Level Up! Lessons Learned from Six Years of Collaborative Technical Skills Development

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ABSTRACT

As academic and cultural heritage institutions increasingly offer digital collections and services, technical upskilling—the process of acquiring and/or expanding technical skills—has moved from an individual prerogative to an institutional imperative. In this publication, the authors share their experiences with, and lessons learned from, a series of four collaborative technical skills development initiatives—the ArchivesSpace-Archivematica-DSpace Workflow Integration Project (2014–2016), a series of Curation Team Workshops (2015), a Technical Skills Pilot Project (2017–2018), and the development of a Bentley Audiovisual Quality Control Utility (2019)—at the University of Michigan Bentley Historical Library. In doing so, the authors advocate for the value of increasing the technical literacy and skills of entire teams/units (as opposed to focusing on the development of individual skills) and provide information and best practices that will enable and empower other institutions to undertake similar initiatives. They conclude by making the case for organizational cultures that value learning together.

KEY WORDS

Collaboration, Technical skills, Team building, Group learning, Technical literacy, Professional development

As academic and cultural heritage institutions increasingly offer digital collections and services, technical upskilling—the process of acquiring and/or expanding technical skills—has moved from an individual prerogative to an institutional imperative. To meet the expectations of researchers and work more efficiently with an ever-growing corpus of digital information, institutions and their staff must possess a general technical literacy as well as knowledge of more advanced subjects, such as web development or programming. For institutions that lack internal information technology (IT) support or want to avoid a situation in which one individual is responsible for all technical issues, a key question is how to encourage employees to approach such upskilling, and, especially as a group, where the benefits can be amplified and maximized?

In this publication, three archivists reflect on more than six years of collaborative technical upskilling within the curation team of the University of Michigan Bentley Historical Library (hereafter referred to as "the Bentley"). The authors—who have filled a diverse range of roles at the Bentley as a student employee, project archivist,[1] assistant archivist, associate archivist, and assistant director—describe and discuss lessons learned from four initiatives: a grant-funded project to integrate and implement open-source software platforms, two series of technical skills workshops oriented toward the entire curation team, and a group effort to develop a command line utility to support quality assurance for audiovisual digitization. The final sections of the publication explore outcomes, lessons learned, and important considerations for other academic and cultural heritage institutions, with an emphasis on issues of equity and inclusiveness inherent to technical upskilling. While the authors' experiences may reflect unique circumstances and perspectives, the reader will hopefully leave with relevant takeaways for their own institutions, regardless of size or affiliation, first and foremost of which is the importance of encouraging staff to work together on the development and promotion of technical literacy.

Institutional Context

Formally established by the Regents of the University of Michigan in 1935, the Bentley serves as both the official archives of the University of Michigan and a repository for organizational records and personal papers for entities from across the state. The Bentley has been involved with issues at the intersection of archives and technology since at least the late 1970s, but it was not until 1997 that archivists received their first significant collection of born-digital archives: a former university president's personal computer.

Through the 2000s, the Bentley continued to collect born-digital archives in addition to launching a web archiving program, but participation in such efforts was largely limited to one or two staff with the requisite skills and knowledge. The Bentley increased its capacity to curate digital archives following the 2009–2010

Mellon Foundation–funded "E-Mail Archiving at the University of Michigan" project, which led to the establishment of a new digital curation division with two dedicated archivists and additional graduate student assistants. Between 2011 and 2014, this team handled all processing of born-digital archives, web archiving, and digitization initiatives.

Following a change in leadership in late 2013, a new "curation" team was established in 2014 that was responsible for processing archival collections in all formats (physical as well as born digital), web archiving, digitization initiatives, and the management of archival software systems. 2014 also witnessed the launch of a new Mellon Foundation–funded project (the ArchivesSpace-Archivematica-DSpace Workflow Integration Project) that sought to reduce the technical barriers to processing digital archives and to increase efficiencies in the creation and reuse of metadata among archival platforms.

In 2018, a new digital initiatives subteam was formed within curation to better coordinate the Bentley's digitization program, digital curation activities, web archives, metadata management, and associated infrastructure. In addition to these core work responsibilities, the subteam sought to establish more efficient workflows through technical innovation and managed the Bentley's technical ecosystem, made up of Aeon (patron request management), ArchivesSpace (archival description and location management), Archivematica (ingest and processing for digital archives), Archive-It (web archiving), and DSpace (a digital repository for preservation and access). In 2021, the curation team finally "re-reorganized" back into a single curation team with a sole head.

Literature Review

Technical upskilling is by no means a new topic in the academic and cultural heritage sector, and professional literature has in fact addressed it over several decades. During the 2000s, such writings frequently focused on the nature and types of skills that were sought after as libraries and archives expanded their digital collections and associated services. Experienced professionals often provided reflections on their work history to highlight in-demand skills, as exemplified by the writings of Eric Lease Morgan, Karin Dalziel, and Bohyun Kim.[2] Morgan, for example, cites XML, relational databases, and indexing as a necessary foundation for advancing in the field, while Kim notes the importance of understanding computer operating systems and the ability to troubleshoot errors. One of the most significant of such publications in the archival profession was *New Skills for a Digital Era*, the collected proceedings of a 2006 colloquium of the same name that was edited by Richard Pearce-Moses and Susan E. Davis.[3] This volume includes the text of keynote presentations by Margaret Hedstrom, an inventory of the skills and knowledge archivists

should possess to address the challenges of digital content, and eleven case studies from practitioners in a variety of professional settings.

Other authors have used the analysis of job postings and/or course offerings in library and information science (LIS) programs to highlight the emergence of important skills and qualifications. Jane M. Matthews and Harold Pardue, for example, documented a "significant intersection between the skill sets of librarians and the skill sets of IT professionals" in their analysis of a sampling of one hundred library job postings and posited that "as IT continues to pervade how patrons access and use library resources, librarians continue to look more like IT professionals."[4] Elías Tzoc and John Millard employed a similar approach, but also explored LIS program course offerings.[5] They found an increase in the number of "digital-related" job postings for librarians and further concluded that practicing librarians need to seek out additional training opportunities to develop the skills that are in demand. Youngok Choi and Edie Rasmussen, on the other hand, distributed surveys to the directors of 123 member institutions of the Association of Research Libraries to better understand "the range of activities in which digital librarians are engaged."[6] The results indicated the value of "soft skills" such as communication and project management in addition to technical literacy that encompasses "expertise in digital library areas" as well as "monitoring the practice and standards of current digital libraries." Jackie Dooley identified an increase in the number of digital archivist positions and associated skills that are in demand by employers in a series of posts on OCLC's *Hanging Together* blog.[7] Peter Chen took this exploration of essential skills a step further in a 2014 post on the Library of Congress's *The Signal* blog by presenting a table that maps duties and responsibilities from job postings to required skills and technologies.[8]

More recently, authors have moved beyond documenting skills to providing guidance on how to acquire them. Andromeda Yelton, a software engineer and librarian, authored a 2015 issue of *Library Technology Reports* dedicated to "Coding for Librarians: Learning by Example."[9] In addition to providing examples of how code is used in libraries, Yelton devotes a chapter to explaining how information professionals can start acquiring skills, with recommendations about online resources, identifying potential projects, and finding mentors. Amy Berish authored a blog post detailing lessons learned as she acquired scripting skills, and Gregory Weidemen provides code samples and step-by-step instructions for archivists to learn how to employ Python scripts in everyday tasks.[10] This focus on practical advice to acquire new skills is also reflected in several series of blog posts from the Society of American Archivists Electronic Records Section, "Script It!" and "Making Tech Skills a Strategic Priority."[11]

Apart from Tzoc and Millard and the Making Tech Skills a Strategic Priority blog series, much of the professional literature assumes that the burden of technical upskilling lies with the individual archivist or librarian. This implicit assumption

is reinforced by the fact that libraries and archives have not been as active as other professions in developing standard approaches to technical skill development for staff, as exemplified by coding "bootcamps" for software engineers or "data carpentry" workshops[12] for research scientists and data curators. In addition, professional development opportunities for librarians and archivists (such as those offered through SAA) frequently focus on technical upskilling for individuals as opposed to institutions (local course-hosting notwithstanding). While some of the literature concedes that mentorship or other outside help is desirable or necessary, it does not typically address the role of the institution and/or its culture in fostering an environment that promotes technical upskilling, especially in the case of a group of employees or an entire team.

Overview of Initiatives

From 2014 to 2019, the authors of this article promoted collaborative technical upskilling within the curation team of the Bentley through four initiatives, as shown in Figure 1:

1. The 2014–2016 ArchivesSpace-Archivematica-DSpace Workflow Integration Project (hereafter referred to as the 2014–2016 Workflow Integration Project) sought to unite ArchivesSpace, Archivematica, and DSpace to allow the more efficient creation and reuse of metadata and to streamline the ingest of digital archives.
2. 2015 Curation Team Workshops sought opportunities to include other curation staff beyond those involved in the 2014–2016 Workflow Integration Project in the exploration of new skills, including command-line operations, audio editing software, and cleaning up messy data.
3. The December 2017–July 2018 Curation Team Technical Skills Pilot Project (hereafter referred to as the 2017–2018 Technical Skills Pilot) built upon 2015 Curation Team Workshops but sought to cover a broader range of topics with more emphasis on an inclusive approach to peer-to-peer learning experiences.
4. The August–December 2019 Bentley Audiovisual Quality Control Utility Project (hereafter referred to as the 2019 BAroQUe Project) focused on the development of a Python-based command-line interface to automate quality control for audio digitized by vendors according to Bentley specifications.

