data sharing allows scholars as well as members of the general public to test hypotheses or to add to or edit the "original" data set or its metadata (Burdick, et al. 2012). Pitti (2004) notes, "Collaborative design involves iterative analysis and definition, frequently accompanied by prototype implementations that test the accuracy and validity of the analysis." Projects may embrace multiple authors and authorial generations.

As Table 1 indicates, fifteen overlapping approaches to digital humanities work may be discerned. A diverse range of tools support these four approaches.

Table 2: Categories of Digital Humanities Work (Burdick, et al. 2012)

1) Enhanced Critical Curation[38]	• "Involving archives, collections, repositories, and other aggregations of materials, curation is the selection and organization of materials in an interpretive framework, argument, or exhibit" (Burdick, et al. 2012, 17). • "To curate is to filter, organize, craft, and, ultimately, care for a story composed out of—even rescued from—the infinite array of potential tales, relics, and voices" (Burdick, et al. 2012, 34).
2) Augmented Editions and Fluid Textuality	• Editing constitutes "a physical as well as a philosophical act, and the medium in which an edition is produced (or an edition's place in the material world) is both part of and contains the message of the editorial philosophies at work" (M. N. Smith 2004). • Augmented editions: bring together numerous versions of single work; track

[38] This is a far narrower definition than the one I would propose. It would be useful for the DH community to consider adopting a broader definition, namely in focusing on curation as the process of adding value to trustworthy digital assets for current and future fitness-of-purpose. Much greater possibilities exist for the concept of curation to bring together various strands of work in the digital humanities.

	development; observe variants; preserve entire comparative apparatus. • "Fluid" textuality: the ways in which over time authorial changes, editing, transcription, and translation practices, and print production account for variations.
3) Scale: The Law of Large Numbers	• The law of large numbers: "the more times a researcher repeats a given experiment, the closer that researcher comes to determining an average value that defines the results of that experiment" (Burdick, et al. 2012, 37). • Usually employs text mining tools, machine reading, and algorithmic analysis.
4) Reading: Distant/Close, Macro/Micro, Surface/Depth	• "Distant reading is almost not reading at all, but rather engages the abilities of natural language processing to extract the gist of a whole mass of texts and summarize them for a human reader in ways that allow researchers to detect large-scale trends, patterns, and relationships" (Burdick, et al. 2012, 39). • Distant reading allows users to focus on units and structures much smaller or much larger than the text, e.g. devices, tropes, themes, and genres (Moretti 2000). • Close reading resembles a "theological exercise—very solemn treatment of very few texts taken very seriously" (Moretti 2000). • "We need to do less close reading and more of anything and everything else that might help us extract information from and about texts as indicators of larger cultural issues" (Wilkens 2012, 251).
5) Cultural Analytics, Aggregation, and Data-Mining	• Cultural analytics work presupposes that "meaning, argumentation, and interpretive work are not limited to the 'insides' of texts or necessarily even require 'close' readings" (Burdick, et al. 2012, 40). • Cultural analytics broadens the possible "canon" of cultural objects conducive to study.

	• Cultural analytics: "The 'data' of cultural analytics are exponentially expanding in terms of volume, data type, production and reception platform, and analytic strategy, making it all-the-more important that humanists are engaged with the design of algorithms, mining and visualization tools, and archiving techniques that foreground questions of value, interpretation, and meaning" (Burdick, et al. 2012, 41). • Aggregation: permits highlighting of data points, clusters, and trends • Data mining: parameterize an aspect of dataset and extracting it; results in statistical, textual, or visual outputs • "The real value of studying common words rests on the fact that they constitute the underlying fabric of a text, a barely visible web that gives shape to whatever is being said" (Burrows 2004).
6) Visualization and Data Design	• Visualization "generates questions that might otherwise go unasked, it reveals historical relations that might otherwise go unnoticed, and it undermines, or substantiates, stories upon which we build our own versions of the past" (White 2010). • "The interest in 'reading' the visual has extended to 'authoring' the visual—using visual means to express intellectual concepts" (Burdick, et al. 2012, 42).
7) Locative Investigation and Thick Mapping	• Locative investigation "brings together the analytical tools of geographic information systems (GIS), the structuring and querying capacities of geo-temporal databases, and the delivery interfaces on GPS-enabled mobile devices" (Burdick, et al. 2012, 44). • Mapping, the "easy synthesis of personal and political, of multiple scales and temporalities offer[s] a radical alternative to the methods of hierarchical analysis, documentary history, and biographies of great men that dominated the traditional

	teaching of most disciplines" (Guldi 2011). • Mapping is "built on the history of cartography; ideologies of discovery, ownership, and control; levels of abstraction; scale; relations between the real and representation; symbology; visual signposting; perspective; and coordinate systems" (Burdick, et al. 2012, 42-43). • Thick Mapping allows "geographic analysis, digital mapping platforms, and interpretive historical practices [to] come together" (Burdick, et al. 2012, 46).
8) The Animated Archive	• The digital archive "becomes a 'mathematically defined space' where retrieval…is not a matter of interpretive, iconological semantics but computing algorithms" (Evans and Rees 2012, 91). "The features that inscribe interpretation in archives are those that embody or express the imprint of the point of view according to which the archive takes shape" (Drucker 2011). • "Most important is not that digital humanists become digital archivists, but that each community think about how best to leverage whatever knowledge, insights, tools, and habits it has evolved so as to enter into fruitful joint collaborations" (Kirschenbaum, The .txtual Condition: Digital Humanities, Born-Digital Archives, and the Future Literacy 2013).
9) Distributed Knowledge Production and Performative Access	• Knowledge production is unprecedentedly distributed; teams of domain experts work together and all are authors; multiple access points and platforms prevail. • "When knowledge exists in iterative form across global networks and local access points, with many versions and expressions of cultural information taking shape in a process whose lifecycle is ongoing, then any access to that knowledge is a performance, an instantiation" (Burdick, et al. 2012, 50).
10) Humanities Gaming	• Gaming "has begun to successfully engage with historical simulation,

	virtuous cycles of competition, and the virtual construction of learning environments" (Burdick, et al. 2012, 51). • Increased processing power and connectivity allow gamers not only to function in real time, but also to engage with multiple geographically dispersed participants (S. Jones 2014). • Games are "designed to structure the fluid relationships between digital data and the game worlds…and between digital data and the player in the physical world," (S. Jones 2014, 33).
11) Code, Software, and Platform Studies	• "Code studies, along with the related study of software and platforms, bring humanistic close-reading practices into dialogue with computational methods" (Burdick, et al. 2012, 53). • Scholars study the history of encoding practices, software and computer languages, code game engines, archaeological software studies, and cultural contexts.
12) Database Documentaries	• Work with documentary materials (film, video, text, and animation) on an expanded scale • Documentaries are "performed by a reader/viewer who is provided with a series of guided paths; and, unlike the cinematic documentary, which is free-standing, database documentaries may be built on multiple, overlapping databases" (Burdick, et al. 2012, 55). • The viewer controls the sequence, the duration, and the sound levels.
13) Repurposable Content and Remix Culture	• "The ease with which content can be repurposed in digital form extends the capacities of the medium to function as a meta-medium" (Burdick, et al. 2012, 55). • "Remix culture is a hallmark of the participatory, programmable Web in which a 'read-only' ethos has been surpassed by one of 'read/write/rewrite'" (Burdick, et al. 2012, 56).

	• Remix culture embraces music, photographs, film, graphic design, software development, and data curation.
14) Pervasive Infrastructure	• Standards-compliant Web services and cloud computing means enables the sharing of entire datasets with scholars and the public • Can access, manipulate, and analyze these huge heterogeneous data streams
15) Ubiquitous Scholarship	• "The tools of humanistic inquiry have become as much objects of research and experimentation as have the modes of production and dissemination of knowledge" (Burdick, et al. 2012, 58).

Tools

Although tools constitute a key extensible asset in DH work, the term "tool" itself remains nebulous (D. M. Zorich 2008). One study concludes, "too few tool builders looked for existing tools that already did what they envisioned, or if they did in fact do an initial check before beginning their own development efforts, they often had trouble finding related tools" (Cohen, Fraistat, et al. 2009). Most tools are one-off and standalone to boot; thus connecting them remains difficult at best (Cohen, Fraistat, et al. 2009).

The problem of orphan tools—operational but not referenced by or linked to a center—remains (D. M. Zorich 2008). Similarly, tools may be abandoned—replaced by commercial or updated tools, but also jettisoned by dint of loss of stakeholder interest, time, or funding (Shilton 2009). Finally, tool developers usually invest less effort in sustaining or supporting the tool than in developing it (Waltzer 2012). For tools, unfortunately, the creators may be the only persistent users (Edwards 2012, 215).

Another study examined 39 tools. While the tools were accessible, their usability was deeply problematic (D. M. Zorich 2008). Zorich (2008) advises digital humanities centers

personnel to advertise their tools, clarify their tools' purpose, disseminate previews, offer support, adumbrate technical instructions, and plan for sustainability.

A similar study of 38 tools also discerned problems: versioning, sustainability, standards, funding sources, and maintenance. Shilton (2009) deems the most useful tools as open source-based and apparently sustainable. She advocates developing best practices regarding website design, staffing, funding, and stewardship, institutional infrastructure, and accessible and sustainable design. Tools might be more useful it they worked better with other tools, used content more robustly, and were more easily locatable (Cohen, Fraistat, et al. 2009). They optimize their usefulness by remaining findable, accessible, transparent, and easy to use long-term.

Tool creators face four challenges: conceptualizing the tool, providing for staffing, participation, and project management, attracting and keeping users, and cultivating rewards systems (Cohen, Fraistat, et al. 2009). They should consider serving constituencies such as established users, software developers and technologists, content providers, funders and supporting organizations, and traditional humanists (Cohen, Fraistat, et al. 2009). An appropriate interface, finally, would "minimize the skepticism of black-box analysis" (Gibbs and Owens 2012). Tutorials and example use cases are imperative.

Other strategies for developing sustainable and interoperable tools include "training the trainer" initiatives, grants for collaborative work, cyberinfrastructure such as a registry for or repository of tools, an infrastructure providing tools, cookbooks, and recipes, and mechanisms for recognition (Cohen, Fraistat, et al. 2009).

Conclusions

The digital humanities face serious if familiar challenges such as faculty engagement, promotion and tenure concerns, funding, and infrastructure (Burdick, et al. 2012) (Svensson, Envisioning the Digital Humanities 2012). Most important, stakeholders would benefit from grappling with collaboration, project management, and sustainability.

Collaboration

Digital humanists frequently work in teams, jettisoning the traditional practice of the solitary scholar. Interdisciplinarity may add a further wrinkle. "'Collaboration' is a problematic, and should be a contested, term," insists McCarty (Collaborative Research in the Digital Humanities 2012, 2). The term persists as "a catchphrase heard quite often, but the difficulty is in carrying it out" (Maron and Pickle 2014, 55). It centers on common understanding of language and terminology, methods and research styles, theories, and values (Siemens, et al. 2012).

Collaboration operates on a spectrum. "On the one hand," notes McCarty (2012):

> The intense struggle to realize something heretofore unrealized, demanding all one's intellectual resources, justifies and demands a researcher's turn away from the group to solitude, summoning and dismissing interlocutors as they prove useful, or not, to whatever formal expression he or she is developing…On the other hand, even in the least dependent modes of work the goal is to catch someone's attention, to interest him or her in what has been made, to provoke a response, even if the maker does not know who this will be, when or where. The fundamental truth remains: our work is for communication. This is often best done as a trial, with close and trusted colleagues; a good collaboration provides a formal, reliable means (Collaborative Research in the Digital Humanities , 4).

But many collaborative efforts run aground: "Individuals working in such interdisciplinary teams often find they are the 'Other'—working beyond a defined disciplinary cultural unit, with the need for the construction of roles and responsibilities that allow their skill sets to be admitted to a working team, rather than behaving, and treating each other, as if they come from foreign climes" (Terras 2012, 213). Waters (2012) identifies "the not-invented-here syndrome: the conviction that 'you and I will collaborate just fine if you adopt my system and abandon yours.'"

Though some examples of collaboration among DHers and librarians, archivists, and museum professionals exist, they are rare (Hockey 2012). Collaborative ventures that revolve around sharing data or tools remain easier to establish and maintain than those that depend upon sharing knowledge. Such is also the case with projects that aggregate (as opposed to co-create) resources (D. M. Zorich 2008). "Even in an age of instantaneous and ubiquitous communication mechanisms," Zorich (2008) stresses, "highly integrated projects apparently require the frequent and often innocuous interactions (such as hallway conversations) that occur when collaborators are co-located rather than geographically dispersed" (45). Collaborations must be continuously managed. Profitable partnerships arise from common self-interest (Treloar, Choudhury and Michener 2012).

Siemens observes that research teams need to cultivate trust, consensus, and task coordination through communication. Differing perspectives, often discipline-related, on the research problem, method, and terminology can trammel communication, as can the cultural backgrounds of the researchers. Teams need to allocate tasks, share information and documents, reach consensus on decisions, and schedule meetings (L. Siemens 2010).

As Siemens (2010) details, communication usually takes one or more of three forms. First, face to face is the richest medium, permitting the apprehension of body and facial cues as well as immediate feedback. This medium nurtures trust and commitment. In the case of geographically dispersed teams, however, tradeoffs obtain. Most notably, travel time and costs can limit the frequency of meetings, thereby impeding decision making. In-person communication may well be particularly important in a project's nascency. Yet a project team can depend more on digital modes of communication if they share a history of collaboration.

Second, email and text-based asynchronous communication such as blogs and wikis offer benefits and drawbacks. The sender and receiver do not have to be in the same place at the same time; the method is also inexpensive. On the other hand, asynchronous communication can be both effortful and time consuming. Moreover, details and nuance may be sacrificed. Finally, email and similar methods pose potential problems regarding prompt checking of and responding to emails, particularly when stakeholders work in different time zones (L. Siemens 2010).

Third, conference calls and instant messaging surmount distance problems; they also allow real time feedback and convey at least some visual cues. Conversely, time delays and transmission problems can obtrude (L. Siemens 2010).

Over the course of a project, the appropriate balance between digital and face to face will evolve as research objectives and relationships among team members change. Digital mechanisms "can supplement, but cannot fully replace the face-to-face in collaboration" (L. Siemens 2010, 44).

Project Management

Digital humanities projects hinge on adept project management. "Alternative academic careers can be made or broken on the success or failure of such collaborative projects" (Leon

2011). Project management skills include organization, planning and follow up, prioritization, grant administration, human resources, and conflict resolution. Often characterized as "soft" or implicit skills, they can resist measurement, which can contribute to their remaining overlooked (Reed 2014).

Planning, content creation, technical development, technical maintenance, preservation, dissemination, and storage—all need to be managed. Successful projects receive support from administrators, communicate with faculty members, partner with campus units, and invest in skilled personnel and scale solutions (Maron and Pickle 2014).

Collaborative project work remains variable regarding funding, timelines, team dynamics, and the problems addressed (Leon 2011). Complicating matters, most humanists lack formal preparation for project management. Hence common failures include scheduling, no deliverables, or leadership vacuums. To combat these problems, a project team might set forth a project proposal that includes deliverables and ways they will be achieved, taking into account the team's expertise and the resources available. This prevents "failure creep" (Leon 2011).

Appropriate workplans identify deliverables, the steps necessary to meet them, and a timeline (Leon 2011). Consulting literature such as "12 Basic Principles of Project Management" and "Ten Rules for Humanities Scholars New to Project Management" can help ground a project (Croxall 2011) (Nowviskie 2012).

Juggling short- and long-term priorities, the PM deals with organizational structures and multitasking; she delegates tasks, tracks project work and associated responsibilities, manages time, conducts efficient meetings, and facilitates communication. Guiding and supervising each team member, PMs need to know enough about a range of subjects to communicate effectively with experts in each area (Leon 2011).

Yet project managers and other project stakeholders would benefit from focusing not merely on the early stages of the project. Funding agencies continue to shift "away from models based on project proliferation and ephemerality and toward an emphasis on preservation and permanence—at least of data, if not of projects" (Reed 2014). As a project matures, stakeholders need to consider familiar challenges such as scope creep, "feature creep" (adding gratuitous tool functionality), and the "educator imperative" (providing gratuitous information to users). As a project progresses revision gets harder instead of easier: its collective knowledge, documentation, and workflow become more diffuse as more collaborators contribute. As McGann (2010) reminds us, "If prophetic forecasting is hazardous, judicious planning is not—indeed, it's imperative" (2).

Sustainability

"The problem of sustainability," Powell (2012) explains, "has shifted dramatically in the last decade as institutions of higher education, from universities to community colleges, move towards a more corporate model, which assesses value in terms of profitability and student preparedness for a new economy" (181). McGann (2010) argues, "A signal failure of online scholarship has been its reluctance, perhaps its inability, to explain why and how a specific online project constitutes an important research undertaking" (3). Waltzer (2012) similarly laments, "Too few digital humanities projects take the extra steps to argue for their generalizable value or even to create the conditions for broad adoption" (342); "notions of how to establish the 'value' of a project are often quite vague" (Maron and Pickle 2014, 5). Indeed, Piez (2011) asserts, "To argue for our meaning and significance using only language in which meaning and significance have been reduced to terms in economic formulas, and…to acquiesce in the attempts gives up any chance of acknowledging the contributions we actually make."

Nearly 50% of respondents (from a sample of four universities) in a recent study not only used digital tools and collections, but also created such resources. Nearly three-quarters (72%) planned to develop projects (whether by themselves or in collaboration with others) and nearly two-thirds (64%) intended their projects to be geared toward public use (Maron and Pickle 2014).

Despite such seemingly propitious numbers, familiar challenges recurred. Faculty generally lacked end to end project support. Many campus stakeholders fail to realize how digital humanities work or products bolster institutional goals, much less who should own the outputs. In this vein, "Few campus faculty or units seem to be regularly measuring usage of DH projects and few are undertaking activities to increase the impact of the works they have taken on" (Maron and Pickle 2014, 56).

"Build it, and the experts won't necessarily come—at least not yet in great numbers," Howard (2014) opines. Nonetheless, a case can be made: sustainability remains a "dark but potent word in the field of digital humanities," the "elephant in the room" (McGann 2010, 5). Project management, collaboration, and sustainability—all are of great importance to successful digital humanities work.

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The digital humanities perennially reinvent themselves (Alexander and Davis 2012). Burdick et al. (2012) foresee "A new kind of digital humanist…who combines in-depth training in a single humanistic subfield with a mix of skills drawn from design, computer science, media work, curatorial training, and library science" (116).

"Discovery," observes Burke (2011), "can go on endlessly, and never become clearly irrelevant or unimportant." Hence "the limit here is our imagination, not technological

possibility" (O'Malley 2010). "If we are indeed experiencing a digital revolution," Gladney (2012) insists, "it is only its early days" (213).

Chapter 4: Digital Curation and Digital Humanities Education in North America

> What must be learned in the classroom or formally? What must be learned from practical field experiences? What must a person know before he or she engages in professional education? What should be key priorities in continuing education? What research is prerequisite to developing and to disseminating proper professional digital curation practices? (C. A. Lee 2009)

Introduction

This chapter reviews five categories of digital curation education programs. It covers 30 programs: ten capacity-building programs,[39] five specializations,[40] nine certificates (graduate, professional, or both),[41] and six workshops.[42]

First, this chapter discusses the importance and the current state of digital curation education. It then similarly explores digital humanities education. Third, it addresses the nature of current digital curation professionals. Fourth, it stresses the opportunities for digital curation

[39] Pratt Institute's Cultural Heritage Access Research and Technology (CHART) (Pratt-SILS with Brooklyn Historical Society, Brooklyn Museum, and Brooklyn Public Library 2013), Catholic University's Cultural Heritage Information Management (CHIM) (Choi, Elings and Zhang 2014), University of Illinois at Urbana-Champaign's (UIUC's) Data Curation Education Program (DCEP) (Palmer, Heidorn, et al. 2007) (Renear, Cragin, et al. 2011) (Thompson, et al. 2013), UIUC's Data Curation Education Program-Humanities (DCEP-H) (Renear, Palmer and Unsworth 2013) (Renear, Teffeau, et al. 2009), University of North Carolina at Chapel Hill's (UNCCH's) DigCCurr I (Lee and Tibbo 2010) (Lee, Tibbo and Schaefer, Defining What Digital Curators Do and What they Need to Know: The DigCCurr Project 2007) (Lee, Tibbo and Schaefer, DigCCurr: Building an International Digital Curation Curriculum & the Carolina Digital Curation Fellowship Program 2007), UNCCH's DigCCurr II (Gregory and Guss 2011) (Poole, 'Curate Thyself' and the DigCCurr Experts' Meeting: Communication, Collaboration, and Strategy in Digital Curation Education 2013), University of Tennessee-Knoxville (UTK) and UIUC's Data Curation Education in Research Centers (Kelly, et al. 2013) (Mayernik, et al. 2015) (Palmer, Allard and Marlino 2011), UTK's Science Links2, UTK's SciData, and University of North Texas's Information: Curate, Archive, Manage, Preserve (iCAMP) (Moen, et al. 2012).

[40] Kent State University's Digital Preservation Specialization, UIUC's Specialization in Data Curation, University of Maryland's Specialization in Archives and Digital Curation (Shilton, Ambacher, et al. 2013), University of Michigan's Preservation of Information Specialization (Yakel, Conway and Hedstrom, et al. 2011) (Yakel, Conway and Krause 2009), and Wayne State University's Archives and Digital Content Management Specialization (Beaudoin 2013).

[41] University of Arizona's Digital Information Graduate Certificate (DigIn) (Botticelli, et al. 2011) (Fulton, Botticelli and Bradley 2011), Dominican University's Certificate in Digital Curation, Johns Hopkins University's Certificate in Digital Curation, Kent State University's Digital Preservation Certificate of Advanced Study, University of North Carolina's Master's Certificate in Digital Curation, University of Maine's Digital Curation Graduate Certificate, University of North Carolina's Post-Master's Certificate in Data Curation, San Jose State University's Post-Master's Certificate in Digital Curation, and Simmons College's Digital Stewardship Certificate (Anderson, et al. 2011) (Bastian, Cloonan and Harvey 2011) (J. Bastian, R. Harvey, et al. 2010) (Harvey and Bastian 2012) (Mahard and Harvey 2013).

[42] University of Massachusetts-Amherst and Worcester Polytechnic Institute's New England Collaborative Data Management Curriculum (NECDMC) (Kafel, Creamer and Martin 2014) (Piorun, et al. 2012), University of Houston (Peters and Vaughn 2014), University of Minnesota (Johnston, Lafferty and Petsan 2012), University of Massachusetts-Amherst (Adamick, Reznik-Zellen and Sheridan 2013), University of Tennessee-Knoxville (Eaker 2014), University of Washington (Muilenberg, Lebow and Rich 2014), and the Digital Humanities Data Curation (DHDC) Institutes (Senseney, et al. 2014).

education for Library and Information Science programs. Fifth, it analyzes recent key digital curation education initiatives, addressing capacity-building efforts, specializations, certificates, and workshops. Last, it sets forth generalizable lessons learned from these initiatives. Existing curricula offer a useful foundation for new digital curation education initiatives geared toward digital humanists (Muilenberg, Lebow and Rich 2014).

Digital Curation Education

At the end of the 2000s, digital curation work arrived at a watershed: many stakeholders acknowledged its importance but too few professionals had the skills necessary to tackle key technological and administrative challenges (Botticelli, et al. 2011) (Gilliland-Swetland 2000) (Harvey 2010) (Ray 2009) (Yakel, Conway and Krause 2009). Tibbo (2012) maintains: a "lack of widespread, long-standing, strong graduate programs in digital archiving, electronic records management, and data curation lie at the core of the neglect of much of our nation's digital heritage and institutional records" (25). Lynch (2014) insists, "The availability and development of the necessary skills and expertise in the workforce will be a serious problem" (399) and Lyon and Brenner (2015) underline the "emerging data talent gap."

A recent report underlined "a shortage of digitally literate professionals and increasing demand from employers seeking professionals to manage digital collections in libraries, museums, media organizations, public offices, research institutions, hospitals, law firms, and private companies" (Education Advisory Board 2014, 4). National employer demand increased by more than 50% between H1 2010 and H1 2013 and by 10% between H2 2013 and H1 2014 (Education Advisory Board 2014). The National Research Council of the National Academies (2015) posits, "Although the number and breadth of educational opportunities supporting digital curation have grown, existing capacity is low, especially for the initial education of professional

digital curators and the midcareer training of professionals with credentials in another field" (4). Ultimately, the need for digital curation education and training is more urgent than ever: digital curation education practices and programs are incipient (Adamick, Reznik-Zellen and Sheridan 2013) (Pomerantz, et al. 2009). LIS programs can play a pivotal role in skilling up digital curation professionals.

Digital Humanities Education

Specific educational programs in the digital humanities include undergraduate, Master's, and doctoral degrees as well as workshops. Educational programs in the digital humanities based in North America are perhaps less mature and more dispersed in the digital humanities than in digital curation. Hirsch (2012) calls attention to "bracketing": the "almost systematic relegation of the word 'teaching' (or its synonyms) to the status of afterthought, tacked-on to a statement about the digital humanities after the word 'research' (or its synonyms), often in parentheses" (5). Bracketing buttresses "an antagonistic distinction between teaching and research, in which the time, effort, and funding spent on the one cannibalizes the opportunities of the other" (Hirsch 2012, 5). Brier (2012) similarly worries, "this recent rush toward the technological new has tended to focus too narrowly…on the academic research and publication aspects of the digital humanities, in the process reinforcing disciplinary 'siloes' and traditional academic issues while also minimizing and often obscuring the larger implications of DH for how we teach in universities and colleges and how we prepare the next generation of graduate students for careers inside and outside the academy" (390).

Though many scholars muse on how best to teach digital humanities, few best practices have emerged (Hirsch 2012) (Scholtz 2011). "Although there are an increasing number of digital humanities graduate programs," Spiro (2012) observes, "the community has not yet reached wide

consensus on what the digital humanities curriculum should include, nor has much research been published on digital humanities education" (Opening Up Digital Humanities Education, 338). Many DHers relegate pedagogy to second-class status (Brier 2012) or frame it as ancillary to information technology (Fyfe 2011). But pedagogy is crucial in establishing and consolidating an academic field or discipline (Hirsch 2012) (Warwick 2012).

