



Library-Coordinated Institutional Membership in the Carpentries: A Qualitative Case Study

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abstract: This qualitative case study explores how Carpentries membership is operationalized inside a member institution. The Carpentries organization teaches data and computing tools and skills to researchers. Institutions that join the Carpentries can implement a regular program of workshops taught by local instructors. While the steps to becoming a member are readily available, little public information exists about operating an institutional membership. This case study examines the first five years of the University of Oklahoma's institutional Carpentries membership, focusing on its membership activities, workflows, sponsorship, and value to participants. The study reveals the complexity of Carpentries membership operations and suggests takeaways for existing and potential member institutions.

Introduction

Computational thinking, methods, and tools enable research and learning in most academic disciplines. Libraries can deliver computing and data training that researchers and their students need and can harmonize their efforts with those of related campus units such as Research, Information Technology, High-Performance Computing, and discipline-specific labs and research centers.¹ Open sources for teaching material and skill development in these topics include the curricula and training programs maintained by the non-profit organization, the Carpentries.

The Carpentries is the umbrella organization for Software Carpentry, Data Carpentry, and Library Carpentry.² Global communities use these openly available curricula to teach data and computing tools and skills during intensive, hands-on workshops taught by certified instructors. The Carpentries' infrastructure helps volunteers in these

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communities organize workshops, train and certify instructors, and develop lessons, which are usually intended for novice audiences.³ Workshops delivering these lessons encourage attendees to embrace a growth mindset when applying new technical skills to their work. A long-term study of Carpentries workshop learners showed that, post-workshop, the majority coded more often, felt more confident using computing tools, and improved their efficiency and ability to manage and analyze data.⁴

Instructors of Carpentries workshops study and practice strategies for motivating learners and inclusively communicating knowledge. Through Carpentries Instructor Training, graduate students, staff, faculty, and postdoctoral researchers can earn certification in using this evidence-based pedagogy.⁵ Carpentries instructors report using acquired skills beyond the workshops, improving their teaching and communication in other settings.⁶ They apply coding, automation, and version control to their work and derive benefits from their Carpentries experiences, including finding community, networking, and building their résumés.⁷

Individual Carpentries instructors can organize workshops at no cost. However, an organization that wants to build a program of recurring workshops can pursue institutional Carpentries membership. Among other benefits, membership offers institutions the ability to train and certify a local cohort of Carpentries instructors as well as some assistance from Carpentries staff with organizing workshops.⁸ Membership tiers range from bronze to titanium and differ in cost, number of available instructor training seats, and number of local workshops organized by the Carpentries.⁹ While the steps toward becoming a member institution are readily available, operating a Carpentries membership is less documented. Little public information exists about the underpinnings of institutional membership, leading to the question, "How does Carpentries membership work inside a member institution?"

This paper attempts to answer this question by presenting the results of a qualitative case study of an institutional Carpentries membership organized by the institution's library. The study explores the institution's Carpentries activities, the membership's multi-unit sponsorship, the work of organizing and maintaining the membership, and the value of the membership to sponsors and individual participants. This analysis reveals the potential for successful membership operations, despite administrative challenges. While individuals and an institution can derive value from engagement with Carpentries activities, coordinating a membership requires a significant volume and variety of work. Adding to the complexity, Carpentries principles and university pressures can come into conflict. While institutions worldwide are Carpentries members, this study focuses on an institution in the United States.

This study is unique within literature about the Carpentries. Data collected and analyzed by a researcher unaffiliated with the case institution tells a story of sustained institutional Carpentries membership and the resulting program of Carpentries activities. This story can provide points of comparison for existing Carpentries member institutions and can inform institutions curious about membership. This study reveals how institutional Carpentries memberships function and how the people involved in membership activities sustain these efforts over time.



Positionality

The author's interest in conducting a formal study of a Carpentries institutional membership grew from a practical need to understand how to organize a membership at her own institution. The author trained and certified as a Carpentries instructor in 2017; her institution joined the Carpentries in 2019. She has received support from her organization, regional Carpentries communities, and informal mentoring relationships with other Carpentries instructors, including instructors from the case institution. The author's familiarity with this work informed the aims and objectives of this study.