While each initiative varied in terms of the total staff involvement, planning, and intended outcomes, all were intended to enhance the technical skills of staff and, at the same time, expand the Bentley's capacity to address core duties and responsibilities. A brief overview of each initiative follows.

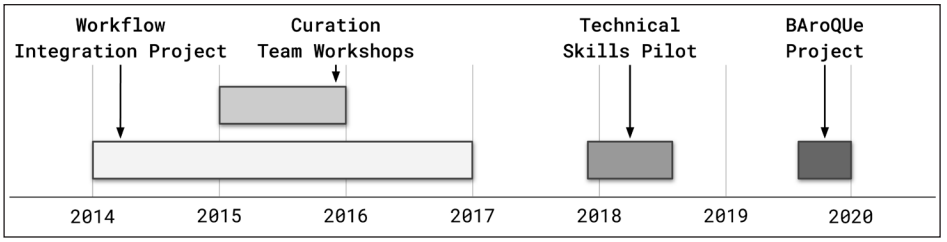

FIGURE 1. Timeline of collaborative technical upskilling initiatives

2014–2016 Workflow Integration Project

As noted, the 2014–2016 Workflow Integration Project sought to unite three open-source software platforms (ArchivesSpace, Archivematica, and DSpace) to allow for the more efficient creation and reuse of metadata and to streamline the ingest of digital archives.[13] While the initial goals of the grant were focused on introducing new workflows and features to the platforms, it soon became clear that there were opportunities for the project team's three archivists to develop a range of technical skills and at the same time advance their core work responsibilities. One of the most important areas of skills development involved working with various software platforms. The Bentley had been depositing content to the University of Michigan Library's DSpace repository since 2008[14] but relied on a University of Michigan Library systems administrator to handle batch processes and general support. With the introduction of two new platforms to the Bentley's technical ecosystem—ArchivesSpace and Archivematica—the three archivists on the project team realized that additional technical skills were needed to use those systems to their full capacity. While the team had extensive experience with preservation principles and strategies, it had much less in terms of programming and the use of application programming interfaces (APIs), knowledge of which would be essential to better engage in the grant project's software development and the Bentley's future use, customization, and support of the platforms. The initiative thus provided an ideal opportunity to expand team members' technical skills and proficiencies.

As a first step, the project principal investigator (PI) scheduled biweekly, half-hour sessions from May through September 2015 at which members worked through a free online Python tutorial to learn programming basics.[15] Over the course of the summer, the team members became familiar with Python terminology, data types, variables, and functions, in addition to learning how to work with file systems and files. While this introduction to key programming concepts and conventions was important, the practical work of cleaning and preparing more than 3,000 Encoded Archival Description (EAD) finding aids for migration into ArchivesSpace proved to be an even more important learning opportunity.

Given the sheer number and size of these finding aids, a manual review and editing process was determined to be infeasible, so the team sought to implement automated, batch procedures. A University of Michigan School of Information graduate student employee who was already an accomplished Python developer helped the archivists move from the abstract, generalized tasks presented in the Python tutorials to the highly specific and practical task of normalizing EAD data (such as dates, subject terms, physical facet descriptions, etc.). Rather than have the graduate student perform the work on his own, the team took the challenge as a learning opportunity, and, with the student's guidance, the archivists learned the skills necessary to parse XML, extract EAD tags and associated text, refine the information, and rewrite the documents with a speed and accuracy that could not be matched by manual editing. The success of the EAD migration to ArchivesSpace was thus a pivotal event that showed how the investment in team members' technical skills could reap significant results for the library in a specific project as well as subsequent efforts.

2015 Curation Team Workshops

Over the course of 2015, the curation team sought opportunities for other staff (such as archival processors, digitization staff, and conservators) to explore new technologies and be introduced to new skills. The team decided to hold a series of informal workshops on topics that included command-line operations with the CMD.EXE shell (i.e., the default command-line interface for the Windows operating system);[16] using the Audacity audio editor[17] to edit and analyze audio files; and cleaning messy data with OpenRefine[18] and Python. Each session followed a basic pattern: an introduction to the technology, practical examples of how and why it is useful in the archival enterprise, and then a hands-on component in which attendees could attempt to complete sample operations in collaboration with their peers. The workshops were highly successful in terms of raising awareness of new tools and the work being performed by colleagues, but as there was no real assessment of learning outcomes or documentation of how skills may have been used for work responsibilities, their overall efficacy in building technical skills was less clear. A key takeaway from the 2015 Curation Team Workshops was thus the need for more structure, planning, and a means of collecting feedback from participants so that outcomes can be analyzed and assessed.

2017–2018 Technical Skills Pilot

The Technical Skills Pilot ran from December 2017 to July 2018; this effort built upon the workshop format of the previous initiative but sought to cover a broader range of topics with more emphasis on an inclusive approach to peer-to-peer

learning experiences within the curation team and a mandate to assess outcomes and identify opportunities for future projects. After discussing the project's intended outcomes and benefits with the Bentley's administrative committee and receiving its support, the assistant director for curation put out a call for a planning committee. Three curation project archivists volunteered and helped establish parameters for the project, which included a limit of one hour per week for sessions, keeping committee preparation time minimal, and orienting the sessions toward the entire curation team. The resulting format gave members of the curation team the opportunity to meet during regularly scheduled, weekly sessions and focus on developing their technical skills.

The committee addressed the project in three phases: planning (two months), implementation (three months), and reporting (two months). During the planning phase, the committee distributed a survey (see Appendix B) to curation team members that asked potential participants to identify technical skills they were interested in learning as well as preferences on the format (structured versus unstructured) and composition (individual versus group) of learning situations. The survey also asked respondents to note skills they had already learned and would recommend for others, with an additional invitation for topics on which they could serve as presenters.

Survey respondents had a strong interest in applications and tools related to data management and project management, with specific references to Python, Excel, OpenRefine, Trello,[19] and GitHub.[20] The committee also found that structured group learning situations were the most preferred instruction format. These responses informed planning and topic selection for biweekly, half-hour sessions, which mirrored the Python sessions that took place during the 2014–2016 Workflow Integration Project and the 2015 Curation Team Workshops. As a result, fourteen sessions were dedicated to learning Python, and eight sessions introduced rotating technical skills topics. The Python sessions covered fundamentals, including variables, expressions, statements, strings, functions, lists, dictionaries, tuples, and files, as well as an introduction to object-oriented programming concepts. The rotating sessions covered topics identified in the survey (i.e., Excel, OpenRefine, Trello, and GitHub) as well as Google Docs/Sheets, regular expressions, and email archiving.

The Python sessions and rotating sessions required different strategies for planning and implementation. Python sessions relied on two free online resources so that participants would work on short problem sets supported with recommended readings and videos provided one week in advance.[21] Participants could then continue work on problems, share answers, and ask questions during meetings. Once the Python sessions began and topics became more complex, the committee adjusted the schedule to allow more challenging topics (e.g., working with CSV files and learning how to use classes) to be explored over multiple sessions. The committee also created the opportunity for a Python "show-and-tell" for participants to share

and demonstrate any scripts they had developed to gain feedback and promote collaborative learning.

The format of the "rotating sessions," on the other hand, varied: roughly half featured presentations, demonstrations, and workshops, while others were organized to foster discussions, to solve problems, and to follow online tutorials as a group. The committee also incorporated new topics (i.e., Google Docs/Sheets, regular expressions, and email archiving) that were not mentioned in survey responses but were suggested by members of the curation team during the implementation phase. Additionally, the committee received administrative support to open a rotating session on the topic of Excel led by a digitization technician to all Bentley employees, not just the members of the curation team.

Outcomes of the project were measured through session participation, the results from two assessment surveys, and participants' application of information learned in sessions to current work tasks. The Python sessions averaged four participants, which, at the time, was just under 30% of the curation team. The rotating sessions averaged six participants, which was just over 40% of the curation team. Additionally, eleven of the fourteen members of the curation team participated in the project by attending or leading a session, resulting in an overall participation rate of 78%. The larger Excel session had eighteen participants, which represented 50% of all Bentley employees, as many were from teams outside of curation.

Given the planning committee's awareness of the need for more feedback from participants, a short preassessment survey (see Appendix C) was administered to participants prior to the first session to determine their level of confidence using technology at work and to better understand their desired outcomes from attending sessions. A postassessment survey (see Appendix D) was later sent to each member of the curation team who attended at least one session, with the goal of documenting their confidence levels at the conclusion of the initiative in addition to gathering any other feedback. This final survey revealed that the collective confidence levels of participants increased 31% during the implementation phase and that both the Python and the rotating sessions were rated a 4 on a 5-point scale in terms of satisfaction levels.

Additionally, 100% of postassessment survey respondents indicated a willingness to participate in additional technical skills sessions. Although the results from the assessment surveys are favorable and there was a strong response rate to the preassessment surveys with ten responses (71% of the Curation team), there were only five responses (35% of the Curation team) to the postassessment survey, which included members of the planning committee. As a result, the sample size of the final survey is not large enough to draw meaningful conclusions, and, because all the surveys allowed for anonymous responses, there was no way to compare individual changes in, for example, confidence levels.