The need to incorporate digital curation into the digital humanities (and vice versa) is pressing. Senseney et al. (2014) posit, "More fully integrating data curation into digital research involves fluency with topics such as publication and information sharing practices, descriptive standards, metadata formats, and the technical characteristics of digital data." Only one digital humanities educational initiatives—the Digital Humanities Data Curation (DHDC) Institutes—out of twelve examined specifically address digital curation in their agenda.[43]

Digital Curation Professionals

Digital curation professionals represent "the human element of a knowledge infrastructure supporting contemporary scholarly practices and are key to developing and sustaining a global system of interoperable digital data and tools across the natural, physical, and social sciences, as well as the humanities" (Weber, Palmer and Chao 2012, 307). The National Research Council of the National Academies (2015) concludes, "The knowledge and skills

[43] Based on an extensive review of the literature, I examined 12 North American digital humanities education initiatives. They include: McMaster University's Humanities Media and Computing Center Multimedia Degree Program (Rockwell and Sinclair, Acculturation and the Digital Humanities Community 2012) (Sinclair and Rockwell 2012), New York University's Archives and Public History (MA) (Wosh, Hajo and Katz 2012), Loyola University's MA in Digital Humanities, University of Alberta's MA in Humanities Computing (Sinclair and Gouglas 2002) (Sinclair and Rockwell 2012), the Digital Humanities Data Curation (DHDC) Institutes (Senseney, et al. 2014), the University of Victoria's Digital Humanities Summer Institute (Bialkowski, Niles and Galey 2011) (Meloni 2010) (Templeton 2014), the University of Virginia's Praxis Program at the Scholars' Lab (Boggs 2013) (Boggs, Nowviskie, et al. 2012) (Nowviskie, A Digital Boot Camp for Grad Students in the Humanities 2012) (Nowviskie, It Starts on Day One 2012), Michigan State University's Cultural Heritage Informatics Initiative, the City University of New York (CUNY) Graduate Center's Digital Fellows Program, Duke University's PhD Lab in Digital Knowledge, Brock University's Interactive Arts and Science (IASC) Program, and Hope College's Andrew W. Mellon Foundation Scholars' Program in the Arts and Humanities.

required of those engaged in digital curation are dynamic and highly interdisciplinary. They include an integrated understanding of computing and information science, librarianship, archival practice, and the disciplines and domains generating and using data" (78).

Perhaps unsurprisingly, information-related jobs remain heterogeneous: many professionals found their careers fortuitously (Pryor and Donnelly 2009). Most are either domain experts who picked up data skills over the course of their career or began as computer scientists who attained domain knowledge. A recent study of contributors to four scholarly venues (*International Journal of Digital Curation*, the International Digital Curation Conference, the DigCCurr Conference, and the International conference on the Preservation of Digital Objects) found that while nearly 40 percent (39.6%) of the 139 respondents with master's degrees earned them in Library Science, Information Science, or LIS, a quarter (25.2% or 35) earned theirs in Computer Science, Engineering, or Applied Mathematics and 28.8% (40) earned theirs in Arts or Humanities. Moreover, nearly as many of those 77 respondents with PhDs earned them in Computer Science, Engineering, or Applied Mathematics (29.9%) as in LIS (28.6%) (Poole, Lee, et al. 2013).

Respondents were asked to describe up to three disciplines in which they classified their research. While many of the 119 respondents included "digital" in their descriptions, the term "digital curation" appeared infrequently: only fourteen times in 304 total responses. Finally, the most common terms used in respondents' presentation or journal article titles included "digital," "preservation," "data," "curation," and "information." But participants used the phrase "digital curation" quite infrequently (57 of 607 titles) (Poole, Lee, et al. 2013). A recent report similarly asserted, "No single occupational category for digital curators and no precise mapping between the knowledge and skills needed for digital curation and existing professions, careers, or job

titles" (National Research Council of the National Academies 2015, 1). In training as well as in scholarship, digital curation persists as an amorphous area.

The Role for Library and Information Science

Findings such as those of Poole et al. suggest that digital curation stakeholders' career preparation should be anchored in iSchool and Library and Information Science curricula. LIS programs focus uniquely on "the full landscape of scientific information and the interactions therein, and with the provision of services to exploit that base" (Palmer, Heidorn, et al. 2007, 37). LIS programs instill humanistic, social science, and technological literacy (Shilton, Ambacher, et al. 2013).

As Pryor (2012) reflects, however, "The library schools in our universities may provide a sound education in what is broadly described as knowledge management or information management, but training in the intricacies of web search engines, information systems and database design does not properly equip the new professionals with an outlook that will fit them for a role as data manager in a research intensive university" (15). Exacerbating the situation, "most data management-related curricula are not openly accessible and are not targeted for students outside of information science programs" (Piorun, et al. 2012, 47). Hence Lyon and Brenner (2015) call for a "transformative re-engineering of data education, training and skills production to keep pace with market demands for data talent" (119).

But teaching digital curation involves wrestling with "an immature discipline characterized by fluid professional boundaries and uncertainty in the development of vital infrastructure" (Botticelli, et al. 2011, 149). Teaching efforts are recently minted and few in number (Jahnke and Asher 2012) and many local variables demand consideration (Moles and Ross 2013). Educators need to prepare students for multiple and evolving roles and

responsibilities: digital curation curricula are never finalized (C. A. Lee 2009), particularly given the pace of technological change (J. Bastian, R. Harvey, et al. 2010, 244) (Botticelli, et al. 2011) (Weber, Palmer and Chao 2012).

It is far from evident that LIS programs are keeping up with demand (Creamer, Morales, et al. 2012) (Gregory and Guss 2011) (Harris-Pierce and Liu 2012). Corrall (2012) calls curricula coverage "limited and uneven" (120) but Bastian and her colleagues (2011) point out, "a number of viable models are developing" (616). Least sanguine, Jahnke and Asher (2012) characterize LIS as largely "a closed circuit, providing concentrations within tracks restricted to LIS enrollees" (39). LIS programs also find themselves competing for students and resources with computer science programs and Management Information Systems programs (Tibbo 2015).

Of 58 accredited Library and Information Science programs in North America, 13 (22%) offer a course in data management or curation (Creamer, Morales, et al. 2012). In April of 2015, I conducted an environmental scan of the websites of all 58 ALA-accredited Library and Information Science programs in the United States and Canada. I searched the sites for courses whose titles contained the term "curation." I made one exception: based on the DigCCurr project, I knew that Simmons College prefers the term "stewardship" to the term "curation." Similarly, I examined each website looking for course titles including "digital humanities." Twenty-one offered a course in digital curation and nine offered a course in digital humanities.

Table 3: LIS programs in United States (50): Digital Curation and Digital Humanities Courses

School	Digital Curation course	Digital Humanities course
University of Alabama	No	No
University of Arizona	No	No
University of California-Los Angeles	Yes	No
San Jose State University	Yes	No
University of Denver	No	No
Catholic University	Yes	Yes

Florida State University	No	No
University of South Florida	No	No
Valdosta State University	No	No
University of Hawaii	No	No
Dominican University	Yes	No
University of Illinois at Urbana-Champaign	Yes	Yes
Indiana University	No	Yes
University of Iowa	No	No
Emporia State University	No	No
University of Kentucky	No	No
Louisiana State University	Yes	No
University of Maryland	Yes	Yes
Simmons College	Yes	No
University of Michigan	Yes	Yes[44]
Wayne State University	Yes	No
St. Catherine University	No	No
University of Southern Mississippi	No	No
University of Missouri	No	No
Rutgers University	Yes	No
SUNY-Albany	No	No
SUNY-Buffalo	No	No
Long Island University	No	No
Pratt Institute	Yes	Yes
Queens College	No	No
St. John's University	No	No
Syracuse University	No	No
University of North Carolina at Chapel Hill	Yes	Yes
North Carolina Central University	No	No
University of North Carolina-Greensboro	No	No
Kent State University	Yes	No
University of Oklahoma	No	No
Clarion University	No	No
Drexel University	Yes	No
University of Pittsburgh	Yes	No
University of Puerto Rico	No	No
University of Rhode Island	No	No
University of South Carolina	No	No

[44] Offered as a Special Topics (half-semester) course.

University of Tennessee-Knoxville	Yes	No
University of North Texas	No	No
University of Texas-Austin	No	Yes
Texas Women's University	No	No
University of Washington	No	No
University of Wisconsin-Madison	Yes	Yes
University of Wisconsin-Milwaukee	No	No
Total: 50	18	8

Table 4: LIS programs in Canada: Digital Curation and Digital Humanities Courses

School	Digital Curation course	Digital Humanities course
University of Alberta	No	Yes (offers Humanities Computing)
University of British Columbia	Yes	No
Dalhousie University	No	No
University of Ottawa	No	No
University of Toronto	Yes	No
University of Western Ontario	No	No
McGill University	Yes	No
Université de Montreal	No	No
Total: 8	3	1

There seems considerable potential for those schools offering both digital curation and digital humanities courses to collaborate.

Key Initiatives: Capacity-building, Specializations, Certificates, and Workshops

The following sections discuss each of the four major classes of digital curation education initiatives. For each type of initiative, the section discusses deliverables (in the class of capacity-building programs), required courses or modules (these suggest key topics included in each initiative), and lessons learned.

To locate capacity-building initiatives, Master's degrees, specializations, and certificates, I examined all LIS programs that offered courses with the term "curation" in the title and looked

to see if they were part of a larger initiatives such as a specialization or certificate.[45] To locate key workshop offerings, I relied upon sources I identified as part or preparing for my comprehensive exam and developing my dissertation proposal literature review.

A caveat is necessary: information on programs was not always available, despite an exhaustive search of the literature and of the program websites. This suggests the need for further efforts to disseminate information about available programs to potential stakeholders. Supplying such information might also promote collaboration among initiatives. Last, the overriding commonality among programs is their diversity. Again, the need for coordination persists, particularly in aligning course or module topics and desired competencies.

Capacity-building

Ten educational initiatives have focused on capacity building (Table 5). All are based in Library and Information Science programs.

Table 5: Capacity-Building Initiatives

Program Title	Institution	Home Department/ School	Constituents	Dates	Funder	Practical Component
Cultural Heritage Information Management (CHIM)[46]	Catholic University	Department of Library and Information Science	Master's students (17)	2012-2015	Institute of Museum and Library Services	Field experience[47]

[45] As such, I chose not to include San Jose State University's MARA, the University of Texas-Austin's Preservation Studies Specialization or its Certificate of Advanced Study in Preservation Studies, Syracuse University's Certificate of Advanced Study in Data Science, or Berkeley's Master of Information and Data Science (MIDS). These programs are not explicitly linked to digital curation courses. Second, I did not include SAA's Digital Archives Specialist Curriculum and Certificate (DAS) because it is not affiliated with an ALA-accredited program. Finally, I chose not to include King's College's MA in Digital Curation because it falls outside the scope of North American digital curation education.

[46] Cultural Heritage Information Management (CHIM): http://lis.cua.edu/MSinLS/coursesStudy/CHIM.cfm

[47] Partners include the Library of Congress, the Art Museum of the Americas, Corcoran School of Art and Design, the National Agricultural Library, the National Library of Medicine, and the Smithsonian Institution.

Data Curation Education Program (DCEP)[48]	University of Illinois Urbana-Champaign	Graduate School of Library and Information Science	Master's students (24)	2006-2011	Institute of Museum and Library Services	Field experience (recommended)
Data Curation Education Program-Humanities (DCEP-H)	University of Illinois Urbana-Champaign	Graduate School of Library and Information Science	N/A	2008-2012	Institute of Museum and Library Services	Field experience (recommended)
DigCCurr I[49]	University of North Carolina at Chapel Hill	School of Information and Library Science	Master's students (5)	2006-2009	Institute of Museum and Library Services	Field experience
DigCCurr II[50]	University of North Carolina at Chapel Hill	School of Information and Library Science	Doctoral students (4)	2010-2013	Institute of Museum and Library Services	N/A
Curate, Archive, Manage, Preserve (iCAMP)[51]	University of North Texas	College of Information	LIS students, post-Master's professionals, non-LIS students	2011-2014	Institute of Museum and Library Services	N/A
Cultural Heritage Access Research and Technology (CHART)[52]	Pratt Institute	School of Library and Information Science	Master's students (18)	2012-2015	Institute of Museum and Library Services	Field experience

[48] http://www.lis.illinois.edu/research/projects/data-curation-education-program

[49] http://ils.unc.edu/digccurr/aboutI.html

[50] http://ils.unc.edu/digccurr/aboutI.html

[51] http://icamp.unt.edu/icamp/content/icamp-project

[52] https://www.pratt.edu/academics/information-and-library-sciences/grant-scholarship-internship/chart/

Science Links2[53]	University of Tennessee-Knoxville	School of Information Sciences	Doctoral students (6)	2009-2013	Institute of Museum and Library Services	Field experience
SciData[54]	University of Tennessee-Knoxville	School of Information Sciences	Master's students (8)	2011-2014	Institute of Museum and Library Services	Field experience
Data Curation Education in Research Centers (DCERC)[55]	University of Tennessee-Knoxville/ University of Illinois Urbana-Champaign	School of Information Sciences/ Graduate School of Library and Information Science	Doctoral students (6)	2010-2013	Institute of Museum and Library Services	Field experience

Required Courses

Five capacity-building initiatives provide information on required courses (Table 6).

Table 6: Required Courses (Capacity-Building)

Cultural Heritage, Access, Research and Technology (CHART)
Management of Digital Collections
Digital Archives and Libraries and Social Media
Digital Preservation and Conservation
Selection, Description, and Access
Cultural Heritage Collections Across Libraries, Museums, and Archives
Cultural Heritage Information Management (CHIM)
Organization of Information
Information Sources and Services
Information Systems in Libraries and Information Centers
Libraries and Information in Society
History and Theory of Cultural Heritage Institutions
Digital Curation

[53] http://www.sis.utk.edu/sciencelinks2

[54] http://scidata.sis.utk.edu/

[55] http://www.sis.utk.edu/dcerc

Metadata
Use and Users of Libraries and Information
Foundations of Digital Libraries
Digital Curation Education Program (DCEP)
Metadata in Theory and Practice
Digital Preservation
Foundations of Data Curation
SciData
Digital Libraries
Database Management
Information Technologies
Information Network Applications
Scientific and Technical Communications
Digital Curation
Human-Computer Interaction
Metadata
Electronic publishing
Curate, Archive, Manage, Preserve (iCAMP)
Digital Curation Fundamentals
Preservation Planning and Implementation for Digital Curation
Digital Curation Tools and Applications
Advanced Topics in Digital Curation

As shown in Table 7, themes that emerged more than once from the required courses of capacity-building programs include digital or data curation (three of five), digital libraries (three), metadata (three), and digital preservation (three).

Table 7: Consolidated Course Topics (Capacity-Building)

Course Topic	Program
Digital/data curation	CHIM
	DCEP
	iCAMP
	SciData
Digital libraries	CHIM
	CHART
	SciData
Metadata	CHIM
	DCEP
	SciData
Digital preservation	DCEP
	iCAMP
	CHART

Outcomes

Eight of the ten capacity-building initiatives publish their outcomes (Table 8).

Table 8: Outcomes (Capacity-Building)

Cultural Heritage, Access, Research and Technology (CHART)
Internships
Curriculum development
Team project work
Recruitment for diversity
Attendance at professional conferences, symposiums, and workshops
Digital Curation Education Program (DCEP)
Develop curriculum for the specialization that builds on existing graduate programs
Establish internships and develop a job network at institutions where students can develop and apply their growing expertise
Expand understanding of the role of data curation in the production of research
Share the educational approach with other schools interested in developing similar specializations
Digital Curation Education Program-Humanities (DCEP-H)
Develop and refine curriculum
Recruiting and advising
Outreach and training
Needs assessment
Coordination with other projects/activities
Carolina Digital Curation Curriculum Project (DigCCurr)
Matrix of Digital Curation Knowledge and Competencies and High Level Categories of Digital Curation Functions
New courses: Understanding Information Technology for Managing Digital Collections and iRODS Rule Construction
Graduate Certificate in Digital Curation
Module template for curriculum
Practical experience
Promoted digital curation networks
Raised awareness
Carolina Digital Curation Curriculum Project (DigCCurr II)
Conceptual frameworks
Educational offerings
Research opportunities
Field experiences
Data Curation Education in Research Centers (DCERC)
Model for LIS schools and science organization partnerships
Graduates prepared for leadership positions
Sharable curation curriculum

Description of key roles of LIS in e-science
Collaborations cemented by scientific problems
Curation best practices
Science Links2
Greater community engagement
Enriched mentoring culture
Increased scholarly community within and across disciplines
Increased student research production
National lab student blueprint
Creation of an interdisciplinary undergraduate course on Environmental Information Science
Curate, Archive, Manage, Preserve (iCAMP)
Develop a Graduate Academic Certificate with four courses in digital curation and data management
Increase students' knowledge and skills through practical training and engagement with real-world digital curation problems
Positively change discipline-specific graduate students' knowledge and perception of academic libraries as collaborators with scientists and scholars in digital curation
Implement a virtual teaching environment for students' experimentation and discovery learning
Deploy a robust technical infrastructure to support student learning, practical engagement, and training
Conduct distributed, online LIS education through the Virtual Teaching Environment infrastructure experience
Improve LIS faculty and UNT librarians' abilities and attitudes for collaboration in LIS education to serve as a model for such collaboration

Table 9: Capacity-Building Programs' Outcomes (Consolidated)

Deliverable	Number of Programs (n=8)	Programs
Curriculum development	5	DCEP
		DCEP-H
		DigCCurr I
		CHART
		DCERC
Internships/field experiences/practical experience	5	DCEP
		DigCCurr I;
		DigCCurr II;
		iCAMP
		CHART
Professional development	5	DCEP-H
		DigCCurr I
		CHART
		Science Links2
		DCERC
Model/sharable deliverable	5	DCEP

		DigCCurr I
		iCAMP
		Science Links2
		DCERC
Foundation for future collaborations	4	DCEP-H
		iCAMP
		CHART
		DCERC
Courses/educational offerings	3	DigCCurr I
		DigCCurr II
		Science Links2;
Research	3	DCEP
		DigCCurr II
		DCERC
Certificate development	2	DigCCurr I
		iCAMP
Recruitment	2	DCEP-H
		CHART

Lessons Learned

Five outcomes were common to at least four of the eight initiatives. First, as might be expected from capacity-building initiatives, five programs engaged in curriculum development. Second, five programs also foregrounded practical experience that allowed their students to apply classroom knowledge to real-world settings. Tibbo (2015) maintains, "Perhaps the greatest challenge for graduate programs is to provide students with consistently meaningful internships and other hands-on experiences" (150); other capacity-building programs' stakeholders concur (Mayernik, et al. 2015) (Moen, et al. 2012). Third, in their publications or on their websites, five of the eight programs advertised the opportunities they provide for professional development. Such professional development allows students to become steeped in various communities of practice and to obtain hands-on digital curation experience in those domains. On the other hand, it also may alert researchers and institutions to the key roles that digital curation professionals trained in LIS schools can play. Fourth, five initiatives developed a model or sharable deliverable, suggesting these programs' interest in developing a common foundation for digital

curation education. Fifth, capacity-building initiatives may give students valuable exposure to and experience in collaboration—a hallmark not only of digital curation work, but also of much current research and scholarship in both the sciences and the humanities.

Four other outcomes were emphasized by more than one program. Three programs sought to develop new courses: UNC DigCCurr I and II developed Understanding Information Technology for Digital Collections and iRODS Rule Construction as well as special topics seminars on digital curation, while Science Links2 developed an undergraduate interdisciplinary course on Environmental Information Science. Three programs sought to stimulate new research: DCEP, DigCCurr II, and DCERC. Finally, two programs engaged in certificate development: DigCCurr I (Graduate Certificate in Digital Curation) and iCAMP (Graduate Academic Certificate in Digital Curation and Data Management) and two premised recruitment of diverse populations (DCEP-H and CHART).

Not to be overlooked, two of these capacity-building efforts, UNC's and UIUC's, resulted in curriculum offerings, namely the Master's Graduate Certificate in Digital Curation, the Post-Master's Certificate in Data Curation (both at UNC), and the Specialization in Data Curation (UIUC). Whether other recent programs such as iCAMP or SciData, both of whose grant funding ended in 2014, can parlay their grant-funded projects into similar sustainable curriculum offerings remains to be seen.

Specializations

Five institutions offer Master's degree specializations in digital curation (Table 10).

Table 10: Digital Curation Specializations

Program Title	Institution	Home Department/ School	Mode of Delivery	Practical Component

Specialization in Data Curation[56]	University of Illinois at Urbana-Champaign	Graduate School of Library and Information Science	Mixed	Field experience
Digital Preservation Specialization[57]	Kent State University	School of Library and Information Science	Mixed	Field Experience (elective)
Archives and Digital Curation Specialization[58]	University of Maryland	College of Information Studies	Mixed	Field experience
Preservation of Information Specialization[59]	University of Michigan	School of Information	On campus	Field experience
Archives and Digital Content Management Specialization[60]	Wayne State University	School of Library and Information Science	Mixed	Field experience

Required Courses

All five specializations require certain courses (Table 11).

Table 11: Required Courses

University of Illinois at Urbana-Champaign Specialization in Data Curation
Metadata in Theory and Practice
Digital Preservation
Foundations of Data Curation

[56] Specialization in Data Curation: http://www.lis.illinois.edu/academics/degrees/specializations/data_curation

[57] Digital Preservation Specialziation: https://www.kent.edu/slis/digital-preservation

[58] Archives and Digital Curation Specialization: http://ischool.umd.edu/content/specializations-0#Archives and Digital Curation

[59] Preservation of Information Specialization: https://www.si.umich.edu/academics/msi/preservation-information-pi

[60] Archives and Digital Content Management Specialization: http://slis.wayne.edu/mlis/archives.php

Choose two: Foundations of Information Processing in LIS Ontology Development Systems Analysis and Management Introduction to Databases Digital Libraries Information Modeling Representing and Organizing Information Resources
Kent State University Specialization in Digital Preservation[61]
Introduction to Digital Preservation
Digital Curation
Implementation of Digital Libraries
Digital Image Processing and Collection Management
Preservation and Conservation of Heritage Materials
University of Maryland Archives and Digital Curation Specialization
Introduction to Archives and Digital Curation
Policy Course (choose 1): Privacy and Security in a Networked World Information Policy Policy Issues in Digital Curation
Technical Course (choose 1): Introduction to Programming for the Information Professional Database Design Implementing the Curation and Management of Digital Assets
Digital Curation and Preservation Pathway (choose 1): Curation in Cultural Institutions Implementing the Curation and Management of Digital Assets Digital Preservation
University of Michigan Preservation of Information Specialization
Preservation Administration
Choose (9 credits): Digital Preservation (3) Data Manipulation (1.5) Economics of Sustainable Digital Preservation (1.5) Web Archiving (1.5) Digitization for Preservation (1.5) Preserving Sound and Motion (1.5)
Wayne State University Archives and Digital Content Management Specialization

[61] Kent State's certificate program does not require any particular courses in digital preservation, opting instead to call certain courses "key electives."

Choose four: Digital Curation and Preservation Digital Libraries Metadata in Theory and Practice Software Productivity Tools Database Concepts and Applications

As depicted in Table 12, key themes on which these specializations' courses focus include digital libraries (three of five) and digital preservation (three). Other key topics include digital curation and preservation (two of five), digital curation (two), databases (two), and metadata (two).

Table 12: Consolidated Course Topics (Specializations)

Course Topic	Program
Digital preservation	UIUC
	Kent State University
	University of Maryland
	University of Michigan
Digital libraries	UIUC
	Kent State University
	Wayne State University
Databases	UIUC
	University of Maryland
	Wayne State University
Digital curation	UIUC
	Kent State University
Metadata	UIUC
	Wayne State University

Lessons Learned

Specializations in digital curation suggest two lessons. First, a curriculum should consider how best to balance courses, practice-based internships, and a technological infrastructure (Yakel, Conway and Hedstrom, et al. 2011). Second, as Yakel et al. (2011) argue based on the University of Michigan's work, a digital curation professional would do well to understand hybrid media environments and a lifecycle approach to information management.

Certificates

Nine institutions offer certificates in digital curation: three to graduate students, four to professionals, and three to both graduate students and professionals (Table 13).

Table 13: Digital Curation Certificates

Program Title	Institution	Home Department/ School	Constituents	Mode of Delivery	Practical Component
DigIn[62]	University of Arizona	School of Information Resources and Library Science	Graduate or professional	Online	Field experience
Certificate in Digital Curation[63]	Dominican University	Graduate School of Information and Library Science	Graduate or professional	On campus	Field experience (elective)
Certificate in Digital Curation[64]	Johns Hopkins University	Museum Studies	Graduate	Mixed	Field experience
Digital Curation Graduate Certificate[65]	University of Maine	New Media Studies	Graduate	Online	Field experience
Master's Certificate in Digital Curation[66]	University of North Carolina at Chapel Hill	School of Library and Information Science	Graduate	Mixed	Field experience or Master's Paper
Certificate of Advanced Study in Digital	Kent State University	School of Library and Information Science	Professional	Mixed	Field experience (elective)

[62] http://sirls.arizona.edu/programs/digIn

[63] http://gslis.dom.edu/academics/certificates/digital-curation

[64] http://advanced.jhu.edu/academics/certificate-programs/digital-curation-certificate/

[65] http://digitalcuration.umaine.edu/

[66] http://sils.unc.edu/programs/certificates/digital_curation

Preservation (PMC)[67]					
Post-Master's Certificate in Data Curation[68]	University of North Carolina at Chapel Hill	School of Information and Library Science	Professional	Mixed	Independent studies (project-based)
Post-Master's Certificate in Digital Curation[69]	San Jose State University	School of Information	Professional	Online	Field experience
Digital Stewardship Certificate[70]	Simmons College	School of Library and Information Science	Professional	Online	N/A

Required Courses

Eight of the nine certificate programs list required courses (Table 14).

Table 14: Required Courses

University of Arizona DigIn
Introduction to Digital Collections
Introduction to Applied Technology
Managing the Digital Environment
Preservation of Digital Collections
Advanced Digital Collections
Dominican University
Introduction to Archival Principles, Practices, and Services
Metadata for Digital Resources
Digital Curation
Johns Hopkins University Certificate in Digital Curation
Digital Preservation
Foundations of Data Curation
Managing Digital Information in Museums
Final Research Paper
University of Maine Digital Curation Graduate Certificate
Introduction to Digital Curation

[67] http://www.kent.edu/slis/advanced-study-LIS

[68] http://sils.unc.edu/programs/graduate/post-masters-certificates/data-curation

[69] http://ischool.sjsu.edu/programs/post-masters-certificate

[70] http://www.simmons.edu/academics/certificate-programs/digital-stewardship-certificate

Metadata
Digital Collections and Exhibitions
Information Systems Software Engineering/ Database Management Systems
Digital Preservation
University of North Carolina at Chapel Hill Digital Curation Certificate
Understanding Information Technology for Managing Digital Collections
Digital Preservation and Access
Introduction to Archives & Record Management
Choose 1: Systems Analysis Resource Selection and Evaluation Archival Appraisal
Choose 1: Electronic Records Management Digital Libraries: Principles & Applications
University of North Carolina at Chapel Hill Post-Master's Certificate in Data Curation
Understanding Information Technology for Managing Digital Collections
Selected Topics: Information Analytics
Database Systems I
Policy-Based Data Management
Independent Study Part I
Independent Study Part II
Metadata Architectures and Applications
Digital Libraries: Principles and Applications
Digital Preservation and Access
Data Curation and Management
San Jose State University Post-Master's Certificate in Digital Curation
Digital Curation
Tools, Services, and Methodologies for Digital Curation
Three of the following: Characteristics and Curation of New Digital Media Digitization and Digital Preservation Electronic Records Information Assurance
Simmons College Digital Stewardship Certificate
Digital Stewardship and Archiving
Preserving Digital Media

As Table 15 indicates, topics underlined in these certificate programs' required courses include digital or data curation (seven of nine), digital preservation (seven), collection issues (four), information technology (three), metadata (three), databases (three), management issues

(three), digital libraries (two), electronic records (two), introductory courses on archives and records management (two), and independent study (two).