Literature Review

The 2010s saw many efforts to orient academic and research libraries toward supporting the growth of data science and researchers' increasingly public responsibilities to manage, describe, and share their data.¹⁰ Reports addressing librarians' capacity for data science work and articulating support pathways for developing related skills identified the Carpentries as an important resource.¹¹ Libraries could benefit from engaging with the program's established characteristics. According to Matt Burton, et al., "The Carpentries sits at the doorstep of libraries with a curriculum already in place, a worldwide network to learn from, and certificate-based instructor training programs."¹²

During this period, many libraries began supporting data science and research data management by teaching data information literacy skills to students and trainees.¹³ As libraries looked to expand their research data presence, the Data Engagement Opportunities Scaffold articulated layers of engagement that crosswalked librarians' existing liaison and information literacy skills to programs such as instruction in data management, data analysis, and data visualization.¹⁴ Subsequent work compared instruction based in the ACRL Information Literacy Framework to the pedagogy of the Carpentries.¹⁵ More recently, "recipes" for library instruction on data and computing topics referenced Carpentries workshops and listed specific tips for hosting them and assessing their effectiveness.¹⁶ In the wake of the COVID-19 global pandemic, both member and non-member institutions experienced the challenges of moving Carpentries workshops to online formats.¹⁷

Publications addressing academic libraries' roles in Carpentries institutional membership have all been authored by affiliates of the member institutions.¹⁸ Many of these memberships were initiated by the library and included co-sponsors such as Research, Information Technology, or Research Computing offices.¹⁹ Some also incorporated sponsorship from discipline-specific departments and schools.²⁰ One membership emerged as a cross-institutional, geographic consortium co-sponsored by the institutions' libraries.²¹ Two memberships mentioned that their libraries' roles as discipline-agnostic campus hubs were key to presenting Carpentries programming as inclusive of all disciplines.²² Some memberships described internal governance or coordination.²³ Most mentioned fostering a sense of community among the members' group of Carpentries instructors.²⁴ Two member institutions specifically mentioned recruiting instructors from across campus as a way to build relationships with departments.²⁵ Libraries garnered benefits from their involvement in Carpentries membership such as professional development



in technology and teaching for library workers and opportunities to increase campus constituents' familiarity with other data-related library services.²⁶

Study Context

The University of Oklahoma's (OU's) Carpentries membership and the assumptions present in the data are better understood with some context about the Carpentries, OU, OU Libraries, and OU's membership activities. The case study time period, 2015–2020, marked a transition for the organizations that became the Carpentries. Prior to 2018, Software Carpentry and Data Carpentry existed as sibling organizations with similar goals. Institutions could join the Software Carpentry Foundation (SCF), with benefits including assistance with organizing workshops and priority access to instructor training.²⁷ While SCF members could organize their own workshops for free, the Foundation suggested a per-workshop fee of \$500 for workshops organized by non-members. This practice changed with the organizations' merger into the Carpentries; since 2018 any certified instructor can organize a workshop for free, regardless of institutional membership status.²⁸

Terminology about Carpentries roles appears throughout this paper. Organizers manage the planning and logistics for locally organized workshops. Helpers assist learners during a workshop. Instructors teach Carpentries workshops, usually after training and certifying as Carpentries instructors. Potential instructors can attend Carpentries Instructor Training by obtaining a seat from a member organization or purchasing an individual seat. Instructor training introduces inclusive, research-based pedagogy in a two-stage training and certification process.²⁹

The 2015–2020 period of OU's Carpentries membership was a time of significant fiscal and administrative challenge at the university. The first membership agreement coincided with drastic cuts to state funding for Oklahoma's public higher education institutions, including a 24 percent decline in OU's state appropriation between fiscal years 2015 and 2019.³⁰ As OU's state funding fell, the institution increased tuition and cut \$35 million from program budgets on the Norman, Oklahoma City, and Tulsa campuses.³¹ Beginning in 2018, a controversial new university president, racially-charged incidents on the Norman campus, sexual harassment allegations against previous administrators, controversy about the university's finances and debt, budget cuts, and layoffs further contributed to the institution's tumultuous environment.³²