The 2017–2018 Technical Skills Pilot provided a valuable opportunity because it allowed the planning committee to identify employee needs and interests related to technical skills and, through an internal report (see Appendix E for the report's executive summary), to recommend supported continuation of the project within the curation team as well as consideration of how aspects of the project can be applied to initiatives across the Bentley. The project also acted as a starting point for a more formal approach to developing technical literacy among curation team members and introducing skills and tools that could be used by participants in their work.

2019 Bentley Audiovisual Quality Control Utility Project

The Bentley Audiovisual Quality Control Utility (BAroQUe) Project, which ran from August to December 2019, allowed the digital initiatives subteam to "generate deliverables around topics . . . directly relate[d] to their work," a key recommendation from the 2017–2018 Technical Skills Pilot final report. The initiative arose from a demonstrated need—the archivist for audiovisual curation recognized that quality control (QC) workflows for digitized moving images and sound recordings were inefficient and time consuming—and, in the process of producing code to automate aspects of these procedures, a diverse group of digital initiatives subteam members (archivists, technicians, and student workers) were introduced to new approaches to project planning and management as well as to the use of Git and GitHub.

In the first place, BAroQUe provided the subteam with a new strategy for defining project needs. After identifying issues with the audiovisual QC workflows, the group decided to hold a "hackathon," a focused brainstorming session that allowed attendees to learn more about the underlying issues and to generate ideas about a solution. This effort yielded an initial list of functional requirements that was refined using a basic impact-effort matrix, a decision-making tool used to prioritize projects and manage time more efficiently, where one axis represents the "impact" of a solution, and another axis represents the required "effort." Group members brainstormed ideas and placed them in one of four quadrants on the matrix/grid:

- low effort, high impact
- high effort, high impact
- low effort, low impact
- high effort, low impact.

After filtering out ideas that would yield low impact but require high effort, the team decided to focus on progressively more impactful ideas that would require a reasonable amount of effort (i.e., "low" or borderline "low" and "high"), producing a final set of functional requirements for a new QC tool that included items such

as the verification of file name conventions and directory structures as well as the validation of checksums and metadata.

Having established the preliminary scope and desired outcomes for the project, the team moved on to the project planning and implementation phases, both of which provided additional learning opportunities. Planning was facilitated through the creation of a project charter[22] based on an online template.[23] The process of drafting this document led the team to thoroughly explore the implications and impact of the project and resulted in the development of criteria to measure the project's success, a communication strategy for the project team, a timeline for important project milestones and deliverables, and designation of roles to be held by the project team members. In considering how to best accomplish the work itself, the team decided to implement the "agile" methodology outlined in Jonathan Rasmusson's *The Agile Samurai*.[24] This methodology emphasizes iterative and incremental development for time-bound software development projects, so that large tasks are broken down into smaller components that are addressed in short one-to-two-week time frames, often referred to as "sprints." A key feature of agile project management is regular, face-to-face communication among team members to identify challenges and share ideas as well as meetings with a "product owner" (in this case, the archivist for audiovisual curation) who provides feedback and suggestions as the work progresses. Using this framework, the project team was able to produce a weekly work plan that identified key tasks and deliverables and at the same time provided flexibility so that team members' regular work responsibilities could be completed.

Learning opportunities continued as the project team launched the actual work of BAroQUe. While the project was ultimately focused on developing a Python utility for quality control, the team members discovered that everyone—regardless of technical ability—had a part to play. While the most advanced Python developer on the team would serve as technical lead, other participants were able to contribute in a variety of ways, which included basic Python coding as well as the exploration of QC tools and strategies from the audiovisual community, user testing, feedback on product features, and the creation of user documentation. The realization that all team members, regardless of technical proficiency, can advance a software development project was thus both liberatory and empowering. Another key learning opportunity involved introducing the entire project team to Git and GitHub. On the one hand, this raised awareness of important tools used widely in the archives and library fields, and, on the other hand, it allowed all team members to better understand the development process and at the same time make contributions to documentation in the GitHub repository.[25] Finally, the iterative nature of the work provided important lessons for team members in how a project must be reactive to changing needs and new feedback. As an example of this flexibility, the archivist for audiovisual curation identified a specialized tool that did an exemplary

job addressing one of BAroQUe's functional requirements (file format validation). Rather than duplicate this functionality, the team decided to implement the tool, MediaConch,[26] and revised an upcoming work cycle devoted to format validation so that it instead focused on bug fixes and general improvements to the Python code. By employing the agile methodology's responsive feedback model, the subteam concluded the project in December 2019, and the archivist for audiovisual curation successfully used BAroQUe to perform QC on digitized audiovisual files in February 2020.

The 2019 BAroQUe project was also important in reinforcing the value of recognizing achievements and celebrating successful outcomes. The subteam's last meeting was a celebration and retrospective, which included pizza, cake, and the debut of a project logo. The retrospective was framed by Retrium's "4 Ls" technique, which focuses on what teams "Liked," "Learned," "Lacked," and "Longed For" during a given project.[27] In the end, all participants indicated that they would be willing to engage in a similar activity and believed that BAroQUe demonstrated the curation team's ability to undertake basic development projects as a team rather than delegate technical issues to one individual. They also noted that in addition to technical skills relevant to daily work—such as version control, Python programming, command line scripting, XML manipulation, and working with embedded audio metadata, among others—BaroQUe provided a valuable introduction to project management and furthermore made clear the significance of short feedback loops to facilitate communication between developers and the product owner and incorporate feedback into ongoing work.

Specific Outcomes of Initiatives

While the 2014–2016 Workflow Integration Project and the 2015 Curation Team Workshops did not formally articulate desired outcomes about technical upskilling, both the 2017–2018 Technical Skills Pilot and the 2019 BAroQUe Project were planned and executed with specific outcomes in mind. A review of all four initiatives, however, reveals a consistent set of results: increased efficiency and throughput due to the application of new tools and technologies; improved team cohesion and collaboration; and enhanced professional development opportunities for individual staff members. It should be noted that these outcomes are primarily based on the experiences and observations of the authors during and after the initiatives. While the lack of quantitative evidence across all four efforts is regrettable, the following sections discuss these outcomes in more depth and provide detailed examples of their manifestations.

Increased Efficiency and Throughput

Perhaps the most recognizable outcome and consistent goal throughout the curation team's various initiatives was an increase in efficiency and throughput as the result of implementing new tools and technologies. Indeed, one of the primary drivers for staff to learn Python during the 2014–2016 Workflow Integration Project was the need to remove errors and standardize data in more than 3,000 EAD finding aids so that they could import them into ArchivesSpace. The number of documents and frequency of specific issues (such as a <unitdate> element nested within <unittitle>) made a manual process impractical. Each successful step in automating the process—for instance, parsing out subjects with the Python lxml library, normalizing them with OpenRefine, and then successfully importing them to ArchivesSpace—increased the project team's confidence and led members to be aware of other opportunities to automate tasks or take advantage of the full set of a tool's features. In a similar fashion, gaining experience with the ArchivesSpace API led to more exploration and eventual incorporation of the Archivematica and DSpace APIs in frequent and repetitive tasks. It is also important to note that these were not one-time benefits, as the skills and efficiency gained during the 2014–2016 Workflow Integration Project allowed the same team members to make highly impactful contributions to the design and development of the BAroQUe software and at the same time introduce other members of the digital initiatives subteam to the agile methodology and related practices.

The ability to apply information from the 2017–2018 Technical Skills Pilot sessions to improve efficiency and throughput with ongoing and new curation projects was particularly impactful. The all-staff workshop on Excel helped staff use formulas and pivot tables to calculate and present information in new ways, thereby avoiding manual calculations and graph creation. Likewise, a session devoted to Trello, a collaboration and task management tool, spurred the development of a new workflow to manage collaboration on a large-scale (i.e., 1627.5 linear feet, 1.34 TB, 4 archived websites, and 2 oversize items) processing project. Trello facilitated this workflow by helping to break a complex process into manageable chunks, allowing archivists to easily visualize work completed and work still to be done, consolidating issue tracking, as well as permitting archivists to ask questions via comments and assign each other to various tasks. Participants in the 2017–2018 Technical Skills Pilot also used Python scripts to automate tasks, such as creating box labels from ArchivesSpace data, comparing subject terms in ArchivesSpace and a FileMaker database, and editing metadata in the file headers of digital images created by donors. The 2019 BAroQUe Project had a similar impact on daily responsibilities, in that the newly developed tool automated aspects of audio QC that previously required sustained manual effort and substantial time. All this illustrates how the iterative development of staff technical skills has allowed staff to reduce the

amount of time and resources devoted to recurring and repetitive tasks. Instead, staff can now focus on those efforts that demand human judgment and attention, including making determinations as to when it is appropriate to operate at scale and with greater efficiency, and when a collection may warrant a closer look and a slower process.