Table 15: Consolidated Course Topics (Certificates)

Course Topic	**Program**
Digital preservation	University of Arizona
	Johns Hopkins University
	University of Maine
	UNC Digital Curation Certificate
	UNC Post-Master's Certificate
	San Jose State University
	Simmons College
Digital/data curation or stewardship	Dominican University
	Johns Hopkins University
	University of Maine
	UNC Post-Master's Certificate
	San Jose State University
	Simmons College
Information Technology	University of Arizona
	UNC Digital Curation Certificate
	UNC Post-Master's Certificate
Metadata	Dominican University
	University of Maine
	UNC Post-Master's Certificate
Collections	University of Arizona
	University of Maine
Management	University of Arizona
	Johns Hopkins University
Databases	University of Maine
	UNC Post-Master's Certificate
Digital libraries	UNC Digital Curation Certificate
	UNC Post-Master's Certificate
Electronic Records	UNC Digital Curation Certificate
	San Jose State University
Introduction to Archives and Records Management	Dominican University
	UNC Digital Curation Certificate

Lessons Learned

Certificate programs suggest, first, that a program may profit from being structured around the curatorial lifecycle stages.[71] Second, any field experience component would likely be enhanced by producing concreate deliverables that add value to the assets of the host institution and can be added to the student's vita.[72] Finally, if the educational program takes place online, program designers might consider employing a variety of media to accommodate different learning styles. For instance, DigIn incorporates hands-on technological demonstrations, Elluminate synchronous video conferencing, or and audio podcasting of lectures.[73]

Workshops

Six workshops provide digital curation education to graduate students, faculty, or researchers (Table 16). Three of the six are based upon the New England Collaborative Data Management Curriculum (NECDMC) developed by the University of Massachusetts-Amherst and Worcester Polytechnic Institute Libraries (Kafel, Creamer and Martin 2014) (Piorun, et al. 2012).[74]

Table 16: Digital Curation Workshops

Workshop Title	Institution	Instructors	Constituents	Mode of Delivery
Research Data Management	University of Houston	University Librarians	Graduate students	On campus

[71] http://digitalcuration.umaine.edu/

[72] http://advanced.jhu.edu/academics/certificate-programs/digital-curation-certificate/

[73] http://sirls.arizona.edu/programs/digIn

[74] The New England Collaborative Data Management Curriculum (NECDMC) employs the following modules: Overview of Research Data Management; Types, Format, and Stages of Data; Contextual Details Needed to Make Data Meaningful to Others; Data Storage, Backup, and Security; Legal and Ethical Considerations for Research Data; Data Sharing and Reuse Policies; and Archiving and Preservation. "Perhaps the greatest achievement of the NECDMC is its attempt to standardize instruction around the unwieldy topic of research data management" (Peters and Vaughn 2014, 99). On the other hand, the NECDMC needs to be modified to apply to those outside of sciences and engineering (Peters and Vaughn 2014).

101 (NECDMC)[75]				
Data Management Basics[76]	University of Massachusetts-Amherst	University Librarians	Graduate students	On campus
Creating a Data Management Plan for Your Grant Application[77]	University of Minnesota	University Librarians	Researchers and faculty	On campus
Data Management Basics (NECDMC)[78]	University of Tennessee-Knoxville	University Librarians	Graduate students	On campus
Research Data Management (NECDMC)[79]	University of Washington	University Librarians	Graduate students	On campus
Digital Humanities Data Curation (DHDC) Institutes[80]	National Endowment for the Humanities Office of Digital Humanities	Trevor Munoz (Project Director)	Open	On campus

Lessons Learned

Nine lessons can be gleaned from digital curation education workshops. First, librarians have a potentially foundational role in educating students, researchers, and faculty in digital curation work. Second, retention may prove an important issue. For instance, one workshop found a considerable gap between interest in the workshops and retention: 78 persons registered but only 35 showed up to the first session (Muilenberg, Lebow and Rich 2014). Third, sessions

[75] http://info.lib.uh.edu/services/faculty-and-graduate-students/data-management-resources

[76] http://www.library.umass.edu/services/services-for-faculty/data-management/

[77] https://www.lib.umn.edu/datamanagement

[78] http://libguides.utk.edu/dataforlibrarians

[79] http://guides.lib.washington.edu/rdm

[80] http://www.dhcuration.org/institute/

geared toward particular disciplines may be more valuable to participants than general ones (Eaker 2014) (Peters and Vaughn 2014). Fourth, active learning or hands-on work can play an important role (Peters and Vaughn 2014). Fifth, educational initiatives may be enriched by effecting cross-campus collaborations (Peters and Vaughn 2014). Sixth, discussion-based training and resources can help researchers familiarize themselves with data management plans and planning (Johnston, Lafferty and Petsan 2012) (Peters and Vaughn 2014). Seventh, planners might weigh a program's optimal duration: while shorter workshops may facilitate both planning and delivery, lengthier ones may permit digital curation to be covered in greater depth, they are more difficult to coordinate as well as to deliver (Eaker 2014). Eighth, among the five initiatives discussed in this chapter, workshops have done perhaps the best job in securing feedback from their participants. Therefore, evaluation mechanisms can be helpful in program development.[81]

Finally, digital curation education geared toward the digital humanities shows two further complications. First, curators who work in the digital humanities show considerable diversity in their job descriptions and their professional identities. Second, dealing with digital humanities data remains particularly challenging because of its format, its anticipated future use, and its methodological "texture" that requires documentation (Senseney, et al. 2014).

Overall Lessons Learned

Useful lessons can be extracted from comparing, contrasting, and ultimately synthesizing these 30 programs' efforts.

[81] Specific feedback obtained from workshops included requests from participants for more focus on familiar granular issues: 1) types, formats, and stages of data; 2) organization and description; 3) deposit, backup, security, and storage; 4) file naming; 5) metadata; 6) citation management tools; 7) funder policies; 8) archiving and preservation; 9) finding and exploiting datasets for research; 10) publishing datasets; and 11) legal and ethical issues (Adamick, Reznik-Zellen, & Sheridan, 2013) (Peters & Vaughn, 2014).

First, planners might benefit from considering existing programs' topical foci. Nineteen of the 30 programs list required courses. Table 17 shows the ten most-frequently mentioned topics based on course titles.

Table 17: Ten Most Frequently Listed Topics in Required Courses

Topic	Number of Courses (n=19)
Digital preservation	14
Digital/data curation/stewardship	12
Digital libraries	8
Metadata	8
Databases	5
Information technology	3
Management	2
Collections	2
Electronic Records	2
Introduction to Archives and Records Management	2

Second, planners might also consider the following nineteen criteria in developing an appropriately-configured program (Table 18).

Table 18: Potential Criteria for Digital Curation Education Programs (Rank Order)

Attribute	Programs	Sources
Integrate classroom learning and practical/real-world skills and competencies through case studies, projects, labs, and field experiences (18 programs)	CHIM	(Choi, Elings and Zhang, Developing Twenty-First-Century Cultural Hertiage Information Professionals for Digital Stewardship 2014)
		http://lis.cua.edu/MSinLS/coursesStudy/CHIM.cfm
	DCEP	(Palmer, Heidorn, Wright, & Cragin, 2007) (Renear, et al., 2011) (Thompson, Senseney, Baker, Varvel, & Palmer, 2013)
		http://www.lis.illinois.edu/research/projects/data-curation-education-program
	DCEP-H	(Renear, Palmer, & Unsworth, 2013) (Renear, et al., 2009)
	DigCCurr I	(Gregory & Guss, 2011) (Lee, 2009) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	DigCCurr II	(Lee & Tibbo, 2011) (Poole, Lee, & Murillo, 2012) (Poole 2013) (Tibbo, 2015)
		http://ils.unc.edu/digccurr/aboutI.html
	iCAMP	(Moen, Kim, Warga, Wakefield, & Halbert, 2012)
		http://icamp.unt.edu/icamp/content/icamp-project

	CHART	(Pratt-SILS with Brooklyn Historical Society, Brooklyn Museum, and Brooklyn Public Library, 2013)
		https://www.pratt.edu/academics/information-and-library-sciences/grant-scholarship-internship/chart/
	SciData	http://scidata.sis.utk.edu/
	Science Links2	http://www.sis.utk.edu/sciencelinks2
	DCERC	(Kelly, et al., 2013) (Mayernik, et al., 2015) (Palmer, Allard, & Marlino, 2011)
		http://www.sis.utk.edu/dcerc
	University of Michigan's Preservation of Information Specialization	(Yakel, Conway, Hedstrom, & Wallace, 2011) (Yakel, Conway, & Krause, 2009)
		https://www.si.umich.edu/academics/msi/preservation-information-pi
	Wayne State University's Archives and Digital Content Management Specialization	(Beaudoin, 2013)
		http://slis.wayne.edu/mlis/archives.php
	University of Arizona's Digital Information Graduate Certificate (DigIn)	(Botticelli, Fulton, Pearce-Moses, Szuter, & Watters, 2011) (Fulton, Botticelli, & Bradley, 2011)
		http://sirls.arizona.edu/programs/digIn
	Johns Hopkins University's Certificate in Digital Curation	http://advanced.jhu.edu/academics/certificate-programs/digital-curation-certificate/
	University of Maine's Digital Curation Graduate Certificate	http://digitalcuration.umaine.edu/
	San Jose State University's Post-Master's Certificate in Digital Curation	http://ischool.sjsu.edu/programs/post-masters-certificate/career-pathways/digital-curation

	University of Houston workshop	(Peters & Vaughn, 2014)
	University of Massachusetts/ Worcester Polytechnic Institute workshop	(Kafel, Creamer, & Martin, 2014) (Piorun, Kafel, Leger-Hornby, Najafi, & Martin, 2012)
Balance online and in-person components (11 programs)	UIUC's Specialization in Data Curation	https://www.lis.illinois.edu/academics/degrees/specializations/data_curation
	Kent State University's Digital Preservation Specialization	https://www2.kent.edu/slis/programs/mlis/digital-preservation.cfm
	University of Maryland's Archives and Curation Specialization	(Shilton, et al., 2013)
		http://ischool.umd.edu/content/specializations-0#Archives and Digital Curation
	Wayne State University's Archives and Digital Content Management Specialization	(Beaudoin, 2013)
		http://slis.wayne.edu/mlis/archives.php
	University of Arizona's Digital Information Graduate Certificate (DigIn)	(Fulton, Botticelli, & Bradley, 2011)
		http://sirls.arizona.edu/programs/digIn
	Johns Hopkins University's Certificate in Digital Curation	http://advanced.jhu.edu/academics/certificate-programs/digital-curation-certificate/
	UNC's Graduate Digital	http://sils.unc.edu/programs/certificates/digital_curation

	Curation Certificate	
	Kent State University's Certificate of Advanced Study in Digital Preservation	https://www2.kent.edu/slis/programs/mlis/digital-preservation.cfm
	UNC's Post-Master's Certificate in Data Curation	http://sils.unc.edu/programs/graduate/post-masters-certificates/data-curation
	Simmons College's Digital Stewardship Certificate	(Anderson, Bastian, Harvey, Plum, & Samuelsson, 2011) (Bastian, Cloonan, & Harvey, 2011) (Bastian, Harvey, Mahard, & Plum, 2010) (Harvey & Bastian, 2012) (Mahard and Harvey, Digital Stewardship Education at the Graduate School of Library and Information Science, Simmons College 2013)
		http://www.simmons.edu/academics/certificate-programs/digital-stewardship-certificate
	University of Massachusetts/ Worcester Polytechnic Institute	(Creamer, Morales, Kafel, Crespo, & Martin, 2012)
Facilitate collaborations on- and off-campus (6 programs)	CHIM	(Choi, Elings and Zhang, Developing Twenty-First-Century Cultural Hertiage Information Professionals for Digital Stewardship 2014)
		http://lis.cua.edu/MSinLS/coursesStudy/CHIM.cfm
	DCEP-H	(Renear, Palmer, & Unsworth, 2013) (Renear, et al., 2009)
	DCERC	(Kelly, et al., 2013) (Mayernik, et al., 2015) (Palmer, Allard, & Marlino, 2011)
		http://www.sis.utk.edu/dcerc
	iCAMP	(Moen, Kim, Warga, Wakefield, & Halbert, 2012)
		http://icamp.unt.edu/icamp/content/icamp-project
	CHART	(Pratt-SILS with Brooklyn Historical Society, Brooklyn Museum, and Brooklyn Public Library, 2013)
		https://www.pratt.edu/academics/information-and-library-sciences/grant-scholarship-internship/chart/
	University of Houston workshop	(Peters & Vaughn, 2014)
	DCEP	(Palmer, Heidorn, Wright, & Cragin, 2007) (Renear, et al., 2011) (Thompson, Senseney, Baker, Varvel, & Palmer, 2013)

Develop curriculum (5 programs)		http://www.lis.illinois.edu/research/projects/data-curation-education-program
	DECP-H	(Renear, Palmer, & Unsworth, 2013) (Renear, et al., 2009)
	DigCCurr I	(Gregory & Guss, 2011) (Lee & Tibbo, 2010) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	CHART	(Pratt-SILS with Brooklyn Historical Society, Brooklyn Museum, and Brooklyn Public Library, 2013)
		https://www.pratt.edu/academics/information-and-library-sciences/grant-scholarship-internship/chart/
	DCERC	(Kelly, et al., 2013) (Mayernik, et al., 2015) (Palmer, Allard, & Marlino, 2011)
		http://www.sis.utk.edu/dcerc
Encourage professional development (5 programs)	DCEP-H	(Renear, Palmer, & Unsworth, 2013) (Renear, et al., 2009)
	DigCCurr I	(Gregory & Guss, 2011) (Lee & Tibbo, 2010) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	CHART	(Pratt-SILS with Brooklyn Historical Society, Brooklyn Museum, and Brooklyn Public Library, 2013)
		https://www.pratt.edu/academics/information-and-library-sciences/grant-scholarship-internship/chart/
	DCERC	(Kelly, et al., 2013) (Mayernik, et al., 2015) (Palmer, Allard, & Marlino, 2011)
		http://www.sis.utk.edu/dcerc
	Science Links2	http://www.sis.utk.edu/sciencelinks2
Develop sharable model or deliverable (5 programs)	DCEP	(Palmer, Heidorn, Wright, & Cragin, 2007) (Thompson, Senseney, Baker, Varvel, & Palmer, 2013) (Weber, Palmer, & Chao, 2012)
		http://www.lis.illinois.edu/research/projects/data-curation-education-program
	DigCCurr I	(Gregory & Guss, 2011) (Lee & Tibbo, 2010) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	iCAMP	(Moen, Kim, Warga, Wakefield, & Halbert, 2012)
		http://icamp.unt.edu/icamp/content/icamp-project
	DCERC	(Kelly, et al., 2013) (Mayernik, et al., 2015) (Palmer, Allard, & Marlino, 2011)
		http://www.sis.utk.edu/dcerc
	Science Links2	http://www.sis.utk.edu/sciencelinks2
Engage LIS professionals in teaching or	University of Massachusetts/ Worcester Polytechnic	(Kafel, Creamer, & Martin, 2014) (Piorun, Kafel, Leger-Hornby, Najafi, & Martin, 2012)

support roles (5 programs)	Institute workshop	
	University of Massachusetts workshop	(Adamick, Reznik-Zellen, & Sheridan, 2013)
	University of Minnesota workshop	(Johnston, Lafferty, & Petsan, 2012)
	University of Tennessee workshop	(Eaker, 2014)
	University of Washington workshop	(Muilenberg, Lebow, & Rich, 2014)
Foreground the data lifecycle (4 programs)	CHIM	(Choi, Elings and Zhang, Developing Twenty-First-Century Cultural Hertiage Information Professionals for Digital Stewardship 2014)
		http://lis.cua.edu/MSinLS/coursesStudy/CHIM.cfm
	University of Michigan's Preservation of Information Specialization	(Yakel, Conway, & Krause, 2009) (Yakel, Conway, Hedstrom, & Wallace, 2011)
		https://www.si.umich.edu/academics/msi/preservation-information-pi
	University of Arizona's Digital Information Graduate Certificate (DigIn)	(Botticelli, Fulton, Pearce-Moses, Szuter, & Watters, 2011) (Fulton, Botticelli, & Bradley, 2011)
		http://sirls.arizona.edu/programs/digIn
	University of Maine's Digital Curation Graduate Certificate	http://digitalcuration.umaine.edu/
Develop new courses (3 programs)	DigCCurr I	(Gregory & Guss, 2011) (Lee & Tibbo, 2010) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	DigCCurr II	(Lee & Tibbo, 2011) (Poole, Lee, & Murillo, 2012) (Poole 2013) (Tibbo, 2015)
		http://ils.unc.edu/digccurr/aboutI.html
	Science Links2	http://www.sis.utk.edu/sciencelinks2
Develop a research	DCEP	(Palmer, Heidorn, Wright, & Cragin, 2007) (Renear, et al., 2011) (Thompson, Senseney, Baker, Varvel, & Palmer, 2013)

agenda (3 programs)		http://www.lis.illinois.edu/research/projects/data-curation-education-program
	DigCCurr II	(Lee & Tibbo, 2011) (Poole, Lee, & Murillo, 2012) (Poole 2013) (Tibbo, 2015)
		http://ils.unc.edu/digccurr/aboutI.html
	DCERC	(Kelly, et al., 2013) (Mayernik, et al., 2015) (Palmer, Allard, & Marlino, 2011)
		http://www.sis.utk.edu/dcerc
Offer new courses	DigCCurr I	(Gregory & Guss, 2011) (Lee & Tibbo, 2010) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	DigCCurr II	(Lee & Tibbo, 2011) (Poole, Lee, & Murillo, 2012) (Poole 2013) (Tibbo, 2015)
		http://ils.unc.edu/digccurr/aboutI.html
	Science Links 2	http://www.sis.utk.edu/sciencelinks2
Stimulate research	DCEP	(Palmer, Heidorn, Wright, & Cragin, 2007) (Renear, et al., 2011) (Thompson, Senseney, Baker, Varvel, & Palmer, 2013)
		http://www.lis.illinois.edu/research/projects/data-curation-education-program
	DigCCurr II	(Lee & Tibbo, 2011) (Poole, Lee, & Murillo, 2012) (Poole 2013) (Tibbo, 2015)
		http://ils.unc.edu/digccurr/aboutI.html
	DCERC	(Kelly, et al., 2013) (Mayernik, et al., 2015) (Palmer, Allard, & Marlino, 2011)
		http://www.sis.utk.edu/dcerc
Tailor content to particular disciplines (2 programs)	University of Houston workshop	(Peters & Vaughn, 2014)
	University of Tennessee workshop	(Eaker, 2014)
Address data management plans and planning (2 programs)	University of Houston workshop	(Peters & Vaughn, 2014)
	University of Minnesota workshop	(Johnston, Lafferty, & Petsan, 2012)
Develop a certificate (2 programs)	DigCCurr I	(Gregory & Guss, 2011) (Lee & Tibbo, 2010) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	iCAMP	(Moen, Kim, Warga, Wakefield, & Halbert, 2012)
		http://icamp.unt.edu/icamp/content/icamp-project
Recruit attendees for	DCEP-H	(Renear, Palmer, & Unsworth, 2013) (Renear, et al., 2009)

diversity (2 programs)	CHART	(Pratt-SILS with Brooklyn Historical Society, Brooklyn Museum, and Brooklyn Public Library, 2013)
		https://www.pratt.edu/academics/information-and-library-sciences/grant-scholarship-internship/chart/
Adopt a modular approach (2 programs)	DigCCurr I	(Lee, 2009) (Lee & Tibbo, 2011) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	New England Collaborative Data Management Curriculum (NECDMC)	(Piorun, Kafel, Leger-Hornby, Najafi, & Martin, 2012)
Determine the optimal structure and duration of the program based on its constituents (one-shot workshop, full-semester offering, or something in between) (2 programs)	University of Tennessee workshop	(Eaker, 2014)
	University of Washington workshop	(Muilenberg, Lebow, & Rich, 2014)
Solicit frequent feedback and evaluation from participants (2 programs)	University of Houston workshop	(Peters & Vaughn, 2014)
	University of Massachusetts workshop	(Adamick, Reznik-Zellen, & Sheridan, 2013)
Develop certificate	DigCCurr I	(Lee, 2009) (Lee & Tibbo, 2011) (Lee, Tibbo, & Schaefer, 2007) (Lee, Tibbo, & Schaefer, 2007)
		http://ils.unc.edu/digccurr/aboutI.html
	iCAMP	(Moen, Kim, Warga, Wakefield, & Halbert, 2012)
		http://icamp.unt.edu/icamp/content/icamp-project
Recruitment	DCEP-H	(Renear, Palmer, & Unsworth, 2013) (Renear, et al., 2009)
	CHART	(Pratt-SILS with Brooklyn Historical Society, Brooklyn Museum, and Brooklyn Public Library, 2013)
		https://www.pratt.edu/academics/information-and-library-sciences/grant-scholarship-internship/chart/

Use varying delivery methods (1 program)	University of Arizona's Digital Information Graduate Certificate (DigIn)	(Botticelli, Fulton, Pearce-Moses, Szuter, & Watters, 2011) (Fulton, Botticelli, & Bradley, 2011)
		http://sirls.arizona.edu/programs/digIn
Balance disciplinary/ domain knowledge and technical skills (1 program)	DCEP	(Palmer, Heidorn, Wright, & Cragin, 2007) (Thompson, Senseney, Baker, Varvel, & Palmer, 2013) (Weber, Palmer, & Chao, 2012)
		http://www.lis.illinois.edu/research/projects/data-curation-education-program
Use various media environments (1 program)	University of Michigan's Preservation of Information Specialization	(Yakel, Conway, & Krause, 2009) (Yakel, Conway, Hedstrom, & Wallace, 2011)
		https://www.si.umich.edu/academics/msi/preservation-information-pi

Although these criteria are helpful heuristics for planning, Moles and Ross (2013) remind us, "The almost countless number of variables that need to be given consideration in the development and execution of curation programs will inevitably vary widely even between similar circumstances" (16).

Conclusion

Teal and her colleagues (2015) remark, "Ideally, training would be high quality with materials vetted by practiced instruction, consistent across universities and locations, could be deployed at multiple and disparate locations, allow researchers to interact with the materials and the instructors, and provide a relatively easy entry in to learning new topics" (136). In similar spirit, Lyon and Brenner (2015) look toward digital curation initiatives to make the transition "from specializations or special topics, to become embedded within the core curriculum and are viewed as central to the mission, or to put it another way, data is mission-critical for iSchools" (119). "Graduate-level programs are springing up although no one curricular model is as of yet

dominant," suggests Tibbo (2015, 151). Most optimistic, a CLIR report (2013) predicts a "national blossoming of professional curricula and certification programs for data curation" (10). Much work remains to be done to fulfill this vision.

"Professional education is a process that is never completed" comment Lee and Tibbo (2011, 167). Parry (2014) contributes, "These are early days in a process of defamiliarization." Just as the digital curation profession remains "a moving target," so too does digital humanities. Thus both pedagogical fields represent, as Pryor (2013) puts it, a "maturing process of engagement." This dissertation seeks to promote that process of maturation.

Chapter 5: Research Methods

> The purpose of a research inquiry is to "resolve" the problem in the sense of accumulating sufficient knowledge to lead to understanding or explanation, a kind of dialectical process that plays off the theoretical and antithetical propositions that form the problem into some kind of synthesis.
>
> -Lincoln & Guba (1985), 227

> The key purpose of undertaking research is to advance society and its understanding across a range of disciplines.
>
> -Pickard (2013), 76

This study employed qualitative methods situated in a naturalistic setting. Favoring emergent research design, it adopted a case study approach. It relied upon semi-structured interviews guided by snowball sampling; it supplemented interview data with documentary evidence. Finally, it embraced inductive and iterative coding methods and constructivist grounded theory analysis.

Research Questions

Research questions concentrate on professional practice or add to the knowledge of the field. My research questions addressed both of these goals. Research questions hinge upon

problem identification, i.e. "unsatisfactory" situations (Wildemuth, Developing a Research Question 2009).

My research questions gestated in my scholarly interests in digital curation and digital humanities.[82] Humanities increasingly engage with digital data; this shift toward data-driven research can be enabled and augmented through digital curation. Thus I pinpointed a gap—an "unsatisfactory" situation in the literature and in practice, namely that the potential for symbiosis between the two fields had not yet been explored.

This dissertation centered on the following research questions:

- What types of data have digital humanists (whether faculty, "alternative-academics,"[83] (alt-acs) or graduate students) created, reused, stored, and planned to reuse in their SUG project?
- What digital curation skills (if any) did they employ and how did they acquire them?
- Are digital humanists interested in acquiring skills to help curate their data and if so, what content would they like to learn?
- What sort of educational framework would be most useful to help them learn more about curating their data?

Participants: The Office of Digital Humanities Start-Up Grants

This study focused on members of project teams that received National Endowment for the Humanities's Office of Digital Humanities's Start-Up Grants (SUGs).[84] I derived my sample

[82] My coursework and my DigCCurr II (2010-2013) fellowship responsibilities were also important influences.

[83] As Bethany Nowviskie puts it, "The #alt-ac label speaks to a broad set of hybrid, humanities-oriented professions centered in and around the academy, in which there are rich opportunities to put deep—often doctoral-level—training in scholarly disciplines to use." See http://chronicle.com/blogs/profhacker/the-alt-ac-track-negotiating-your-alternative-academic-appointment-2/26539

[84] http://www.neh.gov/grants/odh/digital-humanities-start-grants

from the larger population (more than 360 as of the end of the 2014 grant cycle) of NEH-ODH Start-Up Grants awarded since 2007. In line with my interest in studying recent and memorable experiences, I focused on the 23 SUGs slated for completion in 2014.

Up to eighteen months in duration, SUGs offer monies "to support the initial phases of projects offering innovative approaches to the use of emerging technologies in the humanities."[85] Competitively awarded (16% success rate), these grants fund United States-based scholars whose project embrace a "high risk/high reward" model characteristic of the natural sciences.

To maximize the likelihood of interviewee recall, I focused on the 23 SUGs that began in May of 2013 and were slated to be completed by the end of 2014 (no-cost extensions notwithstanding). I approached the Principal Investigators (34 in total) of each of these 23 projects as my initial contacts.

Ultimately, I secured participation by representatives from nineteen of those 23 projects. After interviewing each initial participant, I requested referrals to other project stakeholders (a form of snowball sampling). PIs most frequently referred me to their graduate students, though some referred me to librarians or to others involved in the project. I interviewed 45 scholars, 44 of whom are based in the United States.

Sampling

Pickard (2013) maintains, "The outcomes, rigor, and trustworthiness of your research all rely on the robustness of the sample and how that sample was identified (66). Qualitative inquiry, she elaborates, usually employs purposive sampling. Three considerations guided my sampling strategy. First, purposive sampling dovetailed with emergent design. The successive

[85] http://www.neh.gov/files/grants/digital-humanities-start-faqs_2014.pdf

chosen units, moreover, complemented the data already gathered, provided contrasting data, or filled in gaps. Third, sampling continued to the point of redundancy (Lincoln and Guba 1985).