OU Libraries also experienced significant organizational shifts that coincided with the beginning of OU's Carpentries membership. After a leadership change in 2012, OU Libraries undertook building renovations and major strategic initiatives in digitization, technology services, campus partnerships, and research engagement.³³ Carl Grant described this time as an emphasis on the library as "the intellectual commons and crossroads of the university," a vision phrase from the libraries' strategic plan.³⁴ During this period of approximately 2013–2019, OU Libraries hired personnel and opened spaces and services focused on emerging technologies, 3D printing, digital scholarship, informatics, and consulting for research data, computing, and visualization.³⁵ Carpentries workshops and the institutional membership were deeply embedded in these developments.³⁶



OU's SCF membership began in October 2015. Five university units collaborated to purchase a three-year term at SCF's gold membership level: OU Libraries, the Office of the Vice President for Research, the Oklahoma Biological Survey, the College of Arts and Sciences, and the South Central Climate Science Center. OU Libraries coordinated the \$10,000 per year membership agreement that included access to 15 instructor training seats each year. Three units paid equal shares, while two smaller units split one share of the fee.³⁷ During this membership term, SCF increased the price of gold membership and listed only 11 "Gold Partners," indicating that OU was an early adopter of Carpentries membership.³⁸ During the study period, OU paid for two three-year membership terms. One unit dropped its sponsorship after the first term; the libraries covered this unit's share to renew the membership.³⁹

From 2015 to 2020, OU hosted approximately 25 Carpentries workshops using the Software, Data, and Library Carpentry curricula. These workshops typically took place in person over two days. At the time of the author's site visit, OU's schedule of workshops and workshop topics was established and predictable.⁴⁰ Published literature includes aggregate attendance numbers from OU's Carpentries workshops that roughly coincide with the study period.⁴¹

By 2020, OU had upgraded its Carpentries membership level to platinum, which included seats to train 20 new instructors per year.⁴² OU's Carpentries coordinator indicated that they filled approximately 15 of these seats annually. Each year, the coordinator attempted to recruit approximately equal numbers of university staff members, post-doctoral researchers, and doctoral students, as well as a few faculty members, to attend instructor training. The coordinator estimated that 40 percent of individuals who took the training completed certification.⁴³

Research Questions

This case study describes the first five years, 2015–2020, of OU's Carpentries institutional membership. The longevity and resilience of OU's membership, as well as its ability to attract and retain multiple campus co-sponsors, make it a useful case to examine. The case study method meshes well with the philosophy of the Carpentries. Robert Stake points out the practicality of learning from a specific case when he says, "Experiential descriptions and assertions are relatively easily assimilated . . . into memory and use."⁴⁴ Carpentries pedagogy has a similar emphasis. As the authors of Carpentries Instructor Training point out, "We take an applied approach, avoiding the theoretical and general in favor of the practical and specific."⁴⁵

Four sub-questions structured this inquiry into institutional Carpentries membership:

- What Carpentries activities take place at the member institution?
- What are the contributions and interests of the co-sponsoring units that fund the membership?
- What internal practices organize the work of the membership and sustain it over time?
- What value does Carpentries affiliation hold for the member institution's individual participants and administrative stakeholders?



Methods

To answer these questions, the researcher designed semi-structured interviews and conducted focus groups with people at OU who were involved in the membership. The University of Kansas Institutional Review Board approved this research (STUDY00145237). Potential research participants included OU's Carpentries membership coordinator, administrators of co-sponsoring units, and individual instructors and helpers. Participants from these three categories would offer different perspectives on the membership.

The membership coordinator was central to membership operations, and they interacted with both administrators and instructors. The coordinator's study interviews would reveal the program's complexity. Administrators approved sponsorship and provided the program with personnel and space resources. Their study participation would reveal details about funding a multi-unit membership. During the years under study, OU experienced significant fiscal austerity, driving the question of how the cost of Carpentries membership fit into the sponsors' budgets. Workshop instructors, helpers, and organizers performed the public-facing activities of the membership but were not involved in administering or funding the program. Their stories would uncover operational details of Carpentries membership.