Increased Team Cohesion and Collaboration

While the increased efficiency described here allowed the curation team to accomplish more with less effort, the technical skills initiatives also yielded an increased sense of cohesion and a spirit of collaboration among individual members. In bringing staff together to share the challenge of learning new skills, a core goal of each initiative was to build trust and camaraderie so that staff would recognize each other as important sources of support. This outcome was experienced early in the 2014–2016 Workflow Integration Project when project staff attempted to learn Python together. The frequent failures and frustrations led team members to let down their guards, express vulnerability, and ask one another for help. In subsequent initiatives, the benefits of opening them up to the entire curation team quickly became apparent. A key prerequisite, however, was an intentional approach to inclusivity: the 2015 Curation Team Workshops, the 2017–2018 Technical Skills Pilot, and the 2019 BAroQUe Project were all directed to the entire group, regardless of skill level or technical proficiency. Novices had the opportunity to enhance their general technical literacy and gain an awareness of tools and technologies, more advanced individuals could provide guidance and support, and everyone was able to participate in a shared team experience.

The overall cohesiveness of the curation team has been strongly aided by the reduction of "knowledge silos" as the result of curation's technical upskilling. For those unfamiliar with tools, technologies, or programming in general, there can be something of a "black box" around the implementation of a technical solution. This perception can also lead to a false dichotomy between "technical" and "non-technical" staff, with the former responsible for taking the lead on introducing new software and the latter assuming a more passive role as end-user. The technical skills workshops thus played a key role in diminishing these preconceived notions. By increasing the technical literacy of the team, a larger number of people came to recognize how procedures might benefit from a given piece of software or where an automated workflow might be particularly helpful. A key example is provided by the genesis of the 2019 BAroQUe Project: when the archivist for audiovisual curation recognized the potential for improvements to the manual quality control process, those on the newly reorganized digital initiatives subteam felt confident that they had the technical skills and the organizational autonomy—they were already organized into a small team focused on digital initiatives and reporting to the same person, and they were not asking for money or the time of archivists on

other teams—to engage with it in-house. Similarly, the 2017–2018 Technical Skills Pilot session on Trello helped multiple staff envision how the tool could be used to manage ongoing work and long-term projects. Thus, the lead archivist for collections management employed Trello to provide updates on high-priority processing projects to stakeholders from across the Bentley and the archivist for digitization services developed a workflow with it to manage digitization requests submitted through the Aeon system.

While the increase in opportunities for staff to explore innovative solutions with colleagues was certainly important, curation leadership viewed the personal bonds formed during intrateam collaboration to be as significant as the development of a particular "hard" skill or product. The personal bonds formed between staff—in addition to leading to lifelong friendships—equipped the team to handle the unexpected and high-stress situations. When the COVID-19 pandemic struck in March 2020, the team made a nearly seamless shift to remote work using collaborative tools such as Zoom and GSuite and were able to plan and execute the team's transition back to the building in the fall. The team also experienced an increase in both the number and volume of on-demand digital imaging requests, which staff continue to address as of this writing. The constraints and many of the collaborative, agile ways of working together they learned through these initiatives have proven especially useful during this time. In hindsight, the curation team was fortunate to have already undertaken these opportunities to increase technical skills collaboratively and team cohesion ahead of the COVID-19 pandemic. While it could not have been anticipated, literature on organizational culture and managing through crisis makes it clear that during such times, leaders need to "intentionally pull back," to both "address the urgent needs of the present" without falling into the "trap . . . that your field of vision becomes restricted to the immediate foreground."[28] It would not have been advisable, therefore, to initiate new projects or endeavor to, for example, increase efficiency and throughput, because so many aspects of the Bentley's response to the COVID-19 pandemic required staff to take the crisis one day at a time, figure out how to accomplish basic archival functions in a radically different environment, and remain attentive to the emotional well-being of themselves and their coworkers. While times of crisis are not necessarily conducive to change, they can be moments for an organization to make good use of the personal bonds already formed during previous intrateam collaborative efforts.

Enhanced Professional Development

The empowerment and growth of staff have very much been at the core of the curation team's technical skills initiatives. As the literature review highlights, libraries and archives can no longer rely only on the "digital archivist" or the "digital initiative librarian" to be the one person on staff with some degree of technical

proficiency. In the current environment, "computational thinking" is an important aptitude—even for "nontechnical" staff and administrators. Team members readily recognized this reality and, in responses to the 2017–2018 Technical Skills Pilot preassessment survey, cited a variety of ways in which they hoped to grow and thereby increase their value to the Bentley and the job market in general:

- "Ideas for ways to utilize technology, or know what is possible/who to talk to about using technology in work"
- "I'd like to learn a bit more about the 'how' of common technologies we use—and also learn some tricks to help parse and clean up data."
- "Looking to get some experience with GitHub and other tech I have not had the chance to use"
- "Gain project manag[ement] skills"
- "New tech skills, more confidence engaging with developers, IT folks, also a model for departments learning new skills/professional development"
- "To learn how to use Python in practice (in my work), use spreadsheets more efficiently, and any other tech skills that help in my day-to-day work"

While participants were highly motivated, the barriers to acquiring new technical skills are daunting; in addition to registration fees for some online courses and additional travel fees for workshops, there are questions about prerequisite knowledge or the relevance of potential study areas. By offering the technical skills initiatives during regular hours and tailoring the content to the actual interests and work responsibilities of staff, curation leadership was able to produce impactful professional development opportunities for the entire team. While such a course of action requires the support of supervisors and administration—for which the curation initiative organizers were very grateful—it has yielded significant returns in the engagement and enthusiasm of staff.

Beyond helping individuals acquire new technical skills and awareness, the initiatives also introduced organizers and participants alike to project management and other types of leadership experience. The three project archivists who formed the committee for the 2017–2018 Technical Skills Pilot, for example, gained project management experience for an initiative that reached 50% of Bentley staff. One project archivist reported this experience valuable in providing evidence of leadership skills and the ability to meet objectives within a specified timeframe when seeking employment opportunities. Similarly, the 2019 BAroQUe Project offered every member of the digital initiatives subteam the opportunity to take a project management lead on month-long individual sprints, a role that involved defining roles and expectations, communicating clearly, marking project milestones, and taking time to reflect on and celebrate accomplishments. The significance of this opportunity became clear in the retrospective at the project's conclusion when many of the subteam members noted the value of this project management experience. This was particularly important for professional archivists on staff, as the Bentley's

promotion criteria include the demonstration of "organizational skills, planning, supervision, and management." The experience was likewise highly beneficial for project archivists, early-career professionals with temporary appointments at the Bentley, who would need to demonstrate these skills to future employers after the conclusion of their service at the Bentley.

Lessons Learned

In reviewing the curation team's various technical skills initiatives, several significant lessons around the planning and execution emerged. By implementing a series of projects over a six-year period, the organizers were able to identify challenges, missed opportunities, and successful strategies. While each project was unique in scope and design, the authors found the following items to be universally relevant:

- Team members are significant assets for group skill development.
- Well-defined deliverables enhance personal outcomes.
- Regular and actionable assessments improve planning and implementation.

The curation team intends to apply these lessons in future initiatives, and each is discussed in more detail below.

Team Members Are Significant Assets for Group Skill Development

One of the clearest lessons learned was that involving a team member with considerable experience applying a technical skill created an efficient learning environment that benefited the overall initiative. During the 2014–2016 Workflow Integration Project, for example, the close collaboration of archivists with a graduate student highly skilled in Python development yielded compelling results within the grant period. This dynamic was also employed in a 2017–2018 Technical Skills Pilot session on Excel that was open to the entire Bentley library. A digitization technician, who had developed significant expertise with spreadsheets through educational experience, volunteered to lead this session and was able to translate this knowledge to a high-impact education session that reached a wide range of individuals with various skill sets and job responsibilities. Similarly, the success of the 2019 BAroQUe Project in creating a functioning deliverable over a limited period was due in large part to establishing a technical lead role for an archivist with a higher level of technical experience. This role set the overall technical direction of the tool, created a structure for the command line tool, and reviewed and commented on code contributions across all stages of the project. Assigning these responsibilities to a knowledgeable individual ensured that other participants could more easily work on their own coding skills, without needing in-depth knowledge of the entire piece

of software. Furthermore, this role served as a project-based way of transferring job knowledge between members of the same team.

It is also important to note that team members do not need to have technical expertise to make significant contributions to a group's skill development. For example, having one or more team members undertake a project management role during initiatives helped to ensure accountability within the team as well as the achievement of project goals. The 2017–2018 Technical Skills Pilot had a planning committee of three project archivists who were tasked with planning, implementing, and reporting on the initiative while also leading and participating in sessions. The planning committee was also responsible for taking participant feedback into account and adjusting session content, duration, and structure accordingly. The role of the "meta" project manager in the 2019 BAroQUe Project and the principal investigator of the 2014–2016 Workflow Integration Project closely mirrored the role of the planning committee of the 2017–2018 Technical Skills Pilot. All these roles took on the responsibility of seeing the initiative through to completion and were receptive to participant feedback. These project manager roles, however, did not preclude other project team members from taking on leadership roles during each initiative, such as leading individual sessions during the 2017–2018 Technical Skills Pilot, managing individual sprints during the 2019 BAroQUe Project, and leading 2015 Curation Team Workshops.