Taking a user-centered approach, I posed "viewpoint-driven" questions, focusing on the actual information practices of a sample of researchers working in the digital humanities. (Benardou, Constantopoulos, et al. 2010). My recruitment script is available in Appendix B.

Snowball Sampling

Among the methods that exploits social networks, snowball sampling presupposes that ties exist between the initial persons initially consulted and others in the same target population. Snowball sampling allows a researcher to ferret out participants where they are few in number or difficult to locate or when higher levels of trust are needed to initiate participation (Atkinson and Flint 2004, 1044). On the other hand, snowball sampling necessitates that participants know others similar to themselves who are eligible for the study (Morgan 2008).

The investigator first contacts and interviews key informants involved with information-rich cases. Based on my goal of developing recommendations and best practices for digital curation education, I chose to contact SUG project participants. These researchers represent a core group of those digital humanities researchers that digital curation education initiatives may serve.

First, I contacted SUG PIs. These original sources consented to interview requests, referred me to other project personnel, or both. I thus could not generalize from my sample, therefore: its elements depended upon the judgment of earlier respondents.

Over the course of the research, the investigator controls the sample's start, progress, and close (Biernacki and Waldorf 1981). I found this true in general, though I was beholden to the

schedules and commitment of each member of the sample. As data collection proceeded, so too did analysis.

The sampling process continues until an adequate sample size is reached, no new names are collected from the process, or when the data become repetitive (known as saturation in grounded theory) (Pickard 2013). Specifically, I focused on saturation of my categories, where "continuing data collection produces tiny increments of new information in comparison to the effort expended to get them" (Lincoln and Guba 1985, 350). Rubin and Rubin (2005) elaborate: As you continue to interview people from each of the relevant categories, each new conversation should add less and less to what you already know, until all you start hearing are the same matters over and over again" (67).

Since I did not stipulate a predetermined sample size, I focused on the latter two criteria (names and repetitive data). My work covered nineteen projects and 45 persons; as Weiss (1994) notes pithily, "when further inquiry will add little to the story, stop inquiring" (21).

Rationale for Qualitative Research and a Naturalistic Approach

Qualitative research offers "richer opportunities for gathering and assessing…what the participant values, believes, thinks, and feels about social life" (Saldana 2013, 92). A qualitative approach may be particularly useful when research foci are clear, when the settings are not easily accessible, when the researcher faces time constraints, and when the research focuses on more than one topic (Taylor and Bogdan 1998). Qualitative research often focuses on exploration, description, and comparison (Bernard and Ryan 2010).

Naturalistic Inquiry

The naturalistic paradigm accommodates heterogeneity, ambiguity, and reflexivity. It presupposes qualitative methods, emergent design, a human instrument, focused boundaries and

purposive sampling, inductive, grounded data analysis, idiographic interpretation, and case study reporting mode (Lincoln and Guba 1985). Thus it was well-suited to this study.

The Case Study Approach

Optimal for naturalistic studies, case studies constitute "interpretive instrument[s] for an idiographic construal of what was found" (Lincoln and Guba 1985, 189). Researchers employ case studies to tackle "how" and "why" questions (i.e. in a natural setting) (Choemprayong and Wildemuth 2009) (Yin 2009). Case studies "provide lots of descriptive data, are lifelike, and simplify the data that a reader has to assess" (Bernard and Ryan 2010, 43). Moreover, case studies are useful for description and results may be leveraged to improve actions decisions (King 1994) (Sholtz and Tietje 2002).

First, a case study probes contemporary phenomenon in depth and in real-life contexts. Exploring the most recent round of ODH Start-Up Grant projects constituted just such an inquiry. Second, the researcher relies on multiple sources of evidence (viz., data convergence) (Yin 2009). I obtained multiple perspectives by using multiple methods of data collection, by gathering data based on multiple units of analysis, and by aggregating it to understand the case as a whole (Choemprayong and Wildemuth 2009). Not to be overlooked, finally, the investigator must demarcate the beginning and the end of the case. Choosing grant projects with explicit temporal boundaries satisfied this criterion.

Units of analysis may include individuals, decisions, programs, implementation processes, and organizational changes; they also may include aggregates (groups or organizations), projects, events, and artifacts and changes to artifacts (Choemprayong and Wildemuth 2009) (C. A. Lee 2005) (Yin 2009). My units of analysis included actors, projects, project teams, and artifacts and changes to artifacts. Actors have agency in the Start-Up Grant

projects; actors included individuals and project teams. Projects were the nineteen Start-Up Grants whose personnel consented to interviews. Artifacts were units of textual and media materials. Finally, changes to artifacts were changes (revisions, additions, subtractions) in those artifacts over time, for instance changes in project plans or project plans or outcomes.

Research Design

In naturalistic studies, research design remains emergent. Therefore, "Probably all that can be promised in advance is that 'understanding will be increased,' and that that increase will be noticeable to a variety of audiences" (Lincoln and Guba 1985, 225). Raising awareness and enhancing understanding remain a crucial goal of this dissertation. An emergent design suited this study because little scholarship tackles the potential for collaboration among digital curation professionals and digital humanities scholars in their work and in their education.

Trustworthiness

A study's worth essentially depends upon its trustworthiness. Investigators should verify the accuracy of accounts, welcome negative evidence, and look for alternative explanations (Bernard and Ryan 2010).

First, internal validity refers to the sample's representativeness with respect to the overall population of inquiry. Snowball sampling militates against generalizability. I did not use statistical verification to confirm findings from my 45 interviews; rather, I relied upon triangulation, which can "potentially generate…'holistic work' or 'thick description'" (Jick 1979, 609).

I interviewed more than one person from each project whenever possible, hoping that this would shed light on shared work practices and priorities. Similarly, I consulted multiple

document types about each project and I asked interviewees about the same project but in different ways (i.e. by posing multiple questions during each interview).

Second, external validity refers to the extent to which the data measure what the researcher claims. The investigator can generalize from case studies only theoretically: transferability needs to be reassessed in each case. I used both documents and interviews to acquire a more complete picture.

Finally, the University of North Carolina at Chapel Hill Institutional Review Board (IRB) approved my application in July of 2014. Similarly, I secured informed consent from each participant before conducting each interview.

Data Collection

In constructing data, an investigator homes in on actions and processes, especially on who did what, when, where, why, and how. The investigator examines contexts, situations, and conditions under which actions and processes occurred. She remains sensitive to telling words and phrases and to participants' tacit assumptions (Charmaz 2014).

In line with Charmaz's prescriptions, I collected interview and documentary data to understand the range of contexts immanent in my study and to show the variation of participants' views and actions over time. Similarly, I achieved multiple views of participants' actions and I parlayed my data into the development of analytic categories amenable to comparison.

Goals of thoroughness, accuracy, believability, and transparency steered my data collection as well as my overall research agenda (Rubin and Rubin 2005). First, thoroughness involves not only the exploration of novel paths, but also continual redesign, alternative explanation testing, and following referrals. Second, accuracy involves describing and explaining a phenomenon such that participants understanding the researcher's depiction of their world.

Third, believability emanates from demonstrating that the researcher has not been misled by memory, flawed evidence, or participant bias. Fourth, transparency permits the audience "to assess the thoroughness of the design of the work as well as the conscientiousness, sensitivity, and biases of the researcher" (Rubin and Rubin 2005, 76).

Rationale for Qualitative Interviewing

Qualitative interviewing depends upon understanding experiences and upon reconstructing events (Rubin and Rubin 2005). Interviews allow an investigator to integrate multiple perspectives, to discern processes, and to develop holistic descriptions (Weiss 1994). Its practitioners "expect people to see somewhat different things, examine them through distinct lenses, and come to somewhat different conclusions" (Rubin and Rubin 2005, 27). This was evident when I compared interviews from multiple persons working on the same Start-Up Grant project.

Qualitative interviews are well-suited to a constructivist grounded theory approach. Charmaz (2014) suggests, "Constructivist grounded theorists attend to the situation and construction of the interview, the construction of the research participant's story and silences, and the interviewer-participant relationship as well as the explicit content of the interview" (91). I focused on fostering mutuality and teasing out the participant's definitions of terms, her assumptions, and her understanding of situations and events (Charmaz 2014).

Semistructured interviews combine flexibility and control; the interviewer and the participant co-construct the conversation (Charmaz 2014). In particular, the interviewer may tweak the order and the details of topics. Hence she gives some control to the interviewee. Still,

the interviewer asks nearly the same if not the same questions to each interviewee, so comparisons across interviews are possible (Bernard and Ryan 2010).

By conducting semi-structured interviews based on a 21-question instrument, I targeted the meanings digital humanists ascribe to the experiences, actions, and processes in their daily working lives as seen through the lens of their particular Start-Up Grant project. I focused my interview questions on the interviewees' most recent project (i.e. their NEH-ODH Start-Up Grant scheduled for completion in 2014) to maximize the likelihood of their recalling information accurately. These interviews yielded focused data for developing conceptual categories. My questionnaire is available in Appendix A.

I followed this instrument over the course of my 45 interviews, making only one notable modification. When I initially contacted PIs, several asked to look at my interview instrument; they then informed me that they had nothing to contribute. I felt that my inability to go through the instrument with them and explain key terms (e.g. "data") and provide context as to my goals deterred them from participating. As a result, I chose not to provide the instrument in advance to subsequent interviewees. This also allowed me a certain useful flexibility during the interview. Depending upon the flow of the interview, I adjusted the order of my questions slightly. But ultimately, the interview instrument as originally constructed generated rich data.

The Interview Process

To combat potentially formulaic responses, I asked each of my 45 interviewees to define her terms and to expand upon her responses (Rubin and Rubin 2005). "Each new interview can…be a test, the results of which will support the minitheory, discredit it, or, most likely, require that it be augmented or qualified" (Weiss 1994, 179). I sought to capture detail, depth, nuance, and vividness in each of my interviews.

Detail involves drawing out specifics from the interviewee to understand the unexpected; depth involves picking up explanations from participants with diverse opinions and experiences. To gain nuance, the researcher elicits descriptions showing "that things are not always true or not true, that they may be true in part, or true in some circumstances or at some times" (Rubin and Rubin 2005, 132). Finally, a vivid interview leads to a report that will engage its readers emotionally as well as intellectually.

Interviews proceed through five stages. In the introduction, the researcher establishes the grounds for a positive and empathetic relationship. I did so by researching each interviewee's background, scholarship, and research interests as well as her particular roles and responsibilities in her SUG project. Additionally, I answered any questions the interviewee had, described my work and how her interview data contributed to it, and thanked the interviewee for her time.

Next, the researcher introduces easy, non-threatening questions while underscoring her interest in the interviewee and the interviewee's knowledge. I did this by asking broad questions about the grant and the person's role in it. Third, the researcher segues into tougher questions; in this study, such questions centered on specific work done on the grant, its outcomes, and lessons learned. Fourth, the researcher eases herself and the interviewee down into less stressful questions; she may request documents at this point. I asked for referrals at this stage, requested data management plans, and answered any questions posed by the interviewee. Finally, the interview closes: the researcher thanks her participants and arranges for possible follow-up. I reiterated my appreciation to the interviewee and ensured that she would be willing to expand upon or clarify any of her answers (Rubin and Rubin 2005).

Given memory's flaws, interview data is scarcely unimpeachable. I countered possible bias in three ways. First, I focused on things participants remembered well, namely on critical

incidents centering on motivations, perceptions, and attitudes. Second, I relied on external sources of documentation, namely materials collected by the Office of Digital Humanities from grantees such as applications, reports, and White Papers. Finally, I resorted to multiple data collection and analysis techniques.

Data Collection

Interviews took place between August and November of 2014. I used the telephone and Skype as my primary data collection mechanisms. Deakin and Wakefield (2014) observe: "the face-to-face interview has become somewhat of a 'gold standard' (604). Nonetheless, "there is no need to consider the use of telephones for narrative interviewing as a 'second-best' option" (Holt 2010, 120). Phone interviews may be especially effective when the investigator employs a purposive sampling strategy (Block and Erskine 2012).

Phone interviews allowed me to reduce costs, to increase the geographical reach of my study, and to make efficient use of time (Block and Erskine 2012). On the other hand, in some cases it seemed slightly more difficult to establish trust with an interviewee, likely due to a lack of visual cues (eye contact, facial expressions, and body language) (Block and Erskine 2012). At times I needed to direct conversations more explicitly because of the lack of visual clues (Holt 2010). Overall, I conducted 34 interviews (35 persons) over the phone.

In addition to the telephone, I relied upon Skype, which allowed me to communicate with and to see participants in real time. I conducted seven interviews (including eight persons) through this medium. As with the telephone, Skype interviewing requires that the investigator deliver a short scripted passage acquiring verbal consent; in neither medium is this necessarily conducive to building trust or rapport prior to the interview (Deakin and Wakefield 2014). Skype may prove technologically less reliable than the telephone, namely in its "drop-outs." I

experienced drop-outs in three of the seven Skype interviews. Finally, I conducted two interviews via email (Burns 2010). More specifically, I sent my interview instrument to each participants and she answered the questions to the best of her ability before sending the document back.

Documentary Evidence

Documents offer historical insight; they may also provide information not available in spoken form (Hodder 2000). Documents are available, stable, rich (viz., context-grounded), legally unassailable, and nonreactive (Lincoln and Guba 1985). They may prove more accurate than self-reports (Wildemuth, Existing Documents and Artifacts as Data 2009).

Charmaz (2014) asserts: "A study of what a document does can include the following: 1) what its originators intended to accomplish; 2) the process of producing the document; 3) what and whom the document affects; 4) how various audiences interpret it; 5) how, when, and to what extent these audiences use the document" (46).

But documents have limitations. First, the investigator cannot control the documents' scope, the way they were created, or whether they remain extant. Second, to capture the full meaning of the document, the investigator needs to apprehend the social context of the document's creation (C. A. Lee 2005) (Wildemuth, Existing Documents and Artifacts as Data 2009). Finally, documents fall prey to intentional and unintentional error as well as to possible manipulation by the creator (likely to her advantage) (Lincoln and Guba 1985).

I used documentary evidence to complement the data I obtained through qualitative interviews. First, material from my literature reviews established an analytical foundation for my empirical research. Second, I reviewed each interviewee's basic information, for instance her scholarship, institutional affiliation, program, and degree. Third, though some personnel shared

their grant applications with me, in most cases I relied upon Freedom of Information Act requests to the National Endowment for the Humanities. Of particular interest, each applicant submits a two-page data management plan that addresses the type(s) of data to be generated and the management strategies to be pursued regarding those data.[86] I also reviewed the completed projects' White Papers, available grant products (e.g. software code, algorithms, digital tools, articles, research notes, websites, and project schematics), any media coverage or reviews that concentrated on the grants, and any publications the grants produced.

Data Analysis

Analysis constitutes "the essential qualitative act" (Bernard and Ryan 2010, 109). It begins even before the investigator embarks upon a project; "purely" inductive studies are impossible (Bernard and Ryan 2010).

The less a researcher knows about a problem, the more important it is for her to assume an inductive approach (Bernard and Ryan 2010). Bernard and Ryan (2010) elaborate: "As you develop ideas, you test them against your observations; your observations may then modify your ideas, which then need to be tested again, and so on" (109).

Inductive analysis rests upon unitizing and categorizing. Through unitizing (coding), the investigator renders raw data into units, i.e. single discrete pieces of information, e.g. sentences or paragraphs. Second, categorizing involves grouping unitized data to offer descriptive or inferential information about contexts in which the units were developed. It effectively mirrors the constant comparative approach (Lincoln and Guba 1985).

[86] http://www.neh.gov/files/grants/data_management_plans_2013.pdf

Grounded Theory

The interviews were transcribed and open coded (Saldana 2013). While not embracing a full Grounded Theory methodology, this dissertation borrowed judiciously from it. Lincoln and Guba (1985) issue a caveat: "Defining grounded theory is…rather more complicated than appreciating the need for it" (203).[87]

Proponents of grounded theory "share a conviction with many other qualitative researchers that the usual canons of 'good science'…require redefinition in order to fit the realities of qualitative research and the complexities of social phenomena" (Corbin and Strauss 1990, 4). Thus grounded theory researchers advocate for a rejection of determinism and for the building of flexibility into research methods: phenomena invariably change in response to their environmental conditions. Grounded Theory methods represent "systematic, yet flexible guidelines for collecting and analyzing qualitative data to construct theories from the data themselves" (Charmaz 2014, 1).

Constructivist Grounded Theory methods guided my analysis. Ideal for addressing specific problems or situations, constructivist Grounded Theory methods dovetail with the qualitative and naturalistic perspective and are predicated upon semistructured interviews. They encourage a strong focus on the agency of the researcher and the study participants; they also help capture the dynamism and contextual relationships inherent in their interactions. These methods lend themselves to a strategy of iterative data collection, coding, and analysis. Finally, they explain as well as describe.

[87] Additionally, two caveats should be made about Grounded Theory and the naturalistic paradigm. First, Glaser and Strauss's pioneering work did not refer to the naturalistic paradigm; instead, they focused on prediction and explanation. Second, Glaser and Strauss saw the constant comparative method as a vehicle by which to derive theory, not just to process data (Lincoln & Guba, 1985).

Coding

I coded "slices of social life recorded in the data—participant activities, perceptions, and the tangible documents and artifacts produced by them" (Saldana 2013, 15). In so doing, I focused on processes, practical concerns, and meanings and points of view (Emerson, Fretz and Shaw 1995).

Codes "take a specific event, incident, or feature and relate it to other events, incidents, or features, implicitly distinguishing this one from others" (Emerson, Fretz and Shaw 1995, 149). A code is generally "a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language-based or visual data" (Saldana 2013, 3).

But coding is more interpretive act than precise science (Saldana 2013). Problems during coding may include the following: 1) the codes are too general; 2) they focus on topics instead of actions; 3) they overlook how persons construct actions; 4) they do not focus enough on the participant; 5) they ignore context; or they 6) summarize instead of analyze (Charmaz, 2014).

Initial codes focus on the data's subjects, its contents, its points of view, and its theoretical possibilities (Charmaz 2014). During this stage the researcher should develop "as many codes as possible…without considering possible relevance either to established concepts in one's disciplines or to a primary theoretical focus" (Emerson, Fretz and Shaw 1995, 152).

Next, I moved to focused coding. Finer-grained than initial coding, focused coding involves "building up and elaborating analytically interesting themes, both by connecting data that initially may not have appeared to go together and by delineating subthemes and topics that distinguish differences and variations within the broader topic" (Emerson, Fretz and Shaw 1995, 160). I began not only to recognize patterns, but also to think about emerging arguments.

NVivo software undergirded my coding process. Use of this tool involved three steps: creating free nodes, sorting and linking existing and new nodes, and developing codes to indicate higher order concepts (Blazeley 2007). In line with Blazeley's recommendations, I limited the number of nodes to fewer than ten (ultimately I settled upon eight) and each node went no more than two trees deep.

Focused coding channeled into category formation. Categories, maintains Charmaz (2014), "explicate ideas, events, or processes in your data—and do so in telling words" (189). Throughout this process, I engaged in constant comparison. First, I compared potentially classifiable incidents in each category. Second, I integrated categories and their properties. Third, I aimed for parsimony: I sought at once to reduce my original list of categories and to promote their saturation (Lincoln and Guba 1985).

Qualitative and naturalistic, this study's research methods capitalized upon a case study undergirded by semi-structured interviews. Participants were located through purposive sampling. Documentary evidence fleshed out interview data. Analysis was grounded: moving from initial to focused, coding proceeded iteratively and inductively. These methods worked well for an exploratory that sought to capture current researchers' work practices to inform actions decisions, namely in the generation of an educational framework.

Chapter 6: Study Results

This chapter consolidates the 21 questions from the interview instrument into four broad topics: projects examined, interviewee demographics, education, training, and skilling up, and lessons learned and challenges faced.

Projects Examined

My study targeted 23 grants; I secured participation from personnel representing nineteen of those grant projects. Table 18 maps out the projects' characteristics.

Table 19: Projects Examined

Project	Type of Grant	Discipline	Duration: Projected/ Actual (months)	Deliverable	Number of Personnel Interviewed
1	Implementation	Archaeology	12/19	Scholarly publication	4
2	Implementation	Archival Management and Conservation	13/20	Open source tool	4
3	Planning	Interdisciplinary Studies, General	12/12	Workshop	1
4	Planning	Library Science	12/12	Workshop	2
5	Implementation	Asian Languages	21/21	Prototype Platform	2
6	Planning	Humanities	10/10	Workshop	1
7	Implementation	Music History/Criticism	19/31	Database	4
8	Implementation	Arts	14/25	Software	2
9	Implementation	Interdisciplinary Studies, General	12/12	Best practices	1
10	Planning	Literature	12/16	Workshop	2
11	Implementation	Museum Studies/Historical Preservation	12/27	Prototype Platform	1

12	Implementation	Humanities	13/25	Preservation Strategies	2
13	Implementation	Archaeology	12/24	Prototype Platform	3
14	Planning	Art History/Criticism	12/18	Workshop	2
15	Planning	Humanities	12/12	Workshop	2
16	Implementation	Humanities	12/25	Web-based Tool	2
17	Implementation	Humanities	12/20	Model	3
18	Implementation	Literature	19/31	Software	2
19	Planning	Media Studies	6/18	Pilot Preservation Project	3

Interviewee Demographics

Through my interviews with PIs, I gained a top-down—"five thousand foot level" view, as interviewee 3, a PI, put it—of each project. By the same token, I also received an "in the trenches" perspective that this same PI's Project Manager (interviewee 4) offered.

Table 20: Interviewee Demographics

Interviewee	Gender	Principal Investigator	PhD	Job Title	Home Department	Institutional Affiliation (Carnegie)
1	M	N	N	Master's Student	Classical Studies	Research University-Very High
2	F	N	N	PhD Student	Archaeology	RU-VH
3	M	Y	Y	Professor	Geosciences	RU-VH
4	F	N	Y	Post-doctoral Researcher	Center for Advanced Spatial Technologies	RU-VH
5	M	N	Y	Associate Professor	Computer Science	RU-High
6	F	N	Y	Associate Professor	Writing, Rhetoric, & American Culture	RU-VH
7	F	Y	Y	Associate Professor	Computer Science	RU-High

8	M	N	N	PhD Student	Computer Science	RU-High
9	F	Y	Y	Director, Digital Research & Scholarship	Center (University Library)	RU-VH
10	F	N	N	PhD Student	Library and Information Science	RU-VH
11	M	Y	Y	Professor	Library and Information Science	RU-VH
12	M	N	Y	Independent	Independent	N/A
13	M	Y	Y	Independent	Independent	N/A
14	F	Y	Y	Faculty	English	Assoc/Pub-R-L
15	M	N	N	PhD student	Music	RU-VH
16	M	N	Y	Data Management Consultant	University Library	RU-VH
17	M	Y	Y	Associate Professor	Music	N/A
18	F	Y	Y	Professor	Music	RU-VH
19	M	Y	Y	Professor	Art History	RU-VH
20	F	N	N	PhD student	Computer Science	RU-VH
21	M	Y	Y	Associate Professor	Theology	Master's L
22	F	N	N	Master's Student	Center	RU/VH
23	M	N	N	PhD Student	English	RU-High
24	M	Y	Y	Associate Professor	History	RU/VH
25	F	N/A	N	Senior Program Officer	N/A	N/A
26	F	N/A	N	Senior Program Officer	N/A	N/A
27	F	Y	Y	Associate Professor	Digital Technology and Culture	RU/VH
28	M	N	N	Master's Student	Digital Technology and Culture	RU/VH

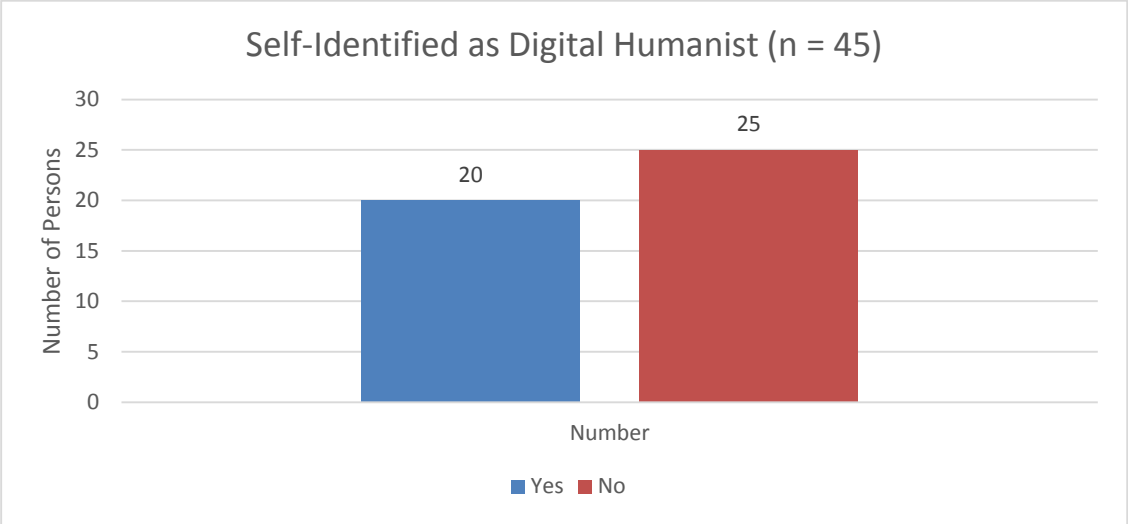
29	M	Y	Y	Assistant Professor	Archaeology	RU/VH
30	M	N	N	Archivist	University Libraries	RU/VH
31	M	N	Y	GIS Architect	A&F Administrative Systems	RU/VH
32	M	N	N	Master's Student	Library and Information Science	RU-High
33	M	N	N	Associate Director	Center	RU/VH
34	F	N	N	Master's Student	Library and Information Science	RU/VH
35	M	Y	N	Archivist	Center (University Library)	RU/VH
36	F	Y	Y	Assistant Professor	School of Literature, Media, and Communication	RU/VH
37	F	N	N	Master's Student	Digital Media	RU/VH
38	M	Y	Y	Assistant Professor	English	RU-High
39	F	N	N	PhD Student	History	RU-High
40	M	N	Y	Assistant Professor	Computer and Information Sciences	RU-High
41	M	N	N	Librarian	University Libraries	RU/VH
42	M	Y	Y	Professor	English	RU/VH
43	F	N	N	Librarian	University Libraries	RU/VH
44	M	N	N	PhD Student	Computer Science	RU/VH
45	M	N	Y	Curator	University Libraries	RU/VH

Self-Identified Digital Humanist

Perhaps surprising insofar as the SUG programs explicitly target digital humanities projects, only 20 of 45 interviewees (44.4%) self-identified as digital humanists. Interviewee 6

began her answer by chuckling, "that's the question of the hour." Many hemmed and hawed. Interviewee 19, a PI, claimed the issue was "not something I've actually thought about." Conversely, interviewee 45 downplayed the issue as "mostly semantics."