The researcher visited OU in March 2020, hosted by OU Libraries and the coordinator of OU's Carpentries membership. Prior to the visit, those engaged in some aspect of the membership received emailed invitations to participate in this research. The membership coordinator was invited to participate in two 90-minute, semi-structured, in-person interviews. Administrators of the units funding the membership were invited to participate in individual, one-hour, semi-structured interviews. OU affiliates who instructed, assisted with, and/or organized Carpentries workshops were invited to participate in a two-hour, in-person focus group. Potential participants were identified by OU's Carpentries coordinator or by their subscription to a Carpentries-focused mailing list hosted by OU Libraries.

The researcher conducted the interviews and focus group during the site visit to OU's campus in Norman, OK. Three unit administrators and the Carpentries coordinator participated in individual interviews. Eight OU affiliates participated in the focus group. All but one of these interactions was audio recorded; one interview participant declined the recording but consented to notetaking by the researcher. A contractor transcribed the audio recordings; subsequently, the researcher removed individuals' names from the transcripts. In informed consent agreements, individual participants agreed to be referred to by a general description of their position.

The researcher analyzed interview and focus group transcripts, as well as notes from the unrecorded interview, using QualCoder, an open-source qualitative data analysis (QDA) software.⁴⁶ The researcher adapted the Flexible Coding method, a structured alternative to grounded theory originating from large sociology studies, for this comparatively smaller project. Flexible Coding emphasizes data organization, links qualitative coding to a project's research questions, and optimizes the coding process for QDA software.⁴⁷ Index codes identify broad concepts present in the interview questions; attribute codes identify characteristics of individuals relevant to the study; analytic codes identify specific concepts that emerge during early analysis.⁴⁸ In a first coding pass, the researcher



applied attribute and index codes to the transcripts to organize the data by participant and research question. In a second coding pass, the researcher applied analytic codes describing concepts that emerged during the first pass. Using QualCoder, the researcher generated reports about occurrences and intersections of codes. To preserve participants' privacy, the interview and focus group transcripts are not available. Potentially identifiable attribute codes have been removed from the public version of the codebook. The questions and codebook are available in the researcher's institutional repository.⁴⁹

Findings

The study findings, which offer stories of the membership and the activities that the membership made possible, are grouped by level of membership participation, to separate voices from administrative and operational perspectives. The author refers to all research participants using they / them pronouns. The first section describes organizational aspects of the membership, including its startup, maintenance, benefits, and risks from the perspectives of OU's Carpentries coordinator and administrators of units that co-sponsored the membership. Several of these perspectives diverge, creating both open and tacit areas of tension in the membership's management layers.

Membership Organization and Administration

OU Carpentries Coordinator

During the studied period, one individual coordinated OU's Carpentries membership and activities. During their first interview, the coordinator discussed the university-level infrastructure that sustained the membership and the administrative aspects of supporting instructors and workshops.

The coordinator described the beginning of OU's Carpentries membership as a convergence of several factors. OU Libraries' strategic emphasis on research and data support beginning in 2013 coincided with Software Carpentry workshops hosted by two different OU units. The enthusiasm that greeted these workshops fueled an initiative to cooperatively fund a Carpentries membership. OU Libraries personnel led this initiative, recruited co-sponsor units, and argued that, because of its experience with outreach and pan-disciplinary digital scholarship, the library should coordinate the university's membership.

The coordinator's Carpentries-related duties included producing individual workshops, supporting instructors and helpers, serving as the primary point of contact for the sponsoring units, and maintaining and renewing the membership. They estimated that these activities comprised approximately 20 percent of their professional responsi-

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bilities. The coordinator emphasized stability and predictability as reasons for assigning this work to a position, stating, "If you are doing it as a volunteer and suddenly work efforts require that you spend less time in a role, then it suffers. And so we were able to convince our [library] administration that if we were going to do this foundation [membership], this needed to be part of the duties of whoever they decid[ed] to select."

The coordinator asserted that the library enhanced its reputation as a knowledgeable partner in research, data, and computing by leading the Carpentries membership, citing an example of vocal faculty support for OU Libraries in a faculty senate meeting. In the coordinator's view, two factors led to this benefit. First, through membership activities, library employees learned enough about computing technologies to better understand researchers' needs. Second, hosting technology-centered workshops and consultations in the library and prioritizing researchers' pain points in those interactions demonstrated that the library was a place to get support for digital scholarship. The coordinator noted,

When we talk about . . . the noble concepts of reproducibility and total open access, . . . those are kind of esoteric topics. . . . By teaching [learners] better practices, they're moving toward that goal of being open, reproducible, sharing. That'll come. But when you ask them what has been the most important thing, it was, 'Oh, I was able to go through a hundred data sets in half the time I normally would.'