An important first step in considering a technical skills development initiative, then, is to register not just the technical skills but the interests and aptitudes of team members. These individual strengths and inclinations are tremendous assets that can do much to move an initiative forward and lead to positive group outcomes. Involving individuals not only increases their engagement in the initiatives but gives them an opportunity for professional development (for instance, in managing a project) and to be recognized by their peers.

Well-Defined, Relevant Deliverables Enhance Personal Outcomes

A key question in the analysis of the technical skills development initiatives centered on those aspects that participants enjoyed and that thus motivated them to continue in their learning efforts. Previous discussion has highlighted the social aspects of the initiatives as well as the professional development opportunities they afforded. An even more important factor for participation and positive outcomes, however, was having a well-defined and practical deliverable associated with the learning opportunity. Indeed, working on a deliverable (e.g., a command line program) with a direct work-related impact was cited favorably by numerous participants because it allowed them to focus on developing specific technical skills (e.g., Python) with a deeper level of expertise. Those involved in the 2014–2016

Workflow Integration Project, for example, found that while half-hour sessions devoted to working through a free online Python tutorial provided an important introduction to key programming concepts and conventions, the practical work of cleaning and preparing finding aids for migration into ArchivesSpace made those concepts and conventions more concrete.

Similarly, the four participants in the 2019 BAroQUe Project who undertook most of the coding work further developed their existing Python knowledge, while the entire project team gained an in-depth understanding of technical specifications associated with audiovisual quality control. One of the most significant outcomes of the 2017–2018 Technical Skills Pilot, additionally, was the application of information from sessions to current curation team projects. The 2015 Curation Team Workshops, on the other hand, lacked clear deliverables and thus may not have been as impactful. While attendees were introduced to various technologies (e.g., OpenRefine, Audacity, the Windows CMD.EXE shell), ready opportunities to apply these tools to current work were not necessarily provided or, to be honest, considered in planning the activities. While raising awareness of workflows and tools was an important step in helping participants understand the work of their colleagues, the absence of clear, relevant deliverables may have limited the utility of the sessions or of individuals' overall engagement.

Regular and Actionable Assessments Improve Planning and Implementation

Despite best efforts, hindsight has shown that all four initiatives lacked robust forms of assessment for individual participants and/or the means to incorporate feedback into the technical skills initiatives. In the skills development portion of the 2014–2016 Workflow Integration Project, for example, assessment was completely overlooked. In hindsight, however, the curation team realized that the successful implementation of the ArchivesSpace archival management system and the Archivematica digital preservation system as well as the development of a more robust, end-to-end digital preservation workflow provided clear indications of the technical skills developed by the 2014–2016 Workflow Integration Project team. Similarly, the successful development and deployment of the tool developed during the 2019 BAroQUe Project provided evidence of the project's success and, by extension, the development and refinement of participants' technical skills, but detailed individual measurements were not included in the initiative. Of the four initiatives, individual assessment was most clearly emphasized during the 2017–2018 Technical Skills Pilot through the distribution of two surveys. A preassessment survey (see Appendix C) was given to participants to determine their level of confidence using technology at work and to understand their desired outcomes before sessions started and a postassessment survey (see Appendix D) was sent to each

participant to determine confidence levels and gather overall feedback from participants after sessions ended. Although the assessment survey results are favorable, the response rates are not consistent enough to draw meaningful conclusions.

The value of regular and actionable assessments lies in their ability to 1) help tailor learning initiatives to the actual needs of individual team members and their daily work responsibilities as well as 2) demonstrate the outcomes and impacts of these efforts in a clear and quantifiable manner. For group initiatives with a strong education component, applying multiple forms of individual assessment throughout the initiative can result in a more holistic understanding of the impact on individual participants and, by extension, the entire group. For example, while the 2017–2018 Technical Skills Pilot relied on pre- and postassessment surveys, periodic face-to-face check-ins with individuals during the initiative could have provided the planning committee with guidance on how to refine or re-envision upcoming sessions to better meet the needs of participants. Furthermore, participants in the 2017–2018 Technical Skills Pilot may have also benefited from setting specific individual learning objectives at the beginning of the initiative and then assessing their performance in meeting those objectives at the end of the initiative in addition to sharing their desired outcomes and quantifying their confidence levels in the pre- and postassessment surveys. Diverse assessment methods have the added benefit of accommodating the different communication preferences that exist in most groups, as some participants may be more forthcoming through written feedback and others through oral. Addressing these differences—and acknowledging the inevitable fatigue that results from multiple survey forms—may result in more robust assessment data.

Employing individual assessment methods is also important for initiatives that produce products, where individual growth and achievements can seem secondary to deploying a functional tool. For example, while the end products of the 2014–2016 Workflow Integration Project and 2019 BAroQUe Project indicate clear growth, less clear is the overall distribution of that skill development and the extent to which the gains impacted individual work performance. Participants in both initiatives had a rough sense of their programming proficiency (or lack thereof) at the outset, but a formal assessment of skill development would have provided a better understanding of individual impact. Conducting structured entrance and exit interviews, ideally by a neutral party, with each participant to evaluate their skill development can result in robust qualitative information that provides insight into individual growth and achievements. Additionally, structured interviews can be used as an assessment methodology for participants to compare their experience across multiple product-based initiatives, which can provide insight into what enhances and what hinders personal technical skill growth while working on a collaborative product. This kind of information can be valuable to an organization when developing future initiatives. Given that workplace technical skills initiatives

represent an allocation of personal time and organizational resources, institutions considering similar efforts would do well to consider how they can best illustrate the return on investment via the assessment of participants.

Things to Consider When Exploring Technical Upskilling Projects

Over the course of the technical upskilling initiatives, the curation team faced a number of difficult if not intractable challenges, which included making the case and achieving buy-in for new efforts, working within time and resource constraints, striving for team inclusivity and equity, and building a culture that values technical upskilling. This section thus highlights some key considerations for the benefit of other academic and cultural heritage institutions exploring technical upskilling projects.

Making the Case for Initiatives

At first glance, it may seem that improving the technical skills of a team only presents upsides for the larger organization and for individual participants. However, there are a variety of reasons why managers and team members may hesitate to move forward, and so making a case for technical skills initiatives may be necessary.

Questions around the time required for initiatives and the overall tangibility of benefits (for instance, in terms of increased efficiency or throughput) may be foremost in the concerns of management. In seeking buy-in from these key stakeholders, then, initiatives and intended outcomes should be framed by an awareness of organizational culture, structure, and values. Some key questions that might be asked include: What importance is placed on (and resources allocated to) professional development? Is there capacity for the initiative in addition to core work responsibilities? What in-house expertise or experience does the organization already possess that can help facilitate positive outcomes? What resources are available for innovation? How does the initiative align with current or upcoming priorities?

Throughout the Bentley's initiatives, the curation team sought administrative support by connecting efforts with one of the library's core strategic goals: to create more product with less process by employing efficient workflows through technical innovation. In making the case for the 2017–2018 Technical Skills Pilot to the Bentley's administrative committee, for example, the assistant director for curation defined a clear scope for the initiative (in terms of duration and the amount of paid time that would be dedicated to the effort) and emphasized that the planning team would analyze the results of the pilot to inform future endeavors. The 2019 BAroQUe Project's successful launch also reflects the importance of understanding and working within the organizational structure. Because the contributors all

directly reported to the head of the digital initiatives subteam, it was relatively easy to schedule the work and shift priorities as needed (though this arrangement might also call into question the "voluntary" nature of the skills development).

To attract and sustain staff participation in technical upskilling initiatives, alignment with individuals' varied motivations for acquiring new skills and knowledge is important. Gaining some knowledge of potential participants' interests, professional goals, and current or prospective projects may thus yield important data for creating such alignment. At the same time, it is natural for some individuals to grow familiar with established procedures and comfortable with their role in an organization. In the absence of clearly defined benefits (either personal or work related), little incentive may exist to invest time and energy to delve into new material that may prove to be both confusing and frustrating. An organizational culture that embraces learning and innovation or sets clear expectations around professional development for staff may help spark interest. Likewise, connecting the acquisition of technical skills to an urgent work need or long-standing pain point may also demonstrate the value of an initiative to individuals. A key selling point of the 2019 BAroQUe Project was its promise of making an exceedingly manual audiovisual quality control process much less labor intensive. Finally, a review of team members' skill sets and strengths may reveal opportunities for involvement beyond the technical components. As one example, the involvement of the project archivists in the 2017–2018 Technical Skills Pilot was presented as a professional development opportunity. By volunteering to organize a more formalized, inclusive approach to peer-to-peer learning experiences, these early-career professionals gained project management skills as well as an opportunity to demonstrate bottom-up leadership. Even with their relative lack of social capital as term-limited employees working alongside permanent ones, they helped build a coalition in support of the idea, and their contributions of time and energy ultimately made the initiative possible.

Helping staff take ownership of initiatives and defining expectations also proved to be important steps to gain buy-in, maintain the involvement of participants, and ensure that everyone stayed on the same page. At the outset of the 2014–2016 Workflow Integration Project, a newly hired archivist was invited to participate in planning prior to their official start date so that they would have a greater personal stake in the work. For the 2017–2018 Technical Skills Pilot, planning was left entirely to the project archivists aside from the constraints identified when the project was approved. The 2019 BAroQUe Project had a similarly collaborative genesis, arising from a digital initiatives subteam meeting in which everyone confirmed their desire and capacity to undertake such an endeavor. Lessons learned from the more ad hoc nature of the first two initiatives also led organizers of the subsequent ones to create formal, written project charters that outlined roles and responsibilities, defined timelines, and specified desired outcomes. These latter initiatives also created dedicated virtual spaces for online documentation and explicit

channels for project communication, all of which helped to create consensus around who was doing what and when, and to what end.