Figure 1: Self-Identified Digital Humanist



Overall, interviewees offered nuanced answers when asked if they saw themselves as digital humanists. One Principal Investigator, interviewee 35, answered, "Not by the term." Another PI, interviewee 27, hedged, saying she identified as a digital humanist "partly." A third PI, interviewee 42, characterized the issue as "such a complicated question" and elaborated that she was "not exactly" a digital humanist.

Project Managers also waffled. Though interviewee 32 said she "absolutely" self-identified as a digital humanist, interviewee 12 thought "digital humanist" a "rather nebulous label" and "not a label I like to use." In much the same way, interviewee 44 first said she was "not particularly" a digital humanist but in her next sentence conceded, "I guess I am one."

A third group, project personnel, also equivocated, using phrases such as "yes and no," "difficult to say," "to a certain extent, yes," "not sure," and "I really don't know" but "I definitely align with the digital approach." Two others linked their understanding of the digital

humanities to a certain level of technological know-how. Interviewee 2 noted that she was "interested in DH but I don't think that I personally have the tech background to call myself a digital humanist." On the other hand, interviewee 8 said, "I think so, though more on the technical side."

Last, three interviewees resorted to metaphor. Interviewee 23, a PM, called digital humanists a "spectrum" of scholars and located her work on that spectrum. Interviewee 33 referred to digital humanities as a "broad umbrella"; a third, interviewee 6, emphasized the many "flavors" of DH work.

These findings point to the inveterate debates over the definition and scope of the digital humanities. Despite the digital humanities' appearance as "a burgeoning field of intellectual inquiry and scholarly practice" (Benardou, Constantopoulos and Dallas 2013), their definition as well as their scope remains oddly ambiguous: "Identity crises abound: until yesterday we did Humanities Computing, today it's Digital *Humanities*, and the more common our practice becomes the shorter and less descriptive its designation seems to get" (Meister 2012, 77). Unsworth (2012) stresses, "Our two problems are defining, and not defining, the digital humanities" (237).

Concerns about the legitimacy of SUG digital humanities work arose. Two interviewees mentioned the challenge of demonstrating the legitimacy of the research to colleagues. Indeed, one mentioned that her colleagues did not realize that grants were peer-reviewed and competitively awarded. This suggests that the notion of grant funding as a funding or evaluation instrument is nascent in the humanities, coexisting with more conventional venues such as peer-reviewed journal articles. Institutionally, the burden of proof seemingly remains on those doing DH work. Lynch (2014) observes, "The inertia and conservatism in this system is enormous"

(Lynch 2014, 397). According to Evans and Rees (2012) Digital humanists should "ensure all of our wonderful whizz-bangy tools are equally followed up with research papers in important places" (186). Indeed, ten of nineteen projects pledged to produce articles or similar publications.

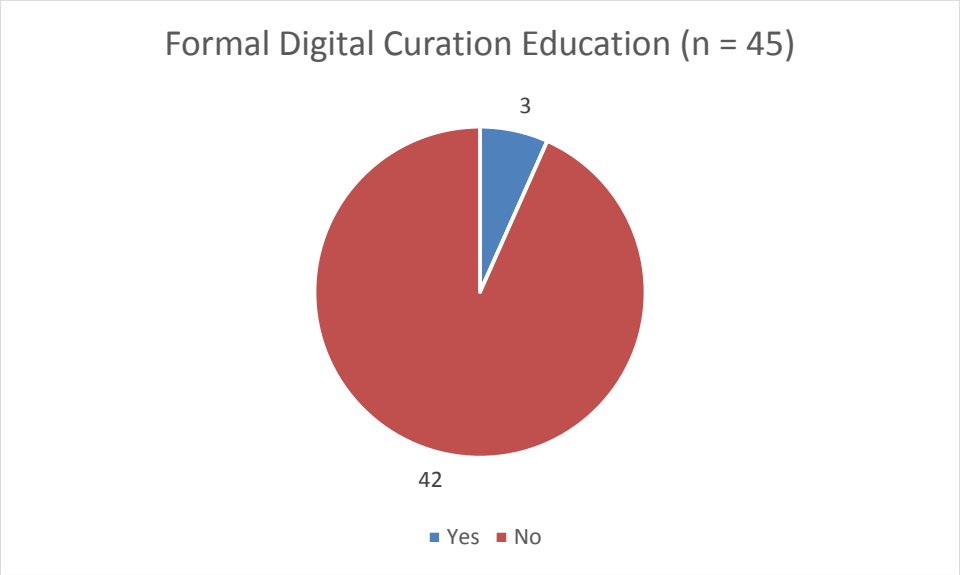
Education, Training, and Skilling Up

Formal Education in Digital Curation

Virtually none of the 45 interviewees (93.3%) had received any formal education in digital curation. The three persons who had taken courses were exposed through Library and Information Science programs (two persons) or through the National Endowment for the Humanities-funded Digital Humanities Data Curation Institute (one person). Moreover, not one interviewee was currently undertaking formal education in digital curation.

These findings paralleled those of a recent CLIR report (2013): nearly nobody in academia receives professional training or certification in digital curation. They also jibed with the findings of a recent study conducted at the University of Northampton: "the vast majority of researchers have not received, or at least do not recall having received, any training relating to data management" (Alexogiannopoulos, McKenney and Pickton 2010, 33). Finally, they mirrored the findings of a study of the first Digging into Data challenge, which stressed the roles and responsibilities of researchers, administrators, scholarly societies, funding agencies, and research libraries in digital curation education for digital humanists (Williford and Henry 2012). Most striking, however, was what the 45 interviewees either did not know or did not mention regarding digital curation education.

Figure 2: Formal Education in Digital Curation



A considerable gap exists between the potential for and the actual conduct of digital curation education. Interviewee 38, a PI, summed up: stakeholders in digital humanities are "not doing a good enough job" teaching digital curation. Interviewee 15, a PM, lamented that the nineteenth century German model of education still prevails in many institutions, including her own—a model that does not include learning about or dealing with data.

Most important, not a single interviewee thought digital curation education could be accomplished only through formal education. Interviewee 45 commented, "I don't think you can get very much by reading about [digital curation]."

On the other hand, however, one of the two interviewees who had worked in digital curation in a classroom setting (interviewee 16) found those skills "fairly transferable" to her professional duties. Along these lines, Shilton and her colleagues (2013) believe the "combination of humanistic, social science, and technology literacy fostered in information programs is a crucial and useful blend." After all, LIS remains "the only field…concerned with the full landscape of scientific information and the interactions therein, and with the provision of

services to exploit that base of information" (Palmer, Heidorn, et al. 2007, 37). But more evidence is needed to show the efficacy of formal digital curation education based in LIS programs.

Principal Investigators

Principal Investigators admitted to little if any need to skill up to engage in their projects. Overall, they emphasized the value of hands-on and immersive project-based work as the best way to learn. Not coincidentally, this was the same type of experience they themselves had endured as early stage researchers.

Interviewee 14, a PI, reflected of her digital humanities work, "I have always been self-educating." Nonetheless, she ascribed much credit to the openness and generosity of the DH community, namely in its tendency to mount their materials on the Web, in helping her facilitate this self-education. Likewise, another PI's (interviewee 9) expertise came "absolutely" and wholly from her "extracurricular" work. A third PI, interviewee 7, suggested the importance of skilling up to tackle non-technological tasks. She reflected at length: "For me, it was more of being able to talk to our potential advisory board members and figure out how they use some of these tools. That's been the main kind of learning that I personally have done, is what are the archiving needs of other research groups, and what types of things do they want to do that they've had to cobble several different tools together to do that we could help make more seamless?"

Finally, two non-PIs weighed in. One Associate Professor, interviewee 6, also stressed the need to adapt to constant changes on the Web, for instance in the development or refinement of tools, and thus also emphasized her propensity for self-education. Interviewee 16, a Data Management Consultant, meanwhile suggested that while a foundational body of knowledge

could be learned formally (e.g. what is metadata), much learning must happen as one works on particular projects given the demand-driven nature of much digital curation work. In her opinion, intellectual flexibility seemed crucial in doing digital curation.

Graduate Students

Graduate students played key roles in these nineteen projects. "On the front line of generating, processing, analyzing, and managing data," graduate students are "not a marginal component, but rather an integral piece of the data management and curation process" (Carlson and Stowell-Bracke 2013). These students perform much of the daily labor in digital curation; they also represent the researchers of the future. Thus their experiences can inform digital curation education program design. After all, "it is easier to do something right from the beginning than to unlearn bad habits and replace them with better ones" (Frugoli, Etgen and Kuhar 2010, 756).

There persists an important lacuna in the literature regarding digital curation as part of obtaining the PhD. Abbott (2015) observes, "some of the digital curation activity undertaken frequently by students themselves may in fact be being performed without the necessary skill levels to minimize both risks to data appropriateness, accuracy, and preservation, and effort on the part of the student" (9).

Graduate students, according to two recent studies, rarely learn the skills and competencies necessary to curate data even though they are expected to take on such responsibilities both as doctoral students and subsequently as scholars (Abbott 2015) (Peters and Vaughn 2014). Frugoli et al. (2010) contend, "Overburdened Principal Investigators (PIs) may forget about, delay, miss or neglect opportunities to formally address data management issues, leaving students to develop data management techniques by observing others or completely on

their own" (756). Therefore, students may undergo the so-called pain and suffering method: the student tries, fails, and then consults her advisor for feedback. This cycle then repeats until the student (ostensibly) attains competency (Carlson, Johnston, et al. 2013). In this vein, students may rely upon trial and error, consulting relevant literature, peer learning, or searching the Web. This strategy, though, may reinforce a disjuncture between project-based skills and deeper, transferable knowledge (Carlson, Johnston, et al. 2013).

On the other hand, one study found that both Master's and PhD students were apparently more aware of recent technological developments and more comfortable with hardware and software changes than their supervisors, even though these students had less experience with managing data than those supervisors (Alexogiannopoulos, McKenney and Pickton 2010). In the end, however, "it is clear that a burden of responsibility to mentor students in best practice remains with doctoral supervisors, who may not themselves have the necessary experience" (Abbott 2015, 4). Despite their prima facie approval of better digital curation, these supervisors may not know what improved curation practices would consist of; they may also be reluctant to impose rules upon their mentees (Akmon, et al. 2011). In a positive sign, however, one study found that 46% of an introductory digital curation workshop's attendees (all graduate students) were requested to attend by their advisors (Peters and Vaughn 2014).

I interviewed five Master's students and eight PhD students. Thus 11.1% of my sample was composed of Master's students and 17.8% of doctoral students. Doctoral students were the largest single group of interviewees. Overall, thirteen of my 45 interviewees (28.9%) were students at the time of the interview. These interviewees—many of whom served as project managers—offered useful insights.

Project managers described their experiences in skilling up. One doctoral student, interviewee 15, reported adapting "messily," i.e. by immersion. She recalled considerable independent work reading about and practicing with coding. A second PM (interviewee 39), also a doctoral student, described her experience as being "tossed in the deep end." Notwithstanding her own independent efforts, she capitalized on informal channels: for example, her spouse taught her how to use Makefile. A third PM (interviewee 32), a Master's student, called her self-education a "deep dive," specifically in learning about encoding standards, metadata vocabulary, and digital platforms. While she emphasized the importance of learning Library and Information Science fundamentals such as the Dublin Core Schema and the Anglo-American Cataloguing Rules (AACR2), she underlined that practical settings are "so vital" and that concepts should be applied to practice—"where the rubber hits the road." A fourth PM (interviewee 12), a postdoc, recalled needing to skill up on Java script, as her knowledge was "sorely outdated." Nonetheless, she learned throughout the project as the need arose; she did not plan to skill up in particular areas.

Other project personnel who were neither PIs nor PMs also spoke about educational challenges. One librarian, interviewee 43, noted simply that skilling up "took a lot of conscious effort." A doctoral student, interviewee 2, exclaimed, "Oh God I'm still doing that [skilling up]"; she was still "picking things up here and there." Another doctoral student, interviewee 8, contributed, "any 'training' was done on my own time and for the sake of my own knowledge rather than for the project specifically." A Master's student, interviewee 1, finally, stressed that she never had a "super overwhelming" moment, but underscored that her six-year relationship—one she characterized as master/apprentice—with one of the project's leaders was crucial. One

Master's student (interviewee 37) I interviewed perhaps said it best: personnel who work on grants such as these must be "self-driven."

PIs offered numerous suggestions for teaching digital curation to students, even as they admitted just how difficult such teaching was. One PI (interviewee 7) reflected, "I'd been breathing this stuff for years. It's really hard to take yourself back to when you were first learning this, and how do you teach somebody that? You have to use things that they know about."

Three PIs suggested the need to integrate formal and informal training. Interviewee 14 stressed the need for students to obtain the broadest possible access to digital work, for instance by starting with formal classroom instruction in basic things such as tagging, Ngrams, and word clouds. Subsequently, though, students learn best in her estimation by doing projects—that is, creating rather than merely reading about creating. Similarly, another PI (interviewee 3) preferred to skill up her students formally on technical issues, then place those students with practitioners in the field to work with an actual problem and its associated data. A third PI (interviewee 24) preferred informal to formal training given the speed of change in digital humanities work. That said, she teaches a "doing DH" class focused on using tools such as Omeka and Google Glass.

Other project personnel (neither PIs nor PMs) also weighed in on teaching students. One Associate Professor (interviewee 6) advocated treating students as responsible "fully working researchers" who work "live," for instance by contributing explicitly to coding and publications. She, too, favored a mix of formal and informal education to develop flexible and adaptable students. On the informal end of the spectrum, she encouraged students to play with tools and tech; in class, she assigns them a different tool to explore each week. Based on his experience in

both computer and library and information science, another Associate Professor (interviewee 5) stressed the need to balance coding and application. One librarian (interviewee 41), finally, also encouraged a foundation based on classroom learning (e.g. learning the rudiments of metadata), but emphasized the importance of bringing hands-on activities into the classroom as well.

Given interviewees' lack of formal education and their sundry struggles in skilling up, LIS programs have ample opportunity to recruit scholars involved in digital humanities work to digital curation education. One PI (interviewee 7) reflected, "Often it is hard to be able to articulate what you need if you don't even know that it would be possible to do, right?"

Challenges Faced and Lessons Learned

Interviewees offered 102 comments that addressed challenges they faced and lessons they learned. Each person was given the opportunity to point to as many lessons learned or challenges faced as she wanted.

These comments comprised six broad categories: data, collaboration and communication, awareness and outreach, planning and project management, resources, and technological issues. Each of these issues should interpenetrate any digital curation education program developed for digital humanities stakeholders. Despite interviewees' emphasis on data issues, they were almost equally concerned with non-technical issues. Gantz et al. (2008) observe, "Dealing with the digital universe is not a technical problem alone" (2).

Data Issues

Most frequently mentioned were data issues (32 comments). But concerns about data were dispersed. Versioning was the most commonly mentioned issue, but it figured in only four of 32 comments (12.5%).

Table 21: Data Issues

Data Issues	Number of Comments
Versioning	4
Data's size	3
Disciplinary data issues	3
Documentation	3
Cleaning data	2
Complexity of data	2
File format	2
Training data	2
Agreements	1
Artisan data	1
Backup	1
Cloud	1
Commercial services	1
Files	1
Foldering	1
Metadata	1
Quality of data	1
Reuse	1
Source data	1

Collaboration and Communication

Second, collaboration and communication earned considerable commentary from interviewees (20 comments).

Collaboration

Benefits of collaboration may include drawing upon a wider range of expertise, sharing costs and pooling resources, accessing new tools, developing standards and best practices, and raising awareness (Harvey 2010). But collaboration remains "a rather shady area" in the humanities (Benardou, Constantopoulos and Dallas 2013, 118). For instance, Molloy (2012) sees a frequent disconnect among librarians, technologists, and researchers. Another study found that digital curation support remains "generally rare, patchy, ad hoc, or simply not promoted directly to students or supervisors" (Abbott 2015, 3). A third study determined that researchers either

may not be aware of collaborative support or may not be willing to ask for help (Alexogiannopoulos, McKenney and Pickton 2010).

The term collaboration persists as "a catchphrase heard quite often, but the difficulty is in carrying it out when all the (well-meaning) actors are working at full capacity" (Maron and Pickle 2014, 55). It depends on achieving common understandings of language and terminology, methods and research styles, theories, outputs and publications, and values (Siemens, et al. 2012). A report covering the 2007-2010 SUG projects concluded, "By far, the biggest problem encountered by project directors had to do with personnel issues, either internally or with outside collaborators" (National Endowment for the Humanities, Office of Digital Humanities 2010, 27).

The Start-Up Grant projects foreground collaboration across departments, disciplines, campus units, and institutions. In the best case, these collaborations flourish. One project member lauded the relationship among the four core project team members, noting that "healthy egos" prevailed.

Doctoral students, PIs, and Office of Digital Humanities personnel spoke about the collaborative process in their interviews. First, doctoral students played foundational collaborative roles in the SUG projects. One PI (interviewee 38) characterized her doctoral student (also her PM) as the project's "linchpin." Often PIs were doctoral students' supervisors or mentors as well as their de facto employers. Additionally, in some cases graduate students played liaison roles between PIs and other project workers such as undergraduates or Master's students.

But doctoral students encountered unfamiliar challenges. One PM (interviewee 15) found it "awkward" and "a little strange" managing other graduate students for the first time because she lacked preparatory project management training.

Second, Principal Investigators reflected upon their collaborative efforts. Interviewee 27 described her work with the other PI on the project as the epitome of their longstanding "intellectual kinship." Another PI (interviewee 6) asserted that collaboration, specifically through co-writing "helped us tremendously." On the other hand, one PI (interviewee 36) said she "assumed too much" of her graduate student worker regarding motivation and work ethic. Another PI (interviewee 29), who relied heavily on undergraduate student workers, stressed the importance of "openness," which she defined as the ability to help students see how "dishwater" work (e.g. work having to do with citations) contributed in key ways to the project overall. She suggested shifting students among tasks to facilitate this openness.

Last, officials from the Office of Digital Humanities underlined the importance of collaboration. It appears "too much to ask," interviewee 26 observed, to find a scholar who owns the requisite data curation, disciplinary/domain, and outreach expertise. The ODH promotes "strength in numbers" (interviewee 25) and tells applicants not to "go it alone" (interviewee 26). Even so, collaboration and communication come with challenges of their own for SUG project personnel, as discussed below.

Translation issues proved most important to participants in this study, but concerns about clarity and about frequency of communication also emerged. One PI (interviewee 35) observed the difficulty of initiating and then sustaining robust communication among groups of scholars who had never met before and who worked apart from one another geographically. Other types of divides could apply. One PI (interviewee 3) emphasized the challenge of translation among technically literature and domain-knowledgeable persons as part of negotiating "institutional culture": she found such translation "really important and very difficult." Finally, one PM (interviewee 23) spoke about even more specific translation issues, noting the challenges of

achieving stakeholder agreement on the definition and use of certain metadata categories such as genre.

Table 22: Collaboration and Communication Issues

Collaboration and Communication	Number of Comments
Terminology	4
Clarity of Communication	3
Frequency of Communication	3
Feedback from Collaborators	2
Geographical Distance	2
Timing	2
Mode of Communication	1
Ownership of Project	1
Translating Workflow	1
Willingness to Collaborate	1

6.4.2.1.1) Interdisciplinarity

Interviewees also reflected upon interdisciplinarity. One PM (interviewee 18) hailed the "tremendous amount" of interdisciplinarity in her project. Another project participant (interviewee 45) suggested that there was "a lot of skill involved" in negotiating with personnel from different academic units. According to one PI (interviewee 38), interdisciplinarity remains "incredibly difficult" and can come about serendipitously. In this vein, another PI (interviewee 19) described the gestation of her collaboration with another campus scholar as a "complete fluke." Obstacles to interdisciplinary collaboration arose. One PI (interviewee 29) stressed the need to grow a "thick skin" and show willingness to ask experts from other disciplines for explanation or clarification.

On the other hand, one PI (interviewee 13) described her project as a beneficial "marriage" of four related disciplines. Such interdisciplinarity could pay dividends. One project member (interviewee 43) noted that interdisciplinarity made their project group of four persons "much stronger": the team proved both "flexible" and "nimble." One PM (interviewee 15) even

described one of her PIs as a "rare bird" able adeptly to traverse disciplines. Along these lines, one Office of Digital Humanities representative (interviewee 25) maintained that many grantees evolve into "wonderful bridge people."

Communication

Not surprisingly, all project personnel relied heavily on email to communicate. Perhaps more surprising, the vast majority (84.2%) of projects' personnel (at least some members of each team) met face to face at least once. This study suggests that digital communication cannot necessarily supplant in-person communication. Last, nearly two-thirds (63.2%) of the nineteen projects employed Skype or video chat.

Table 23: Project Personnel's Mode of Communication

Mode of Communication	Number of Projects (n = 19)
Email	19 (100%)
Face to Face	16 (84.2%)
Skype/Video Chat	12 (63.2%)
Other	6 (31.6%)

Some projects relied on other modes of communication as well. For instance, two projects communicated via telephone and two used Google Docs. One project each capitalized on co-writing, social media, a wiki, an IRC channel, and Google Chat. More projects might exploit these venues to ensure frequent, high-touch collaboration.

Email and other text-based asynchronous communication such as blogs and wikis offer important benefits: the sender and receiver do not have to be in same place at same time. Additionally, these communication methods are inexpensive. On the other hand, such mechanisms pose challenges. For example, details may be omitted involuntarily and nuance can be difficult to convey. Persons may encounter issues with respect to checking and answering

email promptly (L. Siemens 2010). Thus project personnel should likely rely on multiple communication channels, despite email's ease of use.

Face to face communication featured in most of the projects, albeit to a very limited degree. The richest communication medium, in-person is synchronistic, incorporates body and facial cues, and permits immediate feedback. Thus it facilitates trust and commitment. Conversely, if teams are dispersed geographically, face to face communication can be prohibitively expensive and time-consuming. A lack of face to face communication, however, can hinder decision making and project reporting. In the end, as the interviewees suggested, digital technology "can supplement, but cannot fully replace the face-to-face in collaboration" (L. Siemens 2010, 44).

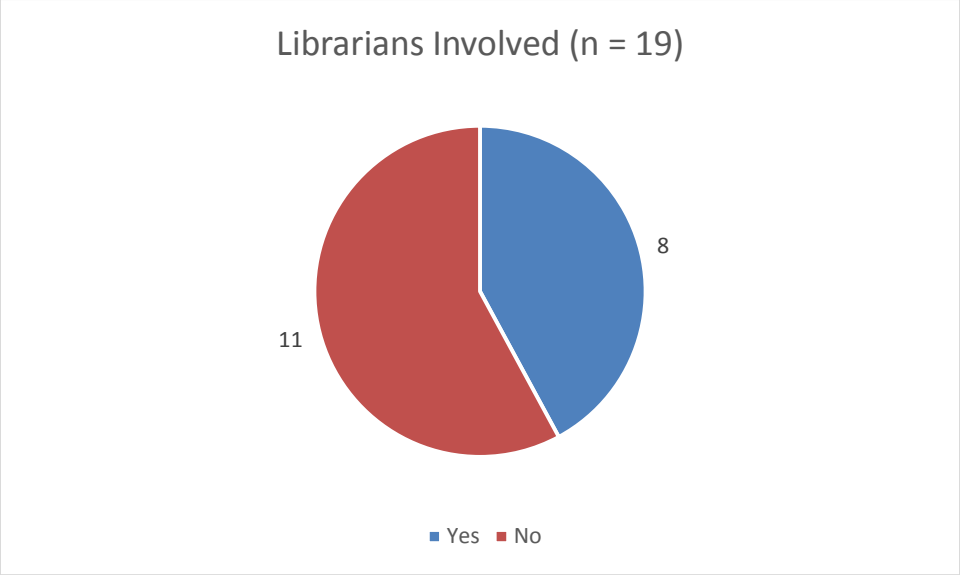
Librarians

Svensson (2010) notes, "The expansion of the digital humanities and changing roles for libraries may lead to a new set of dynamics and a renewed sense of the library as laboratory as well as a physical and digital repository." Digital curation offers librarians a "novel, even groundbreaking role," given their experience with the reference interview and their expertise in subject areas and with information literacy overall (Hswe and Holt 2011, 11). Yet Carlson (2014) cautions, "In developing data services, libraries must invest time and effort to understand current practices with data; when, how, and why these practices are performed; and the gaps between current and ideal practice from the perspective of the researcher" (79).

Librarians or personnel affiliated with the University Libraries were involved—to varying degrees and in various capacities—in eight of the nineteen projects (42.1%). But as numerous scholars observe, there seems great potential for further library involvement in both digital curation and digital humanities work (Bryson, et al. 2011) (Giarlo 2013) (A. Gold 2010)

(Lyon 2012) (Mitchell 2013) (Nicholson and Bennett 2011) (Shaffer 2013) (Starr, et al. 2012) (Tenopir, Birch and Allard 2012) (Walters and Skinner 2011).

Figure 3: Librarian Involvement in Projects



For example, the PIs of two of the nineteen projects relied heavily on librarians. One (interviewee 30) called the library a "key player"; the other (interviewee 42) answered "Good Lord, yes," when asked if librarians played an important collaborative role in the project.

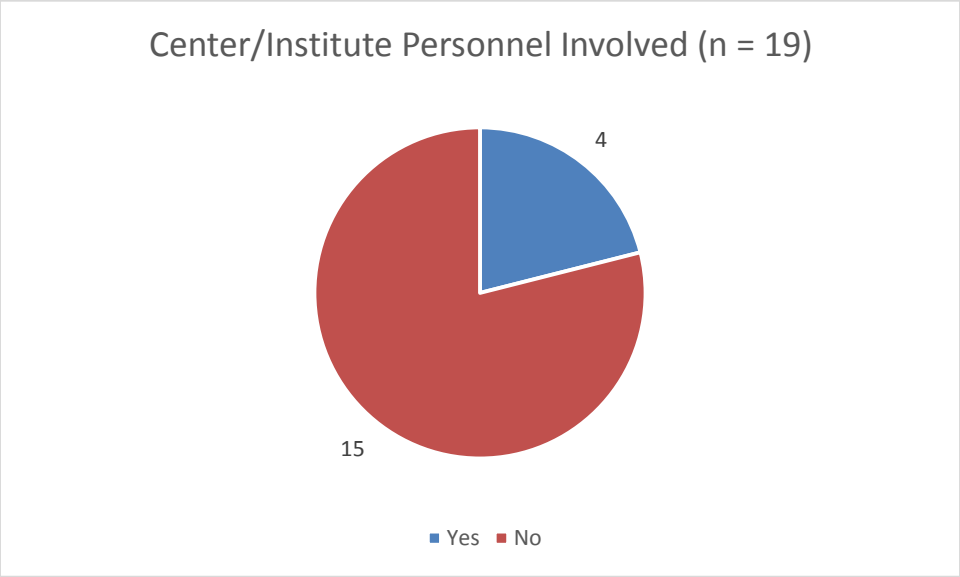
One Principal Investigator (interviewee 3) admitted to not working with librarians on her SUG project, but nonetheless believed such involvement "essential." Further, she noted the importance of early and constant collaboration with librarians. Similarly, this PI's PM (interviewee 4) saw "lots of potential for collaboration" with librarians. Both claimed their SUG project was not yet mature enough to require librarian involvement, a key misconception.