In the coordinator's opinion, only a few events could cause OU Libraries to stop coordinating the membership. These possibilities included the philosophy of the Carpentries organization radically changing, membership fees becoming a budget problem, and new library or campus administration not agreeing with the program. The coordinator believed that other campus groups could sustain Carpentries activities on an interim basis. However, without intentional actions to recruit instructors and funders, the coordinator doubted the program would continue.

The coordinator reported hearing some administrators express interest in requiring student attendance at Carpentries workshops or structuring the curricula into credit-bearing classes. This interest coincided with an administrative focus on bringing data science into all disciplines at the university. While this interest had not moved beyond ideation, the coordinator saw it as evidence that OU's Carpentries programming aligned with administrative priorities: "They see how people are coming out of [workshops] learning skills. . . . I think . . . they want to offer it to even more people." The coordinator described raising several complications of offering Carpentries workshops in a credit-bearing format. These included the questionable ethics of asking volunteer instructors to teach credit-bearing courses and OU Libraries' status as an administrative unit that could not collect tuition or issue course credit.

The coordinator's responsibilities for maintaining the membership included collecting data about Carpentries activities and producing annual reports for co-sponsors to retain support during membership renewals. These reports included information about workshop frequency, registration, attendance, and learner feedback. The coordinator described acquiring, cleaning, and aggregating workshop data as a time-consuming process.

Reports to co-sponsors also included Carpentries Instructor Training attendance under OU's membership. The coordinator reported difficulty compiling this data and attributed the challenge to the Carpentries' practice at the time of providing instructor



training seat usage only upon request. The coordinator did not include specific numbers of instructors certified in these reports; they saw certification as an individual choice related to volunteering for Carpentries activities, commenting,

[The Carpentries] is a volunteer organization . . . as much as it is an institutional entity and sponsored by the university. For most of the folks coming through the program, [participation is] not in their job description. . . . If they were excited enough to take the course . . . [and get] certified, then they're going to be excited enough to let me know they've certified and they want to get into the [instructor] rotation. If they take everything and decide it's not for them, . . . they don't let me know. That's fine too. . . . I want to honor their choices.

The coordinator described various technical and organizational challenges to reporting about the membership. In addition to the difficulties with gathering attendance data, they described lack of access to a centrally maintained list of OU's departments and units as a barrier to documenting unit-by-unit workshop participation. As the program grew, individuals at other OU campuses began training and certifying Carpentries instructors under the existing membership. The coordinator reported occasional difficulty obtaining data about these instances of instructor training and the resulting workshops hosted at other campuses.

The coordinator expressed concern that, in the university's challenging fiscal environment, annual reporting was not frequent enough to help administrators justify their financial support of the membership. OU's membership had lost one sponsor during the first renewal in 2018. The coordinator described attempting to maintain relationships with all sponsoring units by visiting individual administrators, commenting on their unit's participation, and targeting a renewal request to that administrator's issues of greatest concern. These visits relied on administrators' existing knowledge of OU's Carpentries activities. The coordinator implied that the administrator who declined to renew their unit's sponsorship was not sufficiently familiar with the program. The coordinator admitted that the challenge of building relationships with administrators new to Carpentries activities was a risk to the membership, concluding, "There has to be some knowledge [on the administrator's part]. I think there has to be. . . . If I have to go to any one of those positions and . . . start from ground zero on [recruiting a sponsor], that . . . could be a roadblock."

The coordinator indicated that they had begun succession planning as OU's Carpentries instructor cohort grew and stabilized. They described mentoring some instructors in leadership roles such as organizing workshops. Even so, at the time of this interview, the coordinator estimated that only three people at OU could assume their membership coordination duties. The program's heavy reliance on one individual's expert leadership revealed some fragility in OU's Carpentries activities. The coordinator acknowledged this risk while pushing back on the idea that the membership was tied to their presence, stating,

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It never should be about the individual, it should be about the service or the product or the benefit. And if you build something . . . so that it's not personality driven, then it helps to make sure that it has . . . potential to move forward. I don't want to . . . retire tomorrow and the Carpentries goes away because the recipe got lost.