Time and Resource Constraints

As with most undertakings in academic and cultural heritage institutions, all four of the curation team's technical skills development initiatives faced time and resource constraints, as participation took place in addition to existing duties and responsibilities. Gaining administrative support allowed organizers to block off periods of the work week, but even then it could be difficult to master—let alone grasp—complex topics in relatively brief weekly sessions. Experiences with the 2017–2018 Technical Skills Pilot are particularly apt in this regard. Participants reported that both the rotating skill and Python sessions were too short and did not allow enough time to cover topics and ask questions. For example, a postassessment survey response indicated:

> [I] wasn't able to keep up with practice outside of the allotted time since it wasn't totally applicable to my work. I would have liked to stick with it, but it didn't seem possible to learn very much in 30 minutes and to focus on other work [so] I stopped attending. But I think the resources provided are great and I would like to use them at my own pace later, even though learning in a group does seem more beneficial.

In hindsight, the organizing committee realized that a more nuanced approach to scheduling would have been beneficial during the 2017–2018 Technical Skills Pilot. In general, for topics with broader appeal, it would have been useful to hold longer and less frequent sessions like those modeled by the Excel session. On the other hand, topics with narrower appeal (e.g., Python) should have included opportunities for more focused study groups as well as clear avenues for individuals to coordinate with their supervisors to generate deliverables directly related to their work. In addition, participants tended to prefer structured sessions, such as presentations and workshops, over those with less structure, such as collaborative problem solving, pair programming, and discussions. The committee could have arranged for Bentley employees or others to lead more structured sessions, but this approach would have required a longer planning phase and a greater investment of other staff members' time. Given the significant differences that emerged over the course of the initiative—rotating skills versus Python and structured versus unstructured—the organizing committee was essentially running two different projects concurrently, which was a disadvantage in terms of available time and resources. As a result, the rotating skill and Python sessions could have been handled separately, with different program goals and timelines.

Similarly, the 2019 BAroQUe Project faced time and resource constraints, a prime example of which was the "pivot" that occurred between sprints. Rather than continue with the original plan and implement the remaining features on a short

deadline, the project team opted to change course and improve the already-developed functionality. In this case, the "agile methodology" employed by the team contributed to a more useful final product and overall project despite the original constraints.

While local institutional factors may vary, some key questions to ask in relation to time and resource constraints include:

- What is the scope of the project?
- What is the timeline of the project?
- What are the available human or financial resources to support the project?
- How important is the quality of the final product?

It can be helpful to think of these as trade-offs. When budget or other resources are high, or time is unlimited, the scope of the final product can be expansive, and its quality can be high. If time is limited, however, scope and quality may need to be adjusted. In many projects, at least one of these trade-offs will need to give, and it can be helpful for team members and other stakeholders to explicitly agree (preferably before a project begins) on which of these are flexible and which are not. Time and resource constraints thus do not inherently prevent or sideline a project; they do, however, mean that the scope of the endeavor may not be as expansive as it might have been if those time and resources constraints did not exist.

Although technical skills are complex topics that can be difficult to master, there are a number of strategies that institutions may employ to better manage the associated time and resource constraints. One option is to reduce the scope or complexity of the topic, perhaps by focusing on introductory-level content or addressing only one project "track" at a time. Another option is to expand the amount of time devoted to learning by slowing down the pace or gaining administrative support to allocate more time for a given initiative. Finally, project management techniques such as charters and short feedback loops can help manage an initiative's scope but need to be carefully applied and considered. For instance, while the 2019 BAroQUe Project used an agile methodology to facilitate a project pivot between sprints, participants still felt pressure to accomplish more than could be reasonably expected in the allotted time. Because no trade-off existed and the scope was mismatched with the available time, participants worked on the project outside of work hours (without anything like overtime pay). That was certainly not the intention of the project manager and was a significant regret of the project.

Approaches to Team Inclusivity and Equity

The authors cannot write about inclusivity and equity without acknowledging their privilege as employees of an institution like the University of Michigan, which has a long record of both success and failure related to these important topics. While the Bentley has committed to improving its diversity, equity, inclusivity, and

accessibility in the broadest sense, this section focuses more narrowly on the dynamics of internal team inclusivity and equity. The first initiative, centered around the 2014–2016 Workflow Integration Project team, highlighted the importance of an intentional approach, as their collaborative upskilling led to internal perceptions of an exclusive "club" for a select group of white men. As a result, organizers of subsequent efforts deliberately sought to involve a broader range of team members, especially those without pre-existing "technical" skills or who did not readily see the relevance of such skills in their day-to-day work. This care extended to how the initiatives were titled and branded: after initially referring to the 2017–2018 Technical Skills Pilot as a "Technical Skills Club," organizers realized that the name could reinforce the aforementioned view that upskilling sessions were for an exclusive few. In reaching out to staff, the curation team's early-career project archivists were specifically encouraged to participate, as the initiatives could provide opportunities for professional development as well as networking and engagement with more established archivists.

This focus on inclusivity also led the curation team to explore multilevel or differentiated instruction as an approach to learning technical skills. Differentiation is "a method of instruction designed to meet the needs of all students by changing what students learn . . . how they accumulate information . . . how they demonstrate knowledge or skills . . . and with whom and where learning happens. . . ."[29] Adopting this approach would allow participants to start at an appropriate skill level and better ensure that needs related to diverse abilities and interests could be met. In both the 2017–2018 Technical Skills Pilot and the 2019 BAroQUe Project, organizers used a very basic differentiation strategy: starting slow. In the former, the more complex skills like Python were introduced gradually and progressively, starting simple (with the cliche "Hello, World!" program!) and building on those skills over time. In the 2019 BAroQUe Project, the first sprint was dedicated to scaffolding the rest of the sprints, introducing topics that would be needed for the remainder of the project. Nevertheless, it still proved difficult to introduce a variety of topics while addressing the needs of curation team members with wide-ranging experience and skill levels. This challenge was particularly evident in the 2017–2018 Technical Skills Pilot; during the Python sessions, participation by people on both ends of the skill-level spectrum (i.e., those with little to no experience and those with a strong background in programming) decreased over time. In retrospect, the committee should have conducted interviews with potential participants to better understand their needs and expectations. By contrast, technical skills with a lower barrier to entry or that built on participants' previous knowledge of a familiar platform (such as the 2017–2018 Technical Skills Pilot Excel session) could be more effectively introduced to a wider audience (even the entire library!).

In hindsight, it's clear that some techniques for differentiation could have been implemented better throughout the initiatives. In the 2017–2018 Technical Skills

Pilot, the committee could have given participants with more experience (the "high achievers," in education literature) more active roles during sessions. This technique was employed in the 2019 BAroQUe Project, for example, where such participants were given additional roles, such as "technical lead." Additionally, with different project parameters, the committee could have had pre- and postsessions for beginners to provide more time for questions and exercises and an opportunity for more frequent assessment. As it was, informal assessments did prove helpful in gauging the effectiveness of learning across the different initiatives. The technical skills developed in the 2014–2016 Workflow Integration Project could be demonstrated by the number of EADs or accession records imported into ArchivesSpace; the 2017–2018 Technical Skills Pilot by "show and tell" of how participants implemented technologies; and the 2019 BAroQUe Project by how well the product worked for the customer.

Efforts at inclusion brought with them further questions of equity. As a further caution in creating effective and meaningful participation models to promote group learning and technical upskilling, carefully consider the underlying assumption that involving people who might otherwise have been excluded from these conversations is inherently good or desirable for every employee in every situation. As an example, employees at the University of Michigan largely fall into two human resources classifications: Faculty or Staff. While the curation team's archivists are classified as Faculty, digitization technicians (including those who participated in the 2017–2018 Technical Skills Pilot and the 2019 BAroQUe Project) are paraprofessionals who report to archivists and are classified as Staff. Both are incredibly important to the operation, but the respective classifications come with significant differences in performance expectations. To be promoted from "Assistant" to "Associate" rank, for example, archivists are required to demonstrate some of the skills they would have needed to learn to lead initiatives such as those outlined in this case study, and this promotion can occur within the same position. For digitization technicians, however, the university's expectations are that promotion occurs by a transfer or "movement to a position in another classification at a greater level or responsibility," which may or may not require the aforementioned skills or even be a job at the Bentley.[30] Within the curation team, the differences in classification and performance expectations between archivists and digitization technicians also come with significant differences in compensation. As a result, it is not fair to ask a digitization technician to perform the work of an archivist and not get compensated accordingly, regardless of their ability or aptitude.