On one hand, then, libraries and librarians are increasingly staking a claim to digital curation expertise. On the other hand, librarians are not necessarily the first resource that scholars doing digital humanities work consult. Not consulting qualified librarians early and often in SUG projects seems a squandering of human capital.

Center/Institute Personnel

Personnel from centers or institutes were involved in four of the nineteen projects.

Figure 4: Center/Institute Personnel Involvement in Projects



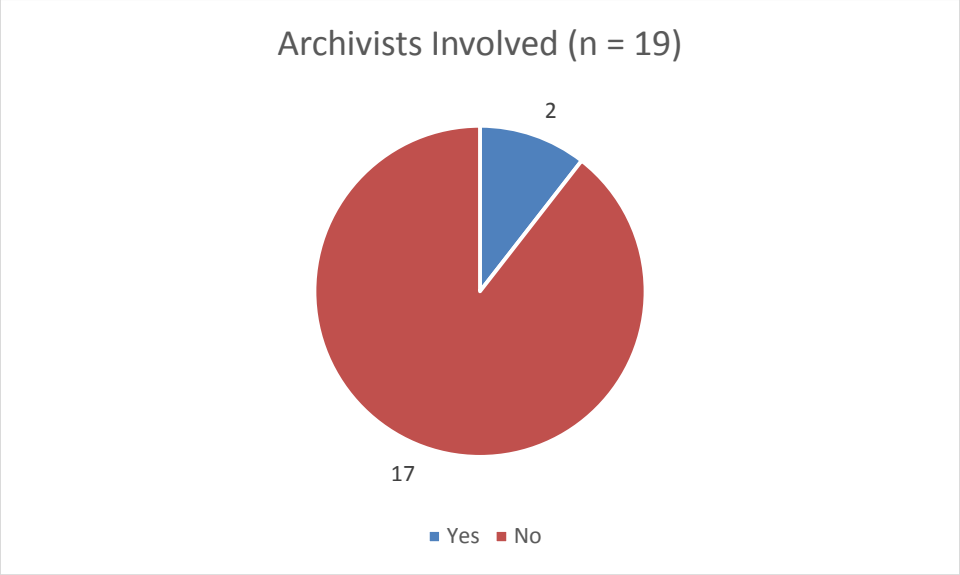
At their best, centers "not only model the kind of collaborative and interdisciplinary work that will increasingly come to define humanities scholarship; they also enable graduate students and faculty to learn from each other while working on projects of common intellectual interest" (Fraistat 2012, 281).

Archivists

As part of asking interviewees about their collaborators, I asked them whether archivists were involved. Archivists' involvement in the nineteen projects was rare: they participated in only two projects (10.5%). The answer to the question "where's the archivist in digital curation" appears in these projects to be "almost nowhere" (Lee and Tibbo 2011). Once again, this likely represents a waste of human resources and therefore a growth area for archives and archivists

(Jahnke and Asher 2012) (Noonan and Chute 2014) (Poole 2015) (Prom 2011) (Redwine, et al. 2013) (Wallis, et al. 2008).

Figure 5: Archivist Involvement in Projects



Planning and Project Management

Third, planning and project management issues elicited twenty comments. One PI (interviewee 29) likened working on a digital humanities project to "wrestling an octopus." One PM (interviewee 23) noted that being skilled at digital humanities work and at project management are two very different things. A predominant concern of interviewees was the challenge of approaching projects with a long-term perspective. Ultimately, a project management component may be a useful addition to a digital curation education program.

Table 24: Planning and Project Management Issues

Planning and Project Management	Number of Comments
Foresight/Longer-Term Perspective	11
Skills	3
Time Management	3
Early Involvement	2
Task Prioritization	1

Duration of Grant

The Start-Up Grant award period lasts up to eighteen months. Grantees may apply for a one-time extension of up to one year. Twelve projects received no-cost extensions. It is no wonder a key concern of interviewees was project planning and management. Of the seven that did not request extensions, four were Planning Grants and all four concluded with workshops.

It appears easier to plan and to keep workshops or meetings than more experimental explorations on track temporally. Additionally, the tendency of projects to train their personnel only as the project unfolds may not be the most time-efficient or ultimately productive strategy. Certainly good digital curation planning and practice requires early and frequent intervention.

Project management skills such as organization, planning, prioritization, monitoring, and human resources seem to be of crucial but sometimes overlooked importance in SUG work as well as in other digital humanities work (Reed 2014).

Awareness and Outreach

Fourth, interviewees identified awareness and outreach issues (19 total comments). Concerns in this area clustered around demonstrating the relevance and legitimacy of digital curation to stakeholders. Communication with researchers and faculty members as well as with users more generally was also key.

Table 25: Awareness and Outreach Issues

Awareness and Outreach	Number of Comments
Relevance and Legitimacy of Digital Curation	4
Researcher and Faculty Issues	4
User Issues	4
Data Preparation and Preservation Mindedness	2
Keeping Current with Digital Curation Field	2
Encouraging Use	1
Defining and Determining Role of LIS Professionals	1

Disseminating Tools and Results	1

Resources

Fifth, resources were mentioned, though perhaps not as frequently as one might suspect (only seven times). Beyond the need simply for more resources of all types to ensure the project reached its presumed potential and proved sustainable, interviewees offered several more specific remarks. They stressed financial and temporal resources, appropriate personnel (interviewee 12 concluded, "Talent is expensive"), technological resources (the need for sufficient server space), and educational resources (in particular those that delivered core concepts and best practices).

Technology

Sixth, technological issues were mentioned only four times. Key issues included user-friendly software, general technological shortcomings and technological "immaturity," and a broad lack of institutional technical support. Perhaps most striking, one interviewee stressed the challenge of making technology obey one's wishes.

Issues surrounding data, collaboration and communication, planning and project management, awareness an outreach, resources, and technological issues hampered project personnel in their efforts to curate their data. These findings show that not only technical skills, but also "softer" skills play a pivotal role in the efficiency of digital curation in the digital humanities, a key lesson for constructing a digital curation education framework.

Conclusion

These empirical study results indicate key foci of digital humanities scholars' work. They provide a base for suggesting ways in which digital curation needs in the digital humanities can be met through education. In the next chapter, I bring this empirical evidence together with best

practices extracted from the digital curation education and digital humanities education literature and with the DigCurV curriculum framework.

Chapter 7: Analysis and Discussion

> There is a conflict at the heart of curation training between general and specific needs that is manifest on both the individual and organizational levels.
>
> -Moles and Ross (2013), 15.

> How do you know what you don't know?
>
> -Molinaro (2010), 45.

This chapter first recapitulates the key points of the study. Next, it addresses the four research questions that guided the study. More specifically, it details the types of data project personnel created and reused, the digital curation skills they employed during their project, whether they are interested in digital curation education, and what sort of educational framework makes sense for their needs. Finally, it suggests paths for future research.

The Research Study

This qualitative study was situated in a naturalistic setting. It revolved around a case study that permitted me to conduct exploratory, evaluative, contemporary, in-depth, and contextual research work. A user-centered case study, it captured the meanings digital humanities scholars ascribe to the experiences, events, and processes that steer their daily working lives.

My research design remained emergent: flexible, iterative, and interpretive. To obtain rich, detailed, and nuanced information, I relied upon purposive (specifically, snowball) sampling. I interviewed Principal Investigators, Project Managers, and other key personnel (45 total) of nineteen recent (slated for completion by the end of 2014) Start-Up Grants funded by the National Endowment for the Humanities's Office of the Digital Humanities. I explored the types of data these scholars reused and created in their projects and the digital curation skills and methods they employed in dealing with their data.

I interviewed scholars in disciplines ranging from music history to archival management, media studies to archaeology, library science to interdisciplinary studies. Interviewees included Master's students and PhD students, "alternative-academics,"[88] and senior faculty members; they worked at institutions ranging from community colleges to Research I universities. Their deliverables included workshops and prototypes, models and tools, databases and meetings.

Documentary evidence culled from the nineteen projects, namely project applications, data management plans, and White Papers, complemented and checked my interview data. Proceeding inductively, my qualitative analysis embraced iterative memoing, in vivo coding (using NVivo), and (re)analysis. In so doing, I borrowed strategically and judiciously from constructivist Grounded Theory methods.

An exploratory study, my serves as a baseline study for future research. Additionally, it helps identify needed skills and competencies among digital humanists and their collaborators. Finally, it sets forth a framework—premised on the relevant literature, the empirical study data,

[88] Bethany Nowviskie puts it, "The #alt-ac label speaks to a broad set of hybrid, humanities-oriented professions centered in and around the academy, in which there are rich opportunities to put deep—often doctoral-level—training in scholarly disciplines to use." See http://chronicle.com/blogs/profhacker/the-alt-ac-track-negotiating-your-alternative-academic-appointment-2/26539

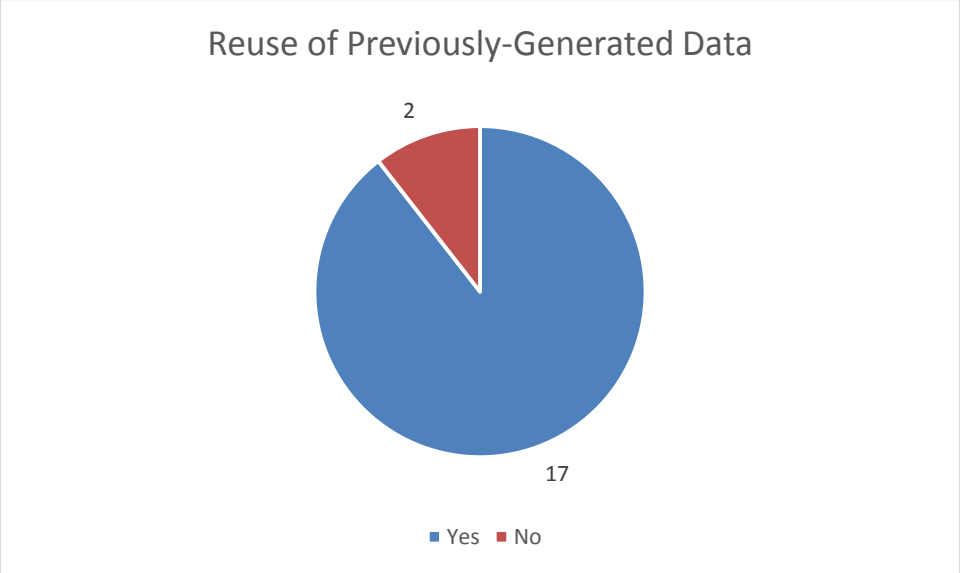
and the DigCurV curriculum framework[89]—for digital curation education aimed at digital humanists.

Research Question 1: What types of data have digital humanists (whether faculty, "alternative-academics,"[90] (alt-acs) or graduate students) created, reused, stored, or planned to reuse in their SUG project?

Reuse of Previously-Generated Data

Seventeen of the nineteen projects (89.5%) in some way reused existing data, whether their own or others.'

Figure 6: Reuse of Previously Generated Data



Data that project personnel reused ranged widely in content. Topics included music, literature, news, periodical literature, digital editions, art, religious studies, and classics. But of those seventeen projects that employed previously-created data, nine relied upon web-based

[89] http://www.digcurv.gla.ac.uk/

[90] As Bethany Nowviskie puts it, "The #alt-ac label speaks to a broad set of hybrid, humanities-oriented professions centered in and around the academy, in which there are rich opportunities to put deep—often doctoral-level—training in scholarly disciplines to use." See http://chronicle.com/blogs/profhacker/the-alt-ac-track-negotiating-your-alternative-academic-appointment-2/26539

information available in the public domain. Thus they implicitly trusted the quality of this information and assumed that it could be revisited by themselves or others at their discretion.

Three projects reused data previously generated by project personnel: survey materials, grant application materials, and field data. A third category of data reuse was more nebulous. Project personnel in these cases reused metadata gleaned from third-party institutions, film prints and ephemera, a video game and its associated materials, original literary texts, and data collected from a historical society, respectively. Hence those responsible for curating such data need a range not only of technological skills, but also of media-specific and domain skills.

Data Created

All nineteen projects created data in the ODH's definition of the term. Notwithstanding the mandatory White Paper and interim and final reports, the projects created at least 36 different types of data. Similarly, a study conducted at Colorado State University found that participants created twenty different types of data (McLure, et al. 2014). Heterogeneity appears to be the norm.

In the current study, certain types of data were created more frequently than other types. Notably, the two most frequently generated types of data were conventional publications and presentations at professional events. Indeed, three of the most frequently cited data types produced were "conventional." This resembles the findings of a recent study: 44.1% of science researchers' DMPs promised traditional publications qua data creation (Mischo, Schlembach and O'Donnell 2014).

Nonetheless, six projects generated code and five generated a database of some kind. Overall, though, it seems a paradigm shift regarding the creation of less traditional types of data has yet to occur in the digital humanities.

Table 26: Types of Data Created

Type of Data	Number of Projects Creating (N = 19)
Interim and final reports (ODH requirement)	19 (100%)
White Paper (ODH requirement)	19 (100%)
Publications	10 (52.6%)
Presentations at professional venues	8 (42.1%)
Code	6 (31.6%)
Database	5 (26.3%)
Conference/meeting records	4 (21.2%)
Software	3 (15.8%)
Blog posts	3 (15.8%)
Datasets	3 (15.8%)
Model	3 (15.8%)
Algorithm	2 (10.6%)
Curriculum materials	2 (10.6%)
Documentation	2 (10.6%)
GIS/map files	2 (10.6%)
Images	2 (10.5%)
Interface	2 (10.6%)
Metadata	2 (10.6%)
Videos	2 (10.5%)
Administrative records	1 (5.3%)
Documentation	1 (5.3%)
Exhibition proposal	1 (5.3%)
Full-text repository	1 (5.3%)
Informal publications	1 (5.3%)
Interview transcripts	1 (5.3%)
Macros	1 (5.3%)
Modules	1 (5.3%)
RDF documents	1 (5.3%)
Recommendations for best practice	1 (5.3%)
Reports	1 (5.3%)
Rules	1 (5.3%)
Scalar documents	1 (5.3%)
Tool	1 (5.3%)
Toolkit	1 (5.3%)
Wiki	1 (5.3%)
Workflows	1 (5.3%)
Total: 36 Types	

File Formats

Though projects employed a wide range of file formats[91] in their work, personnel relied upon some formats more often than others. For example, more than half of the nineteen projects created or used PDF. Yet PDF was the only format that more than half of the projects used. The next most popular format, HTML/XML, was used by less than a third of the projects. Slightly more than a quarter of the projects used .CSV, Java, or .JPEG file formats and more than one in five used MP3/MP4, MySQL, and PowerPoint.

Perhaps most striking, more than half of the projects used other file formats, i.e. formats unique to their project (in the context of the sample). One project, in fact, used more than 60 file formats. Therefore, the file formats each project employs seem to depend upon the individual preferences of the PIs or the graduate student workers or both as well as the discipline or domain. Indeed, one study found graduate students using a bevy of formats: Excel, Sims 3, Word, PowerPoint, Adobe Illustrator, Photoshop, GraphPad, Prism, Filemaker Pro, SPSS, SAS, and NVivo (Piorun, et al. 2012).

Future research might explore the possibility of standardizing file formats for various domains or establishing best practices. After all, format can greatly influence accessibility (Alexogiannopoulos, McKenney and Pickton 2010). Non-proprietary file formats should be stressed to increase the likelihood of future readability by diverse programs (Whitlock 2011). To this end, perhaps the ODH's grant application instructions could insert a codicil that requests applicants adhere to a certain number of commonly used file formats, again in the interest of promoting best practices. Such an addition could encourage at least some format standardization.

[91] Numerous interviewees conflated file formats and data formats. This confusion may point to their lack of foundational data knowledge. If so, such knowledge might be a useful aspect of a digital curation education program.

Table 27: Data Formats

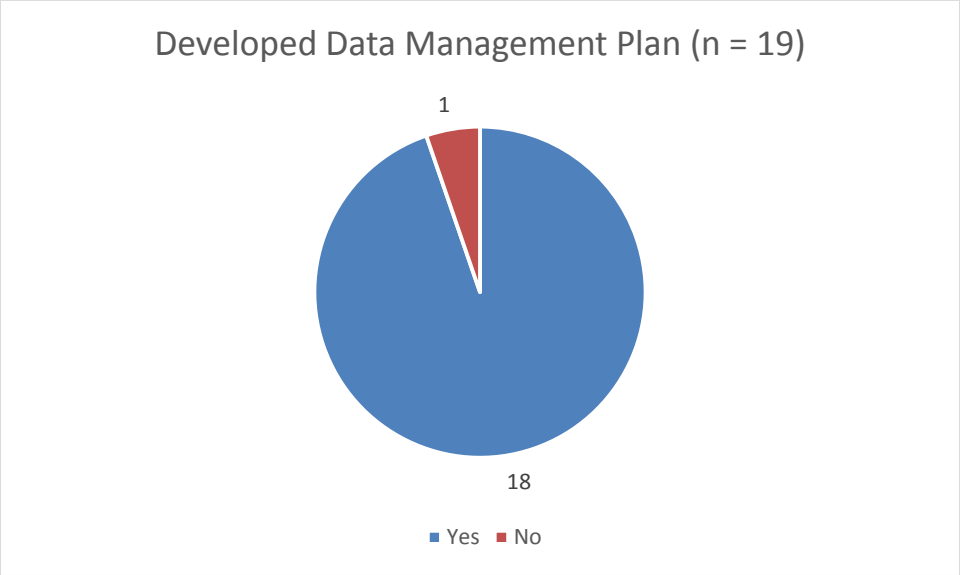
Data Formats	Number of Projects (n =19)
PDF	11 (57.9%)
HTML/XML	6 (31.6%)
CSV	5 (26.3%)
Java	5 (26.3%)
JPEG	5 (26.3%)
MP3/MP4	4 (21.2%)
MySQL	4 (21.1%)
PowerPoint (includes MS Office)	4 (21.1%)
Word (includes MS Office)	3 (15.8%)
Plain text	2 (10.6%)
Python	2 (10.6%)
TIFF	2 (10.6%)
Other	10 (52.6%)

Data Management Plans

Interviewees' attitude toward and involvement in the ODH's data management plan requirement ranged considerably. Compared to basic, social, and medical sciences researchers, one recent study found, "Arts and humanities researchers are most likely to be completely unfamiliar with these funding agency requirements for data management plans" (Akers and Doty 2013, 9). Thanks to the ODH, this study's interviewees were necessarily more familiar with data management planning, though their opinions on the usefulness of the Data Management Plan (DMP) process varied.

Despite the ODH's mandate that each applicant include a DMP, one of the nineteen projects did not do so, an omission the ODH reviewers overlooked.

Figure 7: Data Management Plan Created



Personnel from the other eighteen projects expressed widely varying views on the process and its value. One PI (interviewee 18) found the process of writing a DMP "really annoying" and did the "minimum." Another PI (interviewee 38) characterized her effort as not the "most shining example of the genre," even though she enlisted a librarian's help. Summing up, interviewee 33 suggested that many DMPs remain "somewhat boiler plate."

Persons from three other projects struggled even to remember the process of writing their SUG DMPs. Interviewee 5 said that she was "sure we wrote something down" but that she could not recall its contents. Again, this person wrote a DMP simply because the ODH required it. Interviewee 12 recalled that she thought she wrote the DMP, but could not remember for sure. A third (interviewee 24) noted, "I don't remember who wrote it…I don't actually remember what we said."

Other project personnel felt differently about data management planning. One PI (interviewee 29) called the development of the DMP a "big process." Another (interviewee 42) thought the DMP the "hard part of the process." She and her colleagues were "still feeling our

way." Perhaps most striking, interviewee 43 characterized the DMP process as akin to being "in a box trying to describe another box." Despite the challenges inhering in the DMP process, however only one PI contacted the ODH for input or feedback.

Conversely, some other projects' personnel found the DMP process easier. Interviewee 14 called the process "Quite simple and straightforward." Two projects used DMPTool.[92] As a result, interviewee 9 labeled the development of the DMP a "complete no-brainer." (DMPTool provides a structured environment for data management planning and links directly to funders' stipulations.) The other who used DMPTool (interviewee 44) also reused materials from a previously submitted NEH grant. Finally, interviewee 3 reused information that she created originally for a Mellon grant.

According to personnel from the Office of Digital Humanities, grantees' DMPs have improved since 2011. Further, after four years the ODH now has numerous examples to show applicants. Early plans seemed "very divorced from the rest of the narrative," as though "written in a vacuum, or from a template" (interviewee 35). Interviewee 35 noted that recent DMPs are "much more consistent" and applicants display "at least a baseline sense of what sorts of questions they need to answer." An increasing number of applicants now "see the relationship between other portions of the application and the data management plan" (interviewee 35). Ultimately, remarked interviewee 35, "A weak data management plan often is a signal of a broader weak work plan or weak project conception as well."

The ODH continues to educate its constituents about data management. As one ODH official (interviewee 36) noted, "We don't think of [the DMP] as another hoop for them to jump

[92] http://blog.dmptool.org/about-the-dmptool/

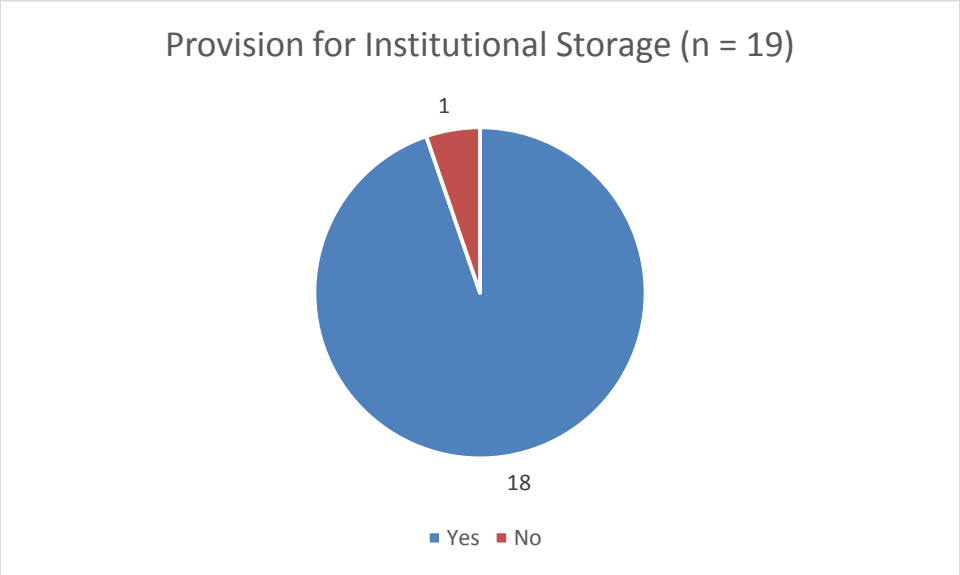
through, but it helps them by thinking about data management, strengthen the overall project. It leads to stronger, more sustainable projects."

One wonders if the ambivalence felt by some members of this sample will abate. Donnelly maintains, "what is of key importance is that the plan is fit for purpose and genuinely considered, as opposed to simply being modified from previously 'successful' plans" (Donnelly 2012, 87). SUG grantees might learn from this argument.

Institutional Storage of Data

First, in their data management plans the vast majority of projects (94.8%) made provisions for storing their data institutionally. This figure far outstripped that reported by Mischo et al., who determined that only 52.9% of their sample planned to use centralized campus resources (Mischo, Schlembach and O'Donnell 2014). On the other hand, far more of Mischo et al.'s (2014) researchers (63.1%) intended to post data on websites than did interviewees in this study. But websites not only may lack sustainability, but also may lack discoverability (Wallis, Rolando and Borgman 2013).

Figure 8: Institutional Storage



Second, representatives from ten projects (52.6%) mentioned storing part or all of their project's data on a personal computer or computers during the project. Personnel often stored the data they had created or worked, not necessarily the entire project's data. They made no mention of whether they would archive this data or whether it would simply fall prey to benign neglect. In any case, this storage was generally ad hoc. This finding is slightly greater numerically than that of a recent study that found almost 40% of researchers referring to local storage media (Mischo, Schlembach and O'Donnell 2014). This finding mirrors that of Carlson and Stowell-Bracke (2013), who found that graduate students make working copies of data for use on their personal computers. Jahnke and Asher (2012) also found researchers storing most of their data—various image formats, video, audio, data sets, documents, code packages, and analysis scripts— on their PCs and not backing it up properly. Still another study found storage and back up occurring via email, the cloud (Dropbox or Google Docs, for instance), local drives, network drives, or external drives—and no standard naming conventions were used (Piorun, et al. 2012).

But relying on one's PC brings up questions of proper backup, versioning, and security. Along these lines, one PM (interviewee 39) commented that PC storage was "not the best data management strategy"; she speculated, however, that "someday [the data] will live somewhere else." Benign neglect thus presumably enters these projects' digital curation picture.

Third, project personnel from eight of the nineteen projects (42.1%) stored or planned to store data on GitHub, "an online platform that offers users free repository hosting for their code…, as well as social networking features common across the web, like the ability to follow users through RSS, comment on changes or updates to a repository, and even solicit help by

posting code snippets to a user forum" (N. Weber 2012).[93] Yet interviewees who resorted to this method apparently gave little thought to possible sustainability or other issues regarding GitHub.

Finally, project personnel mentioned sundry other storage spaces including Omeka,[94] Zotero,[95] ArcGIS,[96] Scalar,[97] YouTube,[98] HathiTrust,[99] commercial providers, and the cloud. They seemingly devoted little thought to the sustainability of these of these entities.

Project personnel were not always aware of relevant institutional policies governing the data retention period. Those who were aware, moreover, did not always know the span of retention to which their institution committed. Institutions committed to specific time periods did so for amounts of time ranging from three years to ten years. More open-ended, some institutions committed to preserving the data for the life of the project, while others committed "in perpetuity" or "permanently," though it remained unclear exactly how long these commitments might play out. Sustainability should be a greater concern in project planning.

A recent study provides a telling juxtaposition with these findings. Fully 80% of participants depended upon their own infrastructure for backup, whereas less than a quarter (23%) used a campus service and 7% employed a commercial solution. Most problematic, 5%

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[93] https://github.com/

[94] http://omeka.org/. Omeka took root in an initial IMLS grant (2007). It bridges the university, library, and museum environments. Free and open source, standards-based, extensible, and interoperable, Omeka capitalizes on Web 2.0 technology, for instance by encouraging user interaction and participation. It has low startup and maintenance costs and a user-friendly interface (Scheinfeldt, Omeka: Open Source Web Publishing for Research, Collections and Exhibitions 2008).