Administrators

Administrators from three of the six sponsoring units at the time, including an administrator from OU Libraries, participated in interviews. The represented units had co-sponsored OU's membership since its beginning. Two of the administrators were part of OU's initial decision to join the Carpentries, while one joined their unit after the membership began.

During these interviews, administrators discussed their units' participation in Carpentries activities at OU, their thoughts on OU Libraries' leadership, and their perceptions of the membership. Findings from these interviews present organization-level perspectives related to the membership.

Administrators reported that their interest in maintaining OU's Carpentries membership was related to the content of the workshops. They viewed training on software and digital scholarship as essential across disciplines and appreciated the practical approach of Carpentries lessons. One noted:

What we liked about the Carpentries . . . is that they had taken some fairly complex topics and boiled them down in a very short format that could be picked up over a couple of days. . . . Many of the people that we [have] worked with . . . have a very specific task that they're trying to achieve. . . . They don't want to take a whole course in how to write [a] programming language or learn an operating system. They want to get their task done. . . . They have an idea [of] what they want to achieve, but they don't know how.

Despite this appreciation, administrators from units other than OU Libraries reported no expectation that their affiliates participate in Carpentries activities such as instructing or helping. One administrator conveyed the impression that their affiliates would need to be software developers to instruct Carpentries workshops. Several administrators characterized OU's Carpentries program as a volunteer effort; they were concerned about the capacity of people in their units to participate beyond learning during workshops. One shared, "I'm just trying to not overwhelm people [and] . . . make sure that things are there for their needs, and not try to create an extra activity or task that they have to be [involved in]."

Participating administrators offered different takes on OU Libraries' lead role in the membership. One administrator described regular interactions with liaison librarians but seemed unaware that the libraries were coordinating OU's Carpentries activities, or that Carpentries workshops were already connected to the libraries' outreach and instruction efforts. Another administrator expressed belief that the membership needed to be centrally coordinated for broad access. However, they did not see the libraries as having a special claim on centrality and judged that other colleges or departments could coordinate the membership.

By contrast, the libraries' administrator described the libraries' central accessibility as an essential part of OU's Carpentries membership and activities. They also deemed



that other academic libraries should be embracing the Carpentries as a service for researchers, stating,

I've been very frustrated with many of my colleagues out in the profession because they leave it over to . . . central IT on the campus. And I'm like, 'No, you're missing the point.' You're trying to connect researchers and build that multidisciplinary, that collaborative approach. And here in the library, of course, we . . . can bring in subject experts. We can bring in data points, or we can bring in resources. It's all in this building. . . . And I think that's why, if you let the Carpentries come onto your campus and it isn't in your library, you've fumbled.

The cooperatively funded Carpentries program complemented and supported OU's existing data scholarship focus by teaching software and visualization tools to researchers who needed them. Administrators appreciated the program's outreach and community-building.

All three mentioned interdisciplinary research as a direct result of people from different disciplines learning to use the same tools. One commented, "When you sit . . . [in] classes together, you really begin to

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understand the nitty gritty of what somebody's trying to do. They've got their problem they're trying to solve, you've got yours, but [you] begin to see, you could share routines. You can share ideas, approaches, datasets."

All three administrators mentioned aspects of the program that contributed to faculty, student, and researcher professional development, including tangible career benefits like jobs and grants. One administrator mentioned that "data is the future of every profession," and expressed belief that more data-related skills meant better-prepared students and researchers as well as competitive advantage for grant applications. OU Libraries' administrator offered an example of how Carpentries membership contributed to enhancing OU Libraries' reputation with researchers: "[A researcher has] done amazing work with the grants he's had. . . . And he will freely come in and say the things that we've been able to show him . . . have made tremendous impact on his research projects. . . . So he's always promoting us. . . . Underpinning so much in what we do in [the libraries' technology- and data-focused teams] are the Carpentries."