Other differences exist in classification that should also be considered. At the Bentley, project archivists were on term-limited contracts; while technical upskilling may very well increase their marketability, the organization itself stands to gain more when permanent employees acquire skills and transfer them to peers. Likewise, student workers and interns on the curation team could have benefited from such

experiences, but there are a number of issues that must be considered. Such staff members are often hired to do very narrowly scoped work, have a lower rate of pay, and may be subject to special regulations on the type and amount of work they can do. In addition, they are likely balancing their work with other competing priorities, namely, being a student. At the same time, interns—while students—may have an added requirement to learn additional skills, in which case their participation might be a more natural fit. Finally, given the significant differences in compensation between archivists and application programmers, one may legitimately ask whether or not acquiring new skills is worth the labor. Even if, as Matthews and Pardue correctly observe, "librarians [and archivists] continue to look more like IT professionals," they certainly don't get paid like them.

While the authors generally take pride in the fact that these initiatives were intentionally inclusive, those seeking to replicate or build on our experience would do well to remember that inclusivity for inclusivity's sake can be harmful to an organization's culture and that there may be a very good reason why some would prefer not to participate in initiatives like these. Participation may not be preferable, for example, during times of professional change—such as the beginning of a new leadership role—or during personal change—such as balancing work and childcare during a pandemic. Of course, paraprofessionals, students, or others without explicit performance expectations for this type of technical skills development shouldn't necessarily be excluded from such initiatives, and their input is incredibly valuable in projects such as the 2019 BAroQUe Project where they would ultimately be the primary users of the tool. However, during the planning stages, their roles should be carefully negotiated to consider factors such as personal interests and goals as well as the structure within which the project team will be working. To reiterate an above point, the Technical Skills Pilot was run by volunteers and participants who could choose their level of involvement. Other initiatives, however, were made up of contributors that all reported to the same person. While this did help facilitate getting work done, this arrangement isn't exactly "voluntary." Likewise, it is not fair to ask a digitization technician or student worker to perform the work of an archivist and not get compensated accordingly, regardless of their ability or aptitude because, paternalistically, "it's good for them." Particular attention should thus be paid to factors such as job classification, employee status (especially with students, interns, or volunteers), reporting structure, performance expectations, and compensation, especially as they relate to power dynamics within the organization.

In short, inclusivity is desirable as long as participants are not required to complete work they did not sign up for or are not paid to do. Likewise, there may be good reasons for different staff members to fulfill distinct roles in initiatives or even to decline participation if they lack bandwidth or the initiative is not relevant. Such cases would thus not indicate exclusivity and as such should not be regarded as inherently bad or undesirable.

Building a Culture that Values Technical Upskilling

The authors are all archivists, and some of them middle managers. While inspired by project and product management practices they gleaned from their work with Artefactual Systems, Inc., the lead developers of Archivematica, during the 2014–2016 Workflow Integration Project,[31] as well as group technical initiatives at institutions like the Rockefeller Archive Center,[32] none of them are experts in organizational culture or organizational change. However, looking outside of the libraries and archives literature has provided some clues as to factors that contributed to both the success of the individual initiatives and, over time, how the Bentley attempted to build a culture that values technical upskilling.

Adam Grant, the Saul P. Steinberg Professor of Management and professor of psychology at the Wharton School, University of Pennsylvania, has written about the types of discomfort that help and hinder collaborative initiatives. Grant characterizes an absence of conflict as "apathy" rather than "harmony." Thus, instead of trying to avoid conflict, it should be used as "one of the ways that a team of people can be creative and make good decisions." He furthermore differentiates between "task conflict," which is "a disagreement about the content of the discussion," and "relationship conflict," defined as "a perception of interpersonal difference between the people in the group."[33] Grant performed a study that involved groups working on collaborative tasks looking at task versus relationship conflict, the results of which suggest that

> failed groups tended to have much more relationship conflict, where they are busy disliking one another and not focusing on the work to be done. In contrast, high performing groups experienced more on task conflict, especially early on in their projects, and spend time working to better understand the ideas being presented. Interestingly, when task conflict occurs early in the work, the group will default to this kind of discussion later in the project when disagreement occurs.[34]

It seems that most, if not all, of the initiatives described here encountered some degree of task conflict at their beginnings, whether in terms of how best to integrate ArchivesSpace, ArchivesSpace, and DSpace (or spend grant funds), which skills to teach in the 2015 Curation Team Workshops, how to teach Python in the 2017–2018 Technical Skills Pilot, or what kind of tool to develop to facilitate QC for digitized audio. All, however, lacked significant interpersonal conflict, and the personal bonds formed during intrateam collaboration became an important, long-term benefit of these initiatives.

In terms of building a culture that values technical upskilling, it's important that those who led these initiatives sought to understand and cultivate the kind of workplace culture they desired to implement, in part by simply defining it. Whether the goal is to create more product with less process by employing efficient workflows or to "innovate and create new technologies," these values gain traction because they

align well with the Bentley's overall mission and yet are "special" to the curation team. Camille Fournier, in *The Manager's Path*, reinforces this point: "Understand what your company's values are, understand what your team's values are . . . write the values down if they aren't already written, and try to be explicit." Fournier goes on to indicate that using this list to "evaluate candidates, praise team members, and inform your performance review process" can be ways to reinforce the culture a leader is trying to build.[35] The curation team has heeded Fournier's advice by ensuring that values such as those articulated previously—and complementary values like "repairing, maintaining, and improving those technologies"—are made explicit, written down, regularly reviewed and updated, and used, in part, to orient new team members.

It's also significant that the impetus for technical upskilling was a "movement" spearheaded by individuals and middle managers rather than a top-down mandate from administration. While a director or a dean holds a position of authority, Bryan Walker and Sarah A. Soule note that such leaders are not as effective as a "movement maker" in leading a cultural movement, as the latter is able to "fram[e] situations in terms that stir emotion and incite action."[36] Indeed, all the curation team's upskilling initiatives had their roots in emotion, what Walker and Soule refer to as "a diffuse dissatisfaction with the status quo and a broad sense that the current institutions and power structures of the society will not address the problem." For the curation team, these motivations ranged from dissatisfaction with the limitations of standard digital archives ingest processes to the desire to automate QC workflows and thereby avoid the negative consequences of overly-manual procedures. Staff needs and discontent thus led to a "movement" when an archivist or staff member "provide[d] a positive vision and a path forward that [was] within the power of the crowd." By advancing a view of a better future—more efficient tools and workflows along with enhanced skills and knowledge to fulfill daily obligations—the curation team's "movement makers" inspired their colleagues to work together and achieve goals that were beyond their capacity as individuals, toiling in solitude. Likewise, all started small and began "with a group of passionate enthusiasts who deliver a few modest wins."[37] Ultimately, such wins help the movement to gain steam and further demonstrate the ability of movements to affect organizational change.

Conclusion

The most important lesson drawn from the experiences of the Bentley Historical Library curation team is that organizational culture yields greater results in technical skills development than project-based approaches or individual efforts, both of which have significant inherent limitations. Although the curation team's initiatives were roughly consecutive over the span of 2014 through 2019, each was of a finite duration and concluded at an established end date; as a result, there

was not necessarily comprehensive coverage or even continuity over those six years. Instead, the efforts were more akin to a series of distinct projects. Even though there was a kind of through line between the initiatives, with the lessons from the 2017–2018 Technical Skills Pilot helping to inform the 2019 BAroQUe Project, for example, the curation team recognizes a need to establish a culture of innovation that fosters group technical skill development.

As indicated, projects are by their very nature limited in terms of time, scope, and resources; the curation team's experiences also suggest that a project-based approach to upskilling relies heavily on strong leadership, motivated participants, and the privilege of being able to prioritize work that is outside of an individual's primary responsibilities or job description. This dependence on strong leadership, however, is simultaneously a distinct disadvantage: in the absence of such an individual, it may be challenging to make the case for such initiatives or to gain buy-in from participants. An alternative approach to group upskilling with the possibility for greater sustainability and individual impact would be to foster an organizational culture where team upskilling is supported and encouraged as much as other forms of individual professional development.

Creating a culture, rather than a project, that supports team technical upskilling would potentially lessen the reliance on team members in a position of power to be the ones who initiate and, thus, legitimize team technical upskilling. Instead, all members of the curation team could, for example, contribute to technical upskilling throughout their tenure because they are all expected and encouraged to do so, much like professional development. Creating this kind of a culture within the curation team may then result in more equitable technical upskilling opportunities that account for a variety of individual job responsibilities and skill levels.

Appendix A: Windows CMD.EXE Workshop Activities

General Resources:

- http://ss64.com/nt
- http://www.robvanderwoude.com/batchfiles.php
- http://www.avpreserve.com/papers-and-presentations/an-introduction-to-using-the-command-line-interface-to-work-with-files-and-directories

NOTE: Never experiment with important files! It's very easy to delete or modify files when using the CMD.EXE prompt; when learning the CMD.EXE shell, always be sure you navigate to a test directory and work with dummy files or copies of content.