[95] https://www.zotero.org/

[96] http://www.arcgis.com/features/

[97] http://scalar.usc.edu/

[98] https://www.youtube.com/yt/about/

[99] http://www.hathitrust.org/

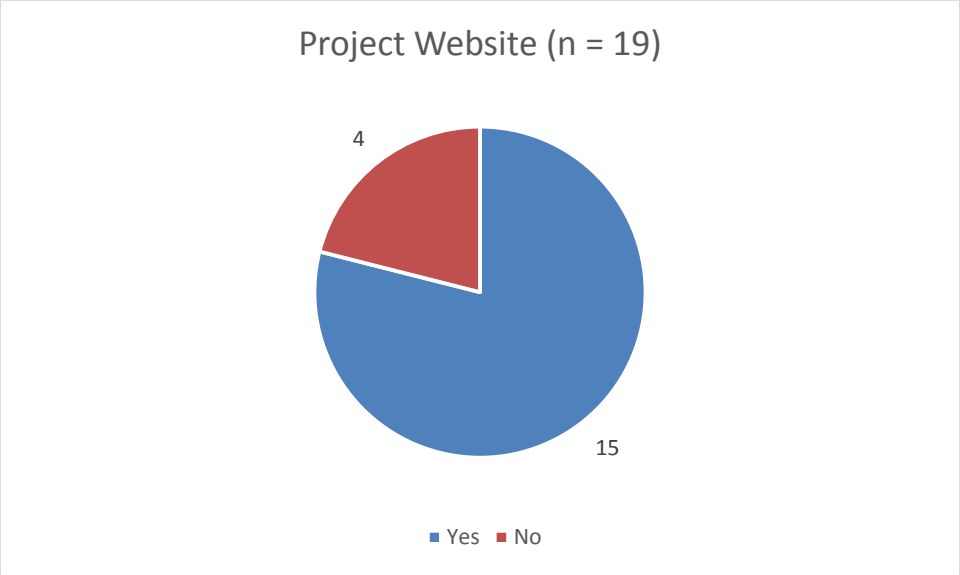
did not backup at all (Steinhart, Chen, et al. 2012). Data storage and backup provisions represent at best a patchwork and researchers tend to rely on themselves rather than campus services.

Another study's participants employed a "huge variety" of data storage and management methods and did so intuitively (Alexogiannopoulos, McKenney and Pickton 2010, 29). Unsurprisingly, these researchers also lacked a system for archiving data once they completed their projects. As the work of Alexogiannopoulos et al. (2010) and Steinhart et al. (2012) suggests, without oversight researchers are likely to store and backup their data in ways that will not maximize the data's sharing or reuse potential. Funders' persuasiveness may have an important role to play in encouraging researchers to keep their fit for future use.

Project Websites

Fifteen of nineteen projects (78.9%) maintained some sort of website whether full-fledged or a blog. These websites varied widely in the extent of their content, in their functionality, and in their currency and frequency of updates. Some projects even used their website as a de facto backup tool, thus again bringing to the fore issues of sustainability. Website posting not only may lack sustainability, in fact, it may also lack discoverability (Wallis, Rolando and Borgman 2013).

Figure 9: Project Website Created



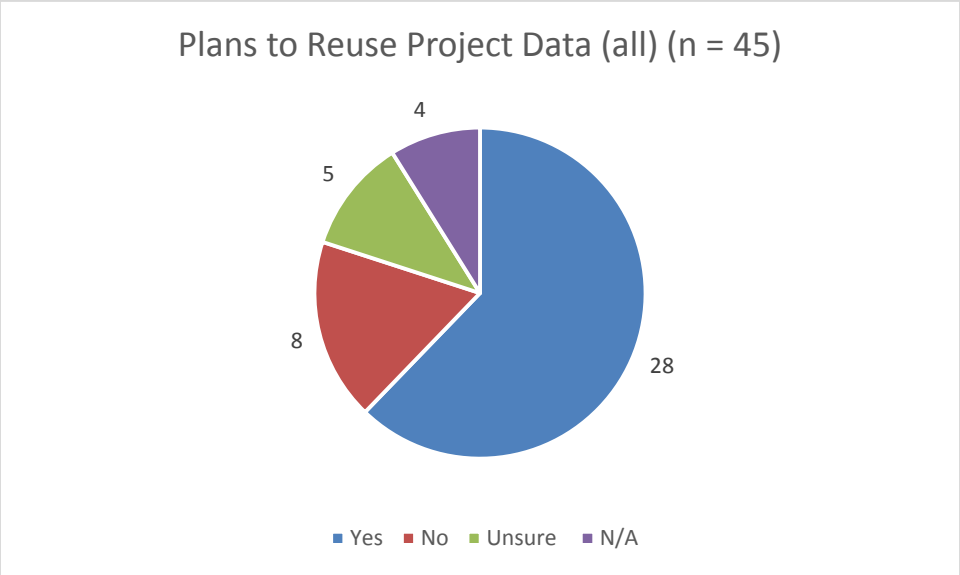
Plan to Reuse Project Data

In accord with NEH policy, all projects committed to sharing their data at some future point, barring issues such as confidentiality or privacy. But the vast majority of projects had not yet produced sharable data; what was more, none knew of any other person reusing their data. Therefore, a crucial priority should be determining and tracking reuse over time.

Nearly two-thirds of interviewees (68.3%) planned to reuse project data themselves, though they had often only speculative thoughts about how to do so. Data management plans, after all, do not require applicants to spell out planned future reuse (though perhaps they should). Rather, the ODH requires only that data be made available and in a format conducive to sharing. Yet as Wallis et al. (2013) point out, "Making data available and making data usable are not equivalent" (13). Interviewees apparently gave scant thought to this concern. The number who were unsure if they could reuse their own data suggests the challenge even of conceptualizing possible reuse for one's own purposes—let alone others' potential desiderata (Wallis, Rolando and Borgman 2013).

Interviewees working on Planning Grants found it more challenging to suggest possible reuses for their data, perhaps because of the perceived limited utility of workshop and meeting records. Nonetheless, such materials provide a foundation for future grant work, whether underwritten by the ODH or another body such the Institute of Museum and Library Services, the American Council of Learned Societies, or the Andrew Mellon Foundation, so digital curation remains a crucial concern. Consonant with a lifecycle approach, moreover, it seems best to cultivate digital humanists as early as possible with respect to digital curation concerns.

Figure 10: Plans to Reuse Data Created During Project



The 28 interviewees who planned to reuse their data hazarded fourteen potential reuses for their project data.

Table 28: Possible Data Reuses

Possible Data Reuses	Number of Interviewees (n = 28)
Code	5 (17.9%)
Approach Toward Data	2 (7.1%)
Dissertation	2 (7.1%)
Doctoral Projects (non-specific)	1 (3.6%)
Genre predictions	1 (3.6%)

Grant applications	1 (3.6%)
Licensing agreements	1 (3.6%)
Longitudinal Studies	1 (3.6%)
Metadata	1 (3.6%)
Pedagogy	1 (3.6%)
Peer Review Process Model	1 (3.6%)
Service Evaluation	1 (3.6%)
Scripts and Macros	1 (3.6%)
Topic Models	1 (3.6%)
Total: 14	

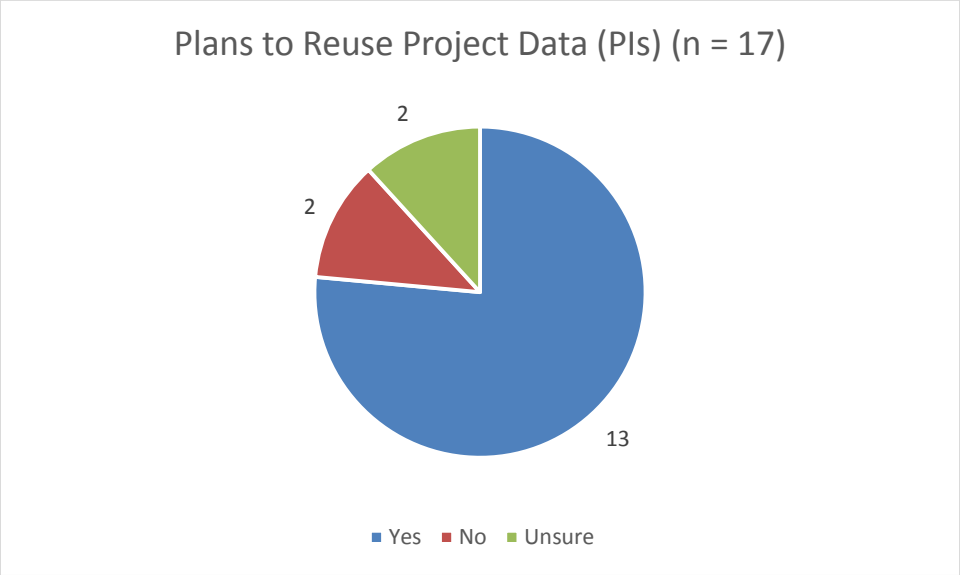
Principal Investigators in nearly all cases thought they could reuse project data in some capacity. Because of their relative job security (ten of the seventeen have tenure), these scholars may have more freedom to think long-term or at least beyond the span of the immediate project. They may also have been able to fit their SUG project into their longer career research trajectory.

Similarly, PIs can parlay their SUG grants into other grant applications. For instance, they can leverage their SUG Planning grant to apply for a SUG Implementation grant, or an Institute for Advanced Topics in the Humanities[100] grant, or a grant from another organization such as the American Council of Learned Societies or the Mellon Foundation. (By the same token, some SUG awardees build upon grants from other agencies and parlay those grants into a SUG.)

On the other hand, students whether Master's or doctoral have a more or less clear educational end point (namely their funding expires). It may prove difficult to maintain ties with PIs given the likelihood of geographical dispersion whether these students enter academia or find careers outside of the academy. Ideally, however, graduate students can reuse project data at least for publications, Master's theses, or dissertations. Paradoxically, data may be most amenable to their reuse when it is reused for so-called conventional purposes.

[100] http://www.neh.gov/grants/odh/institutes-advanced-topics-in-the-digital-humanities

Figure 11: Plans to Reuse Project Data: Principal Investigators (PIs)



Research Question 2: What digital curation skills (if any) did they employ and how did they acquire them?

Satisficing involves choosing "a path that will permit satisfaction at some specified level of all of [the organism's] needs" (Simon 1956, 136). In other words, satisficers "select the satisfactory alternative because it is satisfactory, not because they calculate that stopping the search at that point would maximize utility" (Schmidtz 2004, 32). Indeed, "Satisficing strikes us as reasonable in part because of contingent facts about ourselves and our world," namely our awareness that we are limited in our opportunities to improve our situations in the real world (Schmidtz 2004, 43). Whereas "an optimizing strategy places limits on how much we are willing to invest in seeking alternatives," "a satisficing strategy places limits on how much we insist on finding before we quit the search and turn our attention to other matters" (Schmidtz 2004, 35).

"Researchers live by satisficing," report Kroll and Forsman (2010, 16). Researchers adopt tools or services that are easy to use and that streamline work "even when those tools and services are not optimal, comprehensive, or on the 'approved' list preferred by their university"

(Kroll and Forsman 2010, 16). This adds yet another wrinkle to the challenge of promoting, much less enforcing, the use of standard tools and services.

Recent studies support the importance of satisficing in researcher behavior. For example, the IMLS project "Sense-Making the Information Confluence" (2003) determined, "participants' approaches to information sources and strategies and the amount of time and effort they devote to searching, correspond directly to the perceived importance of their objectives" (Prabha, et al. 2007, 85). Similarly, Prabha et al. (2007) unearthed factors that caused researchers to stop looking for information: 1) user objectives/motivations for wanting the information; 2) characteristics of their information need; 3) external variables such as setting, context, and situation; 4) internal variables such as motivation and searching skills; and 5) phase of project (namely the ending).

Interviewees in the current study generally struggled to describe the specific aspects of skilling up. They mentioned learning to work with particular software as well as developing an understanding of broader concerns. On one hand, interviewees noted the challenges of learning to work with Omeka, the Resource Description Framework (RDF) framework, Java, Git, Unix, Python, Dublin Core and the Anglo American Cataloging Rules (AACR2), XML, R, and GIS. On the other, they spoke about learning to understand standards, scale, domain knowledge, foundational knowledge (e.g. what is metadata), communication and outreach, indexing, management, bibliographic and intellectual control, and dataset vocabularies. Given the heterogeneity of responses and the difficulty interviewees had in describing the skilling up process, future research might present interviewees with a menu of skills from which they can choose. This strategy might help participants translate their work activities into specifics.

Research Question 3: Are digital humanists interested in acquiring skills to help curate their data and if so, what content would they like to learn?

As discussed in chapter six, interviewees expressed interest in digital curation education. On the one hand, they recognized that training was, as one PI (interviewee 42) put it, a "giant question mark"; on the other, they offered few concrete ideas for how to develop or implement educational programs. Another PI (interviewee 29) called for an "honest census" with respect to current educational opportunities. In this vein, one PM (interviewee 15) deemed education in digital curation "worthwhile," but offered little elaboration. Indeed, interviewees offered few specifics about content needed in educational initiatives, suggesting their belief in the importance of aligning training with specific projects.

Without exception, interviewees stressed the imperative of immersive project-based skilling up. One PI (interviewee 38) reflected, "Most education…comes down to working on a particular project." Other project personnel agreed. Advocating a "bootstraps" approach, one PI (interviewee 27) insisted, "[Students] really get it when they have to do it." Another PI (interviewee 14) thought students came up with "great stuff" when "let loose." One PM (interviewee 4) said she was "not sure" that academic programs properly prepared students to deal with discipline-specific data and suggested that students receive a "crash course" once put on a particular project. Two other PMs agreed. Interviewee 23 called education necessarily "very much hands-on." Interviewee 32 saw practical settings as "so vital" and advocated applying concepts to practice "where the rubber meets the road."

In terms of technology, interviewee 45 stressed the need for students to become "conversant" with tools. Another interviewee (interviewee 43) working on the same project insisted that the bedrock of education was "knowing what's possible" regarding technology; in this vein, she underscored the importance of learning to code. Similarly, one PI (interviewee 24)

characterized coding as "vital." She elaborated: "The way one learns code is not by, is not in a classroom, it's actually by doing it." Therefore, the best approach was to "have [students] do some work in the domain they're working in, and then to come back and discuss it, rather than to just start with the training. That's because it forces them to solve certain things on their own, which is really helpful and allows them to discuss the things they can improve and also to explore where they were having challenges and not understanding."

But technological skills needed to be complemented by domain knowledge. One PI (interviewee 18) exclaimed, "Oh good God it was a mess" trying to find students who had both domain and computational knowledge; she emphasized the "steep learning curve" for students should they have technical skills but not domain knowledge. Another PI (interviewee 7) argued for the need to change computer science students' mindsets, namely by encouraging them to think like "non-technologist[s]."

Interviewees also discussed mentoring. One PI (interviewee 35) simply called mentoring "tricky." Interviewee 35 recommended exposing students to digital curation issues as early as possible in their education. Still another PI (interviewee 21) described in detail the process of acculturating one of her students. The student was at first a "fly on the wall," but assumed more responsibilities over time. Another interviewee (interviewee 1) described her process of gradually increasing responsibility over a six-year working relationship with her PM. More broadly, interviewee 6 believed in treating her students as "fully working researchers" and characterized this as an apprenticeship model. Along the same lines, interviewee 29 mentored each of her students by effectively showing her "how to be an adult in the workplace." But in order to maximize the effectiveness of mentoring, faculty members themselves need guidance: interviewee 14 advocated "Faculty development across the board."

Perhaps most intriguing, interviewee 42 recognized and advocated for the potential educational role of iSchools and LIS programs in general. Having collaborated with her institution's iSchool in various capacities, she favored situating a curriculum in such a school and tailoring it such that a digital humanities layer featuring programming and analytical work would be added to an iSchool curriculum grounded in the liberal arts. This suggestion appears particularly promising.

Research Question 4: What sort of educational framework would be most useful to help them learn more about curating (managing) their data?

"At this point," Tibbo (2013) asserts, "continuing education in digital curation and preservation is exploratory and experimental—even the formal looking concentrations and certificates in universities are underway." The DigCurV project found that professionals "must demonstrate domain-specific and technical competencies, generic professional and project skills, and personal qualities in a blend appropriate to their particular professional context" (Molloy, Konstantelos, et al. 2013). This argument applies to students and researchers as well.

Digital curation in the digital humanities involves not only capturing data itself, but also the methods by which the data was produced. This twofold context implicates training and concomitant expertise that includes humanities subject disciplines, library and information science, archival science, computer science, and both systems and records management (Flanders and Munoz 2012). Given these requirements, educational programs should focus on early career intervention (Jahnke and Asher 2012). In addition to faculty members, graduate students are a "natural audience" for educational programs (Carlson, Johnston, et al. 2013, 205).

The proposed learning framework draws from three sources: lessons from the literature (see chapter four), lessons from findings from the empirical study of nineteen SUG projects, and

lessons from the DigCurV curriculum framework. Overall, the proposed framework aims to be both extensible and repurposable (Molloy 2012).

Empirical Findings

Findings from the current empirical study encompass six broad categories that might usefully be integrated into an educational framework:

- Data issues such as versioning, size, disciplinarity, and documentation
- Collaboration and communication, namely terminology, clarity, and frequency
- Planning and project management, primarily a long-term perspective, skills, and time management during the project
- Skills related to effecting awareness and outreach, principally ways to show the legitimacy and relevance of digital curation, to address researcher and faculty issues such as gap between rhetoric and reality of commitment, and to tackle user issues such as securing feedback during project design and testing
- Skills to secure and manage financial, temporal, personnel, technological, and educational resources are necessary
- Technological issues

Digital Curator Vocational Education Europe (DigCurV)[101]

To succeed professionally, personnel "must demonstrate domain-specific and technical competencies, generic professional and project skills, and personal qualities in a blend appropriate to their particular professional context" (Molloy, Konstantelos, et al. 2013, 13). Based on research, surveys, and focus groups, the DigCurV (Digital Curator Vocational Education Europe) initiative produced a flexible, extensible, and iteratively-designed Curriculum

[101] http://www.digcur-education.org/

Framework. Its essential role is to "provide a range of audiences with a means to inform curriculum creation and evaluation for continuous professional development in digital curation" (Molloy, Konstantelos, et al. 2013, 8). It builds on DigCurV reports, the Vitae Researcher Development Framework (SCONUL Working Group on Information Literacy 2011), the RIN Researcher Development Framework Information Literacy Taxonomy (Vitae 2011), the DigCCurr projects at the University of North Carolina at Chapel Hill, in particular the DigCCurr Matrix (Lee and Tibbo 2011), and the Digital Preservation Outreach and Education (DPOE) initiative at the Library of Congress.

The Framework helps stakeholders pinpoint training needs, evaluate current opportunities, and plan further professional development in the cultural heritage sector. It propagates three "lenses" (practitioner, manager, and executive). Each lens adopts the perspective of its target stakeholders and imbues professionals with skills, knowledge, and competencies. Each lens helps develop training materials (overall structure, subjects to be covered, and a common language), facilitate comparison among existing courses, and identify areas of strength and weakness and thus facilitate professional development. But the Framework "requires ongoing development in order to maintain (and gain) credibility, usability, and relevance" (Molloy, Konstantelos, et al. 2013).

First, the practitioner lens centers the larger legal and ethical environment of digital curation on tools and technologies, on one hand, and on workflows and best practices, on the other. Second, the manager lens focuses on the project level (planning, executing, and monitoring) and underlines the connections between programs and organizational goals. Third, the executive lens deals with digital curation in the context of the parent organization's business model and mandate.

The DigCurV Curriculum Framework is predicated upon three levels of comprehension. First, it deals with *awareness* ("Maintains a basic awareness of a given subject area, including basic knowledge of the range of issues that shape developments in the subject area"). Second, it addresses *understanding* ("Able to demonstrate understanding of a given subject area, and possesses some knowledge of the terminology, business processes and tools relevant to the subject area"). Third, it deals with *ability* ("Possesses detailed knowledge of a given subject area, and is able to apply this knowledge to complete tasks on an independent basis").[102] Building upon the existing DigCurV skill identifiers, the proposed Researcher lens also employs these three terms.

Mapping the DigCurV Skill Identifiers to Proposed Researcher Lens

As depicted below, the proposed framework builds upon the 110 DigCurV Skill Identifiers. I have annotated each descriptor to suggest how it does or does not relate to my study results or the digital curation literature or both. Overall, researchers seem to need many of the skills needed by practitioners and managers. That said, interviewees were often unsure of what they needed in the way of skills, much less how to acquire those skills.

Table 29: DigCurV Skill Identifiers

DigCurV Skill Identifiers[103]	**Researcher Lens**
I) Knowledge and Intellectual Abilities (KIA)	
KIA1: Subject Knowledge	
KIA1.1 Subject-specific knowledge and definitions	Understands
• Interviewees stressed the importance of domain knowledge in skilling up to participate effectively in project work.	
KIA1.2 Relevance of, and need for, digital curation activity within subject context	Understands
• Interviewees emphasized the need to have both domain and digital curation skills; the learning curve was steeper if one or the other was lacking.	

[102] http://www.digcurv.gla.ac.uk/skills.html
[103] http://www.digcurv.gla.ac.uk/skills.html

KIA1.3 Current and emerging subject landscape (trends, people, institutions)	N/A
• This is a higher-level issue that project personnel did not mention. This responsibility would likely fall under the auspices of an institution's repository instead of an individual researcher or a small group of researchers.	
KIA1.4 Respective responsibilities for digital curation across institution	Is aware of
• In determining how best to curate their data, project personnel would benefit from knowing what persons on campus are most qualified to support digital curation. This issue came up in particular both in data management planning (where the data would be deposited after the project was over) and in collaborations.	
KIA1.5 Scope the boundaries for digital curation at institution	Is able to
• In developing their data management plans, project personnel (usually PIs) needed to determine who at their institution (or at their collaborators' institutions) could help with their digital curation needs. Having an understanding of what services are available at each institution is thus helpful in the planning stage when roles and responsibilities are set forth.	
KIA1.6 Fundamental digital curation principles including lifecycles	Understands
• By and large, interviewees lacked an understanding of digital curation principles. For example, they rarely used any digital curation terminology. Moreover, they often did not seem to have a sense of their data's lifecycle—they sought to use the data and seemed generally uncertain about what would happen to they used it.	
KIA1.7 Designated community	Understands
• No interviewee had yet had her data reused, which made identifying a designated community difficult. Nonetheless, project personnel might think a bit more about potential reusers. Indeed, some interviewees lacked a sense of how they themselves might reuse their data.	
KIA1.8 Select appropriate technological solutions	Is able to
• Technological issues cropped up in my interviews and information technology skills more broadly are an important part of existing digital curation education programs. Therefore, having a knowledge of how to select and apply technological solutions would be helpful whether or not those solutions are applied by project personnel or by other campus stakeholders.	
KIA1.9 Apply appropriate technological solutions	Is able to
• See KIA1.8	
KIA1.10 Develop a professional network for support	Is able to
• Developing a professional network seems an important part of collaboration and communication, a key concern of interviewees. The SUGs often involved persons from more than one institution; therefore, having such a network might facilitate workflows and time management.	
KIA1.11 Digital curation tools (at high level)	Understands
• Interviewees nearly always learned about digital curation tools while working on a specific project. It might be useful for them to have a broad	

understanding of the range of digital curation tools in addition to their project-specific tool knowledge.	
KIA1.12 Digital preservation standards	Understands
• As suggested in the literature, it would be useful for project personnel to learn about standards as part of a formal education component, as opposed to ad hoc while dealing with data during a project.	
KIA1.13 Digital curation and preservation terminology	Understands
• See KIA1.6	
KIA1.14 Scope of team responsibilities within institution	N/A
• Project personnel saw their SUG work as part of their academic work and/or as part of their daily work (for example, graduate students often relied on project work to fund their education). The place of the project and of the project team with respect to the institution was not discussed.	
KIA1.15 Information technology definitions and skills	Understands
• Understanding information technology was an important theme in both my interviews and is also important in the literature on digital curation education.	
KIA1.16 Select and apply digital curation and preservation techniques	Is able to
• Project personnel would benefit from knowing how to select and apply digital curation and preservation techniques whether or not they or others on campus have sole or final responsibility for doing so. Current literature on digital curation education underlines the importance of familiarity with such techniques.	
KIA1.17 Scope of own role within institutional context	N/A
• Interviewees did not mention how their SUG work fit into larger institutional contexts. In fact, their project work was framed as part of their larger academic agenda as members of a department or campus unit.	
KIA2: Selection/Appraisal	
KIA2.1 Maximize benefits and long-term value of collections	N/A
• In nearly every case, each project personnel planned to deposit their data with a campus stakeholder. Therefore, the responsibility for maximizing benefits likely will devolve upon digital curation professionals who take over management of project data.	
KIA2.2 Articulate information- and records-management principles	Is able to
• Some interviewees stressed the importance of learning about foundational issues in the classroom (most notably metadata). It seems as though other basic records management principles would be a useful addition to such formal education. In particular, personnel might benefit from learning about the relationship between records management and digital curation.	
KIA2.3 Articulate the benefits and long-term value of collection	Is able to
• Several interviewees struggled to explain to their university colleagues the legitimacy of their work. Showing colleagues the value added by digital curation to collections of humanities data would thus be beneficial. The literature on digital curation education also supports the need to understand the characteristics of collections.	

KIA2.4 Contribute to institutional policies, including criteria for selection/appraisal	N/A
• No interviewee mentioned having a role involving institutional policy. Their data management plans stressed the need only to adhere to existing institutional policy.	
KIA2.5 Information- and records-management principles	Understands
• See KIA2.2	
KIA2.6 Institutional policies, including criteria for selection/appraisal	N/A
• See KIA2.4	
KIA2.7 Plan application of selection/appraisal criteria to collections	N/A
• Neither selection nor appraisal of collections of SUG data were mentioned by interviewees. They created and used the data they needed and subsequently deposited it.	
KIA3: Evaluation Studies	
KIA3.1 Prioritize funding for curation activities based on the value of digital objects and the risks facing objects	N/A
• Interviewees did not deal with high-level (repository or institutional) funding issues.	
KIA3.2 Respond to findings from user studies constructively in future decision-making	N/A
• As noted in KIA1.7, no interviewee had had her data reused. Moreover, no interviewee mentioned the need to envision the needs of future reusers of her data. User studies and analysis would likely remain the province of repository personnel.	
KIA3.3 Conduct user needs analysis	N/A
• See KIA3.2	
KIA3.4 Continuously monitor and evaluate digital curation technologies	Is able to
• Monitoring and evaluating digital curation technologies would likely help project personnel choose the best tools for their projects. This would likely enhance their own efficiency and thus project and data management capabilities; it might also facilitate data sharing and reuse after the project ends.	
KIA3.5 Monitor and assess needs of designated community	N/A
• Project personnel did not seem to focus a great deal on designated communities, perhaps because they lacked information on potential reusers (and had not had any actual reusers of their data).	
KIA3.6 Conduct usability evaluation	N/A
• See KIA3.2	
KIA3.7 Prioritize curation activities based on value of digital objects and the risks facing them	N/A
• This responsibility would likely be given to repository staff. These projects did not involve enough data such that prioritization of activities was an issue, not did interviewees express concerns about any potential risks to their data.	
KIA4: Information Skills	

KIA4.1 Information-seeking strategies, access technologies, and user sharing behaviors	Understands
• As required by the ODH, data management plans described how project data was to be made available and sharable. Yet neither data management plans nor interviewees provided information on how access to and sharing of their data might be facilitated. This may be a useful skill for project personnel to learn.	
KIA4.2 Support information access and sharing	Is able to
• See KIA4.1	
KIA4.3 Deploy appropriate information seeking strategies	Is able to
• All project personnel would likely profit from a proficiency with basic information seeking strategies, ranging from the use of search engines to knowledge of MARC.	
KIA4.4 Key metadata standards for sector/subject	Understands
• For interviewees, metadata came up as an important issue for formal education. Similarly, current digital curation education program stress metadata's importance. It seems likely that dealing with metadata standards is thus among the most important aspects of digital curation in projects such as the SUGs.	
KIA4.5 Select metadata standards	Is able to
• See KIA4.4	
KIA4.6 Apply metadata standards	Is able to
• See KIA4.4	
KIA4.7 Relationship between appropriate controlled vocabularies and metadata standards	Understands
• See KIA4.4	
KIA5: Data Skills	
KIA5.1 Data structures and types	Understands
• Dealing with data issues was the most commonly mentioned lesson learned/challenge faced. Thus it likely should occupy a central place in formal and informal digital curation training and skilling up.	
KIA5.2 File types, applications, and systems	Understands
• See KIA5.1	
KIA5.3 Database types and structures	Understands
• See KIA5.1	
KIA5.4 Execute analysis of and forensic procedures in digital curation	Understands
• See KIA5.1	
II) Personal Qualities (PQ)	
PQ1: Integrity	
PQ1.1 Responsibility, accountability, and good practice in digital curation	Understands
• These qualities facilitate optimal collaboration and communication and by extension, project management, all of which were key concerns of interviewees.	
PQ1.2 Value of policy formulation to deal with malpractice	N/A
• Interviewees did not deal with policy formulation.	