Two administrators cited the content and relevance of Carpentries workshops when describing their commitment to sustaining the program. One of these participants described these aspects as more important than their own unit's participation: "We don't track how many [unit affiliates] are going to those workshops. So we're not . . . like, 'If we're not benefitting, we're no longer part of it.' . . . We're pretty committed."

Administrators mentioned the small scale of the program as a potential drawback in a campus climate that stressed data skills in every discipline. One mentioned the need to expand resources if the program was experiencing staffing shortages. Another mentioned comments from a central administrator that the program's content was relevant to campus goals but the delivery model could not expand to reach every OU student.



Administrators' comments revealed that communication was an area where the program could improve. They received information about upcoming workshops through emails from OU's Carpentries listserv or liaison librarians, although one admitted that emailed communication was likely to get lost in their daily email deluge. One administrator described finding out about workshops one at a time; they would have preferred to be able to announce an entire year's schedule to their affiliates. This person did not seem to be aware that the workshop schedule for the academic year was posted on a libraries' Carpentries-specific webpage.

Administrators reported having limited time to communicate back to the program. One mentioned relying on colleagues to inform them of the need for their input; another indicated that personal contact with the membership coordinator was their sole channel for giving input. The third described knowing who they could contact to provide feedback but indicated that they had not done so. Administrators also reported a desire to increase communication among the sponsoring units to strengthen cross-disciplinary ties. One suggested,

I do think that it would be nice just to have more conversation amongst those sponsor units to think about . . . where the gaps are and how we could fill gaps. . . . That's something where I think we could coordinate better to have [working groups] People that potentially are tackling similar issues to try to encourage them to be in the same workshop together, so they can start using that as a mechanism . . . to start interacting or building bigger data science.

Administrators desired more frequent assessment and reporting about the membership, including details about workshop topics, attendance, and learner feedback. One described receiving an annual summary of membership activities from the coordinator. They wanted more specific information and evaluation of whether the tools taught in workshops were meeting researchers' needs. Another administrator reported not receiving information about Carpentries activities other than workshop announcements. They believed that they could get assessment information if they wanted it but did not know where to look.

Administrators cited financial issues, including budget cuts and declining university enrollment, as the biggest threat to the membership. Withdrawal of one or more sponsoring units posed another risk, since the remaining partners' costs would increase. One administrator pointed to recent budget cuts requiring a reassessment of priorities. Another administrator described the importance of accurate reporting about Carpentries membership activities to tell the story of the membership and help it survive fiscal challenges.

Membership Activities

This section describes the activities that the membership made possible and examines the perceived value of those activities. The researcher analyzes perspectives about Carpentries workshops and instructor training from OU's Carpentries coordinator and individuals who participated in the membership as workshop organizers, instructors, and helpers. These perspectives often align, demonstrating areas of common understanding and practice between coordinating and participating layers of the membership.



OU Carpentries Coordinator

During their second interview, the coordinator discussed their Carpentries-related duties regarding individual instructors, helpers, and learners. These duties included recruiting new instructors and supporting OU's instructor cohort. To identify potential new instructors, the coordinator reported relying on colleagues' referrals and promoting Carpentries Instructor Training during workshops: "I talk it up at the workshops, that if you really enjoyed this, if you're interested in this, if you're a PhD candidate thinking about tenure track, a two-day workshop on how to teach is probably something you're not going to get anywhere else before you . . . [apply] for tenure track positions."

According to the coordinator, OU's faculty, staff, postdoctoral researchers, and doctoral students were eligible to attend instructor training after participating in at least one workshop as a helper or learner. The coordinator acknowledged that faculty who attended the training were often too busy to complete certification; they hoped these individuals could become ambassadors for the program. The coordinator expressed hope that staff who certified as instructors would participate in workshop offerings for at least three years.

The coordinator described organizing and facilitating monthly meetings of the instructor cohort. Agenda items included pre- and post-workshop discussions, conversations about improving the teaching materials, and support for potential instructors and instructors-in-training. During these meetings, workshop debriefings served to improve future workshops and develop instructors' skills. The coordinator noted, "[A post-workshop discussion] allows for instructors who may not have been [at the workshop] . . . to hear how it went and . . . if they know they've signed up for [teaching] the next one, to hear about