From the Command Prompt:

1. Enable the following default settings for CMD.EXE shell properties:
   - QuickEdit
   - Insert Mode (allows right-click to paste from clipboard)
   - AutoComplete (allows user to hit tab to complete path/filenames)
2. Command to create a directory:
   - `MKDIR test-dir`
3. Commands to navigate directories (note that if path has spaces, enclose in single/double quotation marks):
   - `CD test-dir`
   - `CD ..` ("..." indicates go up one level in the directory hierarchy)
   - `CD ../..` (Additional ".." allow user to navigate up two or more levels in the directory hierarchy, etc.)
3. Command to change directories via different drive letters (note use of '/D' option):
   - `CD /D Z:/unprocessed`
4. Command to list directory contents to STDOUT:
   - `DIR C:/path/to/folder`
   - `DIR /S /B C:/path/to/folder` ("/S /B" enables recursive listing of all contents, with full paths)

   NOTE: you can add the following parameters before the file path in DIR commands:
   - `/A:-D` (Only list files)
   - `/A:D` (Only list folders)
5. Command to list directory contents that match a pattern:
   - `DIR /S /B C:/path/to/folder/*.docx` (find all .docx files)
   - `DIR /S /B C:/path/to/folder | FINDSTR /C: "pattern"` (find any folder or file that matches the pattern string)

6. Commands to redirect output to files (note use of ">" and ">>"):
   - `DIR /S /B C:/path/to/folder > test.txt` (writes new file)
   - `DIR /S /B C:/path/to/folder >> test.txt` (appends to end of file)
7. Command to read and print text from a file:
   - `TYPE test.txt`
8. "|" is known as the "pipe" operator; it allows users to pass output of one operation as input to another
   - `TYPE test.txt | SORT` (Read from file and sort output)
   - `TYPE test.txt | SORT /R` (Read from file and sort output in reverse order)
9. Command to find an exact string in a file:
   - `FINDSTR /C:"[string]" "file.txt"`
10. Command to rename a file:
    - `REN test.txt newfile.txt`
11. Command to copy a file to a new location:
    - `COPY test.txt C:/path/to/folder`
12. Command to move a file to a new location:
    - `MOVE test.txt C:/path/to/folder`
13. Examples of commands that use conditional logic to test a variable:
    - Example 1:
      ```
      SET _var = 2
      IF % _var% GTR 1 (ECHO Winner!)
      ```
    - Example 2:
      ```
      IF %_var% GTR 1 (ECHO Winner!) ELSE (ECHO Loser!)
      ```
14. Command to loop through a list of files and do something to them (use "delims=" in case there are spaces in path names):
    - `FOR /F "delims=" %A IN (test.txt) DO (ECHO %A)`
15. Command to delete a file:
    - `DEL test.txt` (Force delete: `DEL /F /Q test.txt`)
16. Command to delete directory:
    - `RD C:/path/to/file`
      `RM /S /Q C:/path/to/folder` (Force delete, if folder includes content)

Appendix B: 2017–2018 Technical Skills Pilot Planning Survey Instrument

Introduction

The Curation Team Technology Club aims to offer members of the Curation team the opportunity to learn various tech skills that they might not otherwise have a chance to use. Within the club, technical skills are defined very broadly, so feel free to suggest anything from office software, project management tools, and data manipulation to anything in between! The club plans on having two thirty-minute sessions a week, with one session covering rotating tech skills (based on your suggestions), and one ongoing Python session.

Skills

1. What kind of technical skills are you interested in learning?

2. What technical skills have you learned that you recommend others learn?

3. Please list 2-3 technical skills that you are confident in using.

Learning Situations

4. What type of learning situation(s) do you prefer for technical skills? Please check all that apply.

	Group	Individual
Structured (i.e., following a curriculum)	☐	☐
Unstructured (i.e., self-directed)	☐	☐

Logistics

5. Which days/times generally work best for you? Two half hour sessions will be offered weekly. Please check all that apply.

	Morning (before 11am)	Afternoon (after 2pm)	This day does not work for me.
Monday	☐	☐	☐
Tuesday	☐	☐	☐
Wednesday	☐	☐	☐
Thursday	☐	☐	☐
Friday	☐	☐	☐

Almost done!

6. Please record your name if you would be interested in joining the Tech Club.

7. Please feel free to share any additional information or suggestions.

Appendix C: 2017-2018 Technical Skills Pilot Preassessment Survey Instrument

1. What is your confidence level using technology related to your work?

	1	2	3	4	5	
Not Very Confident	◯	◯	◯	◯	◯	Very Confident

2. What do you hope to get out of this experience?

Appendix D: 2017-2018 Technical Skills Pilot Post Assessment Survey Instrument

Confidence Level

1. What is your confidence level using technology related to your work?

	1	2	3	4	5	
Not Very Confident	◯	◯	◯	◯	◯	Very Confident

Python Sessions

2. Did you attend any of the Python sessions held on Mondays?

◯	Yes	
◯	No	(Skip to question 5)

3. What was your level of satisfaction with the Python sessions?

	1	2	3	4	5	
Very Satisfied	◯	◯	◯	◯	◯	Not Very Satisfied

4. Feel free to add any additional feedback about the Python sessions.

Rotating Tech Skills Sessions

5. Did you attend any of the rotating tech skills sessions held on Thursdays?

◯	Yes	
◯	No	(Skip to question 8)

6. What was your level of satisfaction with the rotating sessions?

	1	2	3	4	5	
Very unsatisfied	◯	◯	◯	◯	◯	Very satisfied

7. Feel free to add any additional feedback about the rotating tech skills session.

Future Participation

8. Would you be interested in participating in similar tech skills sessions in the future?

◯	Yes	
◯	Maybe	
◯	No	
◯	Other	[short answer text]

9. Feel free to add any additional feedback.

Thanks!

Appendix E: Executive Summary of 2017–2018 Technical Skills Pilot Internal Report

This report provides an overview of a technical skills pilot program that was initiated in December 2017 and concluded in July 2018 within the Curation team of the Bentley Historical Library. The primary goal of the program was to develop and promote technical literacy within the Curation team while fostering collaboration and team building. Additionally, the pilot program serves as a model from which to assess outcomes and challenges, which are detailed in this report, to support future iterations and promote consideration of library-wide applications.

The key findings of this report are summarized as follows:

- Overall, the pilot program was successful in developing the technical skills and confidence levels of participants while promoting collaboration and team building.
- There is a high interest amongst members of the Curation team to develop technical skills and literacy that directly support projects and daily work activities.
- One of the most significant outcomes from the program was the application of new technical skills to current Curation projects, making work more effective and efficient.
- The major challenges encountered include working within the thirty-minute time constraints of sessions and meeting the needs of participants with varying experience levels.
- Additional methods for promoting inclusivity across the Curation team need to be implemented to support the development of team-wide technical literacy.

The key recommendations of this report are summarized as follows:

- Overall, the authors recommend that the technical skills program within the Curation team be continued and that the opportunity for library-wide application be explored.
- For technical skills topics with broad application, create opportunities for sessions to be longer, less frequent, and more structured, following a similar format to BEEs.[38]
- For technical skills topics with narrower application, create opportunities for study groups to form and individuals to develop deliverables around topics that directly relate to work.
- Employ multiple, ongoing feedback mechanisms throughout the duration of the program to meet the developing needs of participants as skill increases and new needs arise.

Notes

[1] The Bentley's project archivist program was a hiring initiative to match recent graduates with term-limited positions aligned with the library's key initiatives. In a team environment, project archivists develop essential career skills and contribute to strategic goals. Multiple positions could be available each year; terms range from one to three years depending on projects.

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[16] See Appendix A for the handout used in the CMD.EXE workshop.

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[18] "OpenRefine (previously Google Refine) is a powerful tool for working with messy data: cleaning it; transforming it from one format into another; and extending it with web services and external data." OpenRefine, https://openrefine.org.

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[35] Camille Fournier, *The Manager's Path: A Guide for Tech Leaders Navigating Growth and Change* (Sebastopol, CA: O'Reilly Media, Inc, 2017).

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[38] Bentley Engagement and Enrichment Sessions (BEEs) are general professional development events, presentations focusing on archival issues and developments, and social activities. All Bentley staff, students, and volunteers are welcome to attend.

ABOUT THE AUTHORS

Max Eckard started working at the Bentley in 2015 as the archivist for digital curation, and then as lead archivist for digital initiatives beginning in 2018. He is now the assistant director for curation. He was a member of the Workflow Integration Project team, participated in Curation Team Workshops as well as the Technical Skills Pilot, and served as the "Meta-" Project Manager for BAroQUe. He is also the author of *Making Your Tools Work for You: Building and Maintaining an Integrated Technical Ecosystem for Archives and Digital Libraries*, which deals, in part, with using the kind of technical upskilling described in this article to more efficiently manage archival workflows, particularly when they involve working with multiple archival systems.

Elizabeth Gadelha started working at the Bentley in 2015 as a student employee in the areas of reference and academic programs. As a student, she participated in a Curation Team Workshop on structured data wrangling co-led by Eckard. In 2017, Gadelha joined the curation team as a term-limited project archivist with an emphasis on digital imaging. As a project archivist, she co-led the Technical Skills Pilot and, after she became a regular archivist in 2019, she participated in the BAroQUe Project. She is currently the archivist for digitization services at the Bentley Historical Library.

Mike Shallcross worked at the Bentley from 2010 to 2018, serving as an assistant archivist in the former Digital Curation Division, lead archivist for curation, and then as assistant director for curation. He developed an automated digital processing workflow for the library in 2012, served as principal investigator for the 2014–2016 Workflow Integration Project, and participated in Curation Team Workshops. He is currently an associate archivist at the Inter-university Consortium for Political and Social Research (ICPSR) at the University of Michigan.