PQ1.3 Make transparent decisions	Is able to
• Transparent decision-making also seems a crucial part of effecting optimal collaboration, communication, and project management.	
PQ1.4 Demonstrate leadership in high quality standards of work	Is able to
• Both PIs and PMs in particular might benefit from setting an example for other project personnel. It seems as though such leadership and dedication to quality could exert a beneficial trickle-down effect.	
PQ1.5 Identify malpractice	Is aware of
• No instances of malpractice were mentioned by interviewees. Nonetheless, it seems appropriate for project personnel to be aware of the possibility and consequences of malpractice.	
PQ2: Communication and Advocacy Skills	
PQ2.1 Communicate across domains, staff groups, and with other relevant communities	Is able to
• Interviewees stressed the importance of communication, particularly among project teams as well as among disciplines and institutions. This was one of the most important lessons they learned and challenges they faced during their project work. Communication skills are also related to interpersonal skills, another key theme in the literature.	
PQ2.2 Articulate importance of digital curation to peers, other staff, and public	Is able to
• Interviewees emphasized the importance of making a case for the legitimacy of their projects vis-à-vis "traditional" academic work. In this vein, they underlined the importance of advocacy and outreach in showing the value of their efforts.	
PQ2.3 Articulate value of collections to peers, other staff, and public	Is able to
• See PQ2.2	
PQ2.4 Make case for funding of digital curation activity	Is able to
• Funding efforts of project personnel were limited to PIs as part of their SUG applications. But making a case for funding could be an important part of advocacy and outreach and thus part of gaining legitimacy for digital curation in digital humanities work.	
PQ2.5 Manage and foster stakeholder relationships	Is able to
• Nurturing stakeholder relationships seems a pivotal aspect of promoting collaboration and communication. It may also help effect outreach and advocacy efforts.	
PQ2.6 Plan and deliver dissemination activities	Is able to
• As part of their data management plans, project personnel committed to making their data accessible. Yet they did not have opinions on how to disseminate their data. But this skill might be a useful component of an educational program.	
PQ2.7 Make case for staff training and development	Is able to
• An overriding theme of the study was how project personnel almost never received any formal training or development, despite the potential costs of not having this training and development in terms of time and resources. It would be useful to develop a more structured approach to training both	

before the project starts as well as throughout its lifespan. PI mentoring of PMs and other student workers seems particularly important.	
PQ2.8 Engage with wider digital curation community	Is able to
• Project personnel tackled diverse types of projects. Even so, more communication among digital humanists who are engaged in digital curation work might help them arrive at common understandings about tools and technology that in turn could facilitate sharing and reuse.	
PQ2.9 Communication protocols for designated community	Understands
• While project personnel did not know who potential reusers of their data might be, communication and outreach alike were vital parts of their lessons learned and challenges faced. Learning to communicate with their designated communities seem a good way to raise awareness, to promote reuse, and thus to show the value of digital curation work in the context of digital humanities projects such as the SUGs.	
PQ3: Responsiveness to Change	
PQ3.1 Potential developments in business models, strategic planning, and management models in digital curation	N/A
• Interviewees did not deal with business or management modeling or strategic planning. This appears to be a higher-level concern.	
PQ3.2 Potential of developments in digital curation to influence new services and tools	N/A
• Interviewees did not consider developing new tools.	
PQ3.3 Emerging developments in discipline, and their applicability to digital curation activity in the institution	Is aware of
• Keeping up with such developments both within (and in fact across disciplines) can engender new collaborations and may suggest new possibilities for data reuse by the original project team or in new projects embarked on by other researchers.	
PQ3.4 Cultivate and maintain relationships with other relevant sources of information in digital curation (individuals/services/institutions)	Is able to
• Developing such relationships might lead to new collaborations and innovative projects that could raise awareness of and show the return on investment of digital curation work.	
PQ3.5 Value of new and emerging digital curation technologies and processes	Understands
• Interviewees tended to satisfice when it came to digital curation. But it would be useful for them to monitor and appreciate new technologies and practices, particularly if they plan to reuse their data and/or extend their current SUG projects.	
PQ3.6 Translate knowledge of technology and processes into services and tools for needs of designated community	N/A
• See PQ3.2	
PQ3.7 Assess, extend, and generate digital curation models for cultural heritage domain	N/A

• Interviewees were essentially concerned with their own specific projects, not how best to propagate new models for themselves or other digital humanists.	
PQ3.8 Maintain continuous awareness of emerging developments in digital curation	Is able to
• Ideally, project personnel would be able to monitor cutting edge developments in digital curation. But as most necessarily satisficed and skilled up in digital curation work on the fly, it may not be possible for them to do so. Even so, it would be desirable for project personnel to keep up to data on such developments—such awareness might help them better prepare their data for future reuse.	
PQ3.9 Translate current digital curation knowledge into new services and tools	N/A
• SUG project personnel were not responsible for providing tools and services at their institutions, much less developing new ones.	
III) Professional Conduct (PC)	
PC1: Regulatory Requirements	
PC1.1 Legal frameworks in which digital curation is taking place	N/A
• Project personnel operated within legal frameworks already established at higher institutional levels.	
PC1.2 Domain policies and standards for management and preservation of digital objects	Understands
• Though interviewees did not mention domain standards, they were aware of the importance of domain knowledge. Thus having a grasp of domain standards might be a useful complement to domain knowledge.	
PC1.3 Contribute to national/international regulatory frameworks in which digital repositories operate	N/A
• Project personnel were not involved in high-level policy making.	
PC2: Regulatory Compliance	
PC2.1 Institution's legal culpabilities in digital curation activity	Is aware of
• Though my interviewees did not deal with sensitive data, it seems useful for them to be aware of legal issues.	
PC2.2 Incorporate legal requirements into institutional policies	N/A
• Interviewees did not have responsibility for institutional policy issues.	
PC2.3 Contribute to institutional regulatory framework in which digital repositories operate	N/A
• Interviewees were not involved in regulatory issues.	
PC2.4 Apply appropriate actions to curation workflow to ensure compliance with legal and policy frameworks and relevant standards	Is able to
• While project personnel did not discuss these issues specifically, the literature suggests that compliance is an important consideration.	
PC2.5 Select and apply validation techniques to detect policy infringement	N/A
• See PC2.2	
PC3: Ethics, Principles and Sustainability	
PC3.1 Social and ethical responsibility in digital curation	Understands

• Such responsibility seems part and parcel of behaving like a professional researcher in an academic setting. Additionally, the literature underlines the importance of familiarity with ethical issues.	
PC3.2 Energy consumption and carbon footprint of digital curation activity	N/A
• This was not a concern of interviewees (nor is it stressed in the relevant literature) and thereby seems an issue to be dealt with on a higher level.	
PC3.3 Embed principles of ethical conduct throughout institutional policies (including those affecting curation activity)	N/A
• Project personnel did not have responsibility for or involvement in policy making.	
PC3.4 Adhere to principles of ethical conduct	Is able to
• See PC3.1	
PC3.5 Evaluate and treat employees fairly	Is able to
• Personnel management was an important concern for a number of PIs and PMs.	
IV) Management and Quality Assurance (MQA)	
MQA1: Risk Management	
MQA1.1 Undertake succession planning	N/A
• Succession planning remains the province of high-level policy makers	
MQA1.2 Risk management theory and standards	Is aware of
• No interviewees in this study specifically mentioned risk management concerns. That said, the digital curation education literature suggests the need for an understanding of risk management. It is reasonable to conclude that these researchers need at least an awareness of risk management theory and standards.	
MQA1.3 Apply risk management practice, techniques, and standards to digital curation activities within institutional risk management context	N/A
• See MQA1.2	
MQA1.4 Assess, analyze, monitor and communicate risks	N/A
• See MQA1.2	
MQA2: Audit and Certification	
MQA2.1 Audit and certification standards	Is aware of
• No interviewees mentioned audit and certification. But it seems researchers may need an awareness of these issues even if the work is done by other persons on campus, if only to be assured that their data remains trustworthy and reusable. Even so, a number of project personnel mounted their data on the web or on GitHub, a strategy which bypasses the audit and certification process altogether.	
MQA2.2 Benefits of audit process, and relevance of audit results	Is aware of
• See MQA2.1	
MQA2.3 Institutional liabilities in audit process	N/A
• Interviewees were not concerned, nor were they responsible, for institution-level liabilities such as the audit process.	
MQA2.4 Level of audit appropriate to institution	N/A
• See MQA2.3	

MQA2.5 Lead repository through certification process	N/A
• See MQA2.3	
MQA2.6 Respond to audit report and build new service plan where required	N/A
• See MQA2.3	
MQA2.7 Prepare effectively for an audit of curation functions	N/A
• See MQA2.3	
MQA2.8 Audit of curation functions	N/A
• See MQA2.3	
MQA2.9 Certification of repositories or programs	N/A
• See MQA2.3	
MQA2.10 Maintain documentation in preparation for audit process	N/A
• See MQA2.3	
MQA3: Resource Management	
MQA3.1 Undertake strategic planning	N/A
• While interviewees emphasized the importance of project planning, they did not have roles and responsibilities for higher-level strategic planning.	
MQA3.2 Undertake business continuity management including disaster planning	N/A
• As with strategic planning, interviewees left this issue to higher-level policy makers.	
MQA3.3 Resources required for digital curation activity including energy consumption.	N/A
• Energy consumption was not mentioned by my interviewees, nor is it highlighted in the digital curation education literature.	
MQA3.4 Reputation management	N/A
• Reputation management was not mentioned by my interviewees, nor is it highlighted in the digital curation education literature.	
MQA3.5 Respond to staff recruitment, training, and development needs	Is able to
• Recruiting, training, and developing staff was generally ad hoc. Projects may benefit from more focused attention to these issues, particularly on the part of PIs.	
MQA3.6 Undertake financial planning, cost analysis, and economic sustainability	N/A
• Aside from developing budget plans for the SUGs, interviewees did not have responsibility for nor did they mention financial planning, cost analysis, or economic sustainability. Such issues seem more relevant to high-level policy makers and repository personnel.	
MQA3.7 Undertake business planning in line with corporate/institutional goals	N/A
• Business planning and its relation to institutional goals was not a concern of interviewees and is not featured in the relevant literature.	
MQA3.8 Make sound decisions based on information produced by project team	Is able to
• Decision-making is heavily reliant upon good communication among all project personnel. Communication may be most beneficial when it proceeds both top-down and bottom-up.	

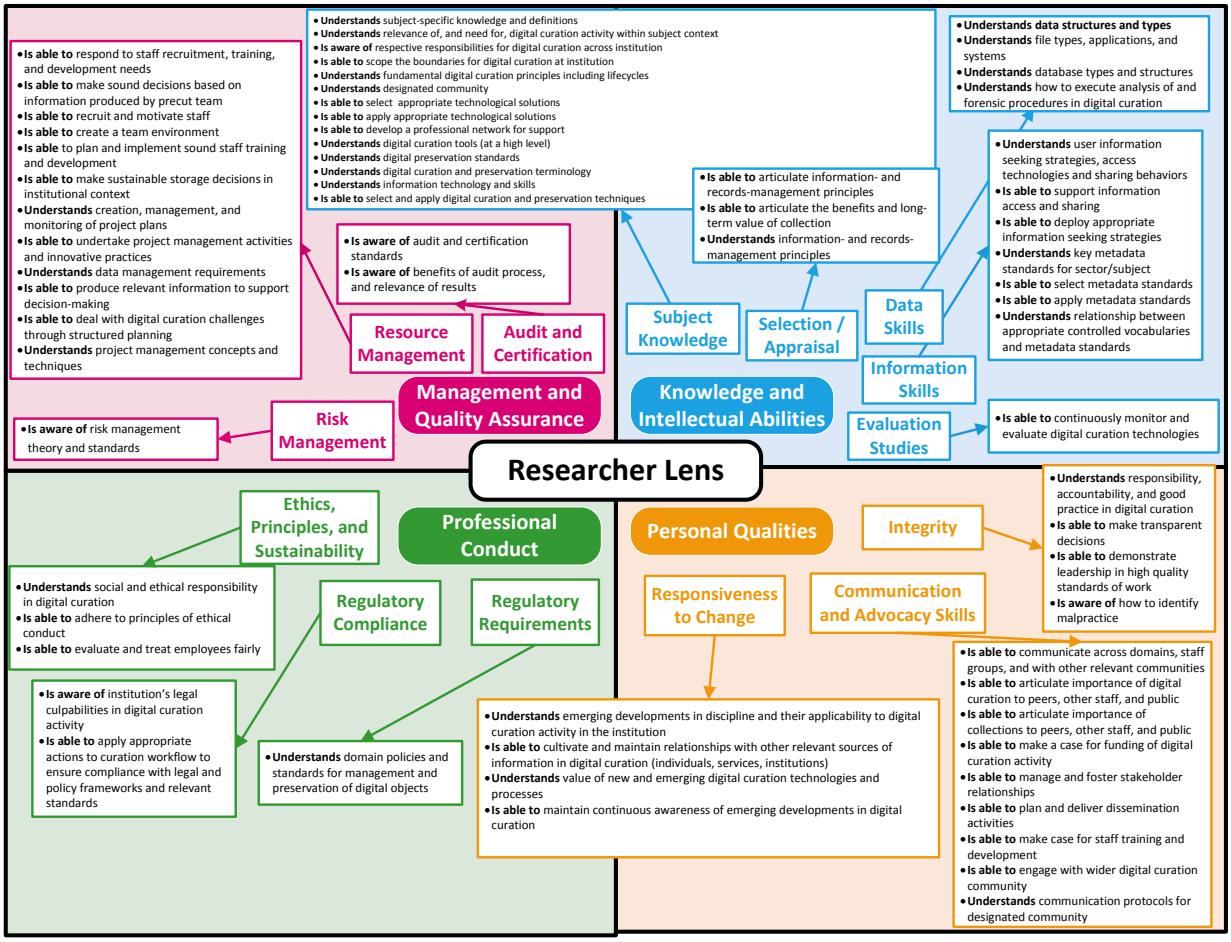
MQA3.9 Recruit and motivate staff	Is able to
• See MQA3.5	
MQA3.10 Create a team environment	Is able to
• Some PIs were more hands-on than others. That said, it seems that most PIs could invest a bit more effort in facilitating team-building, particularly if the project personnel have not worked together before. Communication and interpersonal skills seemingly have an important role in this respect.	
MQA3.11 Plan and implement sound staff training and development	Is able to
• See MQA3.5	
MQA3.12 Make sustainable storage decisions in institutional context	Is able to
• For the most part, the SUG projects accommodated sustainability in their data management plans. That said, in some cases little thought was given to sustainability issues, for instance when personnel said they would put their data on GitHub or mount it on a website. On the other hand, some personnel simply planned to pass off their data to other parties at the institution, often librarians or personnel at institutional repositories.	
MQA3.13 Creation, management, and monitoring of project plans	Understands
• Project planning was identified as a key concern by interviewees. Given the challenges the SUGS had in adhering to their stated schedules, time management and taking a long-term perspective are perhaps especially important.	
MQA3.14 Undertake project management activities and innovative practices	Is able to
• Among the key lessons learned was the importance of project management. After all, twelve of the nineteen project requested no-cost extensions. Therefore, good project management skills seem imperative and might help keep these projects closer to their original planned timeframe.	
MQA3.15 Data management requirements	Understands
• In sponsoring the Start-Up Grants, the Office of Digital Humanities recognizes the importance of data management by requiring applicants to include a data management plan. Some interviewees found the exercise of writing and following a DMP more useful than did others. Nonetheless, understanding data management requirements seems crucial in enabling the sharing and reuse of data in these projects. • Data management plans were usually written by PIs, but often the daily responsibilities for data management itself was left to PMs or other project personnel. It might be beneficial for all project personnel to be involved in the data management planning stage (if feasible). If this is not possible, perhaps early in the project the teams could meet to ensure each member understands how the data management plan can be translated into action.	
MQA3.16 Produce relevant information to support decision-making	Is able to
• This appears to be an important part of transparency and thus of collaboration, communication, and project management more broadly.	
MQA3.17 Deal with data curation challenges through structured planning	Is able to
• See MQA3.13	
MQA3.18 Project management concepts and techniques	Understands

• See MQA3.14	

A Researcher Lens for Digital Curation in Digital Humanities

Among the goals of the DigCurV project is to develop new or innovative ways to apply the Framework (Molloy, Gow and Konstantelos 2015). This study seeks to capitalize on this suggestion: it builds upon the Framework to address digital humanities work.

Figure 12: Researcher Lens



Implications and Limitations

Implications

Implications of this study are five-fold. First, the study suggests that awareness of the value of digital curation among digital humanists is increasing, even if many such scholars remain unsure about how best to implement optimal digital curation practices. Second, it suggests that the DigCurV model is flexible and can be applied to educational as well as to professional settings. Third, the study indicates that so-called soft skills such as communication and collaboration and planning and project management merit increased attention in digital curation education. Fourth, challenges in translating terminology between digital curation and digital humanities persist. Finally, Library and Information Science represents an important potential locus for digital curation and digital humanities work.

Limitations

Limitations are also five-fold. First, as a case study grounded in snowball sampling, its results are not generalizable. Second, the projects on which this dissertation focused were relatively immature and small in scale. Third, the 45 interviewees by and large hailed from similar institutions (Carnegie RU/VH and Carnegie RU/H). Fourth, although semi-structured interviews worked well, a more structured approach that guides the interviewees a bit more might prove useful, for instance in probing their familiarity with specific terms and skills in digital curation. Fifth, the time frame of the projects was advantageous on one hand (it depicted the current state of research in the field), but on the other, numerous projects exploited no-cost extensions and thus had not yet finished their projects by the time of my interviews with their personnel. In this vein, none of the projects' data had yet been reused; thus project personnel's digital curation efforts could not yet be fully evaluated. Ultimately, this study provides a useful

baseline for future research: now we can ask better and more specific questions and pose those questions to more diverse digital humanities scholars working on more diverse and mature digital humanities projects.

Future Research

Research "helps to facilitate standardization, planning and assessment by identifying and building benchmark data within and across research areas, institutional settings, and local and national jurisdictions" (Gilliland and McKemmish 2004, 149). In examining digital curation practices in the digital humanities in particular, "Case studies of research data practices in context are essential for the development of services to support and develop practice" (SCARP Project 2009, 18).

Three sets of questions are promising for future research; each one builds upon the work of this study. As interviewee 15 insisted, digital curation in the humanities remains a "greatly unexplored area."

A first set of questions centers on the learning framework presented in figure 12. First, how might such a model be tested and refined? Second, how can the proposed learning framework be converted into a full-fledged curriculum model? Third, how might such a curriculum subsequently be propagated across social science and natural science disciplines? Fourth, how can such a curriculum be implemented at diverse types of institutions?

A second set of questions concentrates on sampling from other kinds of digital humanists. A full two-thirds of my interviewees work at Carnegie-classified Research Universities (RU/VH) that show "very high" research activity. Another eight work at Research Universities (RU/H) that demonstrate "high" research activity. Thus 38 of 45 persons (84.4%) work at one of these two types of institutions. By contrast, only one interviewee works at a Carnegie Master's College and

University (Master's L) (i.e. the institution awards at least 200 Master's degrees) and only one works at a Carnegie Associate's—Public Rural-serving Large (Assoc/Pub-R-L). Therefore, my sample includes only four of 29 Carnegie categories.[104] Given the seeming similarity of many of the participants' affiliations in this study, what other digital humanities populations' digital curation practices would be most conducive to study? In particular, what are the digital curation practices (and education practices) for digital humanities scholars at liberal arts colleges, traditionally women's colleges, Historically Black Colleges and Universities (HBCUs), community colleges, and Master's level institutions?

On a related note, as part of their applications, prospective SUG grantees select a disciplinary classification from a menu provided by the. The NEH lists 145 possible areas clustered under twelve categories: Arts, Communications, History, Interdisciplinary Studies, Languages, Law, Literature, Philosophy, Politics, Religion, and Social Sciences. The nineteen projects examined in this study occupied twelve of the National Endowment for the Humanities's 145 disciplinary classes. Thus future research might explore projects that embrace more variegated disciplinary classifications.

This issue of sampling channels into a final question: what digital curation skills are employed by personnel pursuing digital humanities projects more advanced (i.e. creating and using more data and data of greater complexity and variegation, as in the Digging into Data projects) than the Start-Up Grants?

A third set of questions takes a longitudinal approach. First, what is the fate of the nineteen SUG projects here examined? Have they proven sustainable? Has their data been reused by project personnel, by those outside the original project team, or both? Second, is digital

[104] http://carnegieclassifications.iu.edu/resources/

curation education for digital humanists becoming more formalized or systematic? What are optimal ways of measuring the outcomes of existing digital curation education programs? Third, do stakeholders view data management plans (DMPs) as more important than they did in the past? How can we measure DMP improvement (or lack thereof)? Finally, have the roles of librarians' and archivists' roles in digital curation evolved or increased?

Notwithstanding areas for future research, stakeholders need to continue efforts to raise awareness about the import of digital curation in the digital humanities (as well as in other areas of study). Molloy contends, "Raised awareness remains one of the preliminary challenges to be met in the successful creation and embedding of research data management training courses" (Molloy 2012, 12). A small project can exert a substantial ripple effect (Molloy 2012). Hence information professionals can play "an important role in raising awareness of open research data, demonstrating the benefits of data sharing and preparing for the longer term preservation of research data" (Alexogiannopoulos, McKenney and Pickton 2010, 26). Yet Abbott's researchers rarely used such external resources, likely because of a lack of awareness of such services' availability (Abbott 2015). Interviewee 44 advocates for a "cultural shift" among researchers.

As yet it is far from evident that many researchers would voluntarily undertake additional training (Jahnke and Asher 2012). Patrick and Wilson (2013) reflect, "Researchers are not rebellious schoolchildren who need to be bullied into working harder; they are generally highly motivated and highly skilled individuals who take a great deal of pride in what they do, and thus are more likely to embrace digital curation as a worthy goal if persuaded of its merits." Along these lines, Molloy calls for "promotion of RDM across all disciplines, perhaps by publication of case studies from varied disciplines and through training events; continued partnerships working with the primary contacts from partner departments; soliciting feedback specifically from target

student audiences in each department, and the incorporation of MANTRA resources into research student induction sessions" (Molloy 2012, 14-15).

Despite manifold challenges, it seems clear that digital curation, as interviewee 16 insisted, is a "well-established part of the university of the future." Interviewee 43 agreed, noting, "That's where all the jobs are." A recent Council on Library and Information Resources report (2013) concludes, "The one certainty regarding research data management, both in terms of planning and execution, is that the needs will continue to grow at an exponential pace in years to come. The number of data objects requiring management; the size of those objects; their past and future relevance; and the communities that wish to collaborate on creating, analyzing, and searching those objects will all increase, as will the complexity of the human and technical infrastructure required to support data management activities" (77). It is our responsibility as LIS professionals to equip digital humanists as well as other digital curation professionals to meet this formidable challenge.

APPENDIX A: INTERVIEW QUESTIONNAIRE

Interview Questionnaire

1) Do you consider yourself a digital humanist?
2) Please describe your involvement in the project
3) What were your goals in undertaking the project?
4) Did you use already existing data?
    a. If so, please describe what data you used and how you used it
5) What type(s) of data did you create?
6) Did your project involve interdisciplinarity
7) What methods did your project involve? (qualitative/quantitative mix)
8) What type(s) of software did you use in the project?
9) How did you develop your data management plan?
    a. Were you assisted in developing or implementing it by anyone such as a librarian or archivist?
    b. If you used a data management plan, did it change over the course of the project?
10) Did you encounter any challenges using your data during the project?
11) Was there any sharing or reuse of data during the project?
12) Where is your data now?
13) Do you plan to transfer or deposit your data?
    a. If so, when and where?
    b. How long would you like to keep your data?
14) Have you/would you consider sharing your data?
    a. If so, is it ready to be shared?
    b. If so, with whom and under what conditions?
15) Are you interested in or planning to reuse your data?
16) What were the deliverables of the project?
    a. Did those deliverables differ from those you expected?
17) Was any education or training involved for you or for others involved in the project?
    a. What types of education or training do you think would be most helpful?
18) Did you have collaborators, e.g. librarians or others on or off campus?
    a. Division of labor in project?
19) Did you work with students?
20) Would you do anything differently in managing your data before, during, or after your project? I.e. lessons learned?
21) Who else should I talk to?

APPENDIX B: SCRIPT FOR PARTICIPANT RECRUITMENT

Script for Participant Recruitment

Dear XXX:

A PhD candidate at the School of Information and Library Science at the University of North Carolina at Chapel Hill, I am working on a dissertation under the guidance of Drs. Helen R. Tibbo (Chair), Christopher A. (Cal) Lee, Ryan Shaw, and Sandra Hughes-Hassell (all of SILS), and Costis Dallas (of the University of Toronto's Faculty of Information).

My dissertation poses the following research question: Are digital humanists (whether faculty, "alternative-academics," (alt-acs) or graduate students) interested in acquiring skills to help manage their data and, if so, what content would they like to learn and how would they like to learn it?

To address this question, I am conducting qualitative interviews with the Principal Investigators of the most recent round of NEH-ODH Start-Up Grants. Given your leadership in digital humanities, as the NEH-ODH has recognized, I would like to request your participation in a semistructured interview focusing on your project, XXX.

The interview would take between 45 minutes and one hour and would be conducted by phone (or Skype, if you prefer). If you are willing to participate, could you please let me know when an interview would best fit with your schedule?

I am happy to answer any questions you may have about this study. More information about my work can be located at http://alexhpoole.wordpress.com/. I am most grateful for your consideration.

Sincerely,
Alex H. Poole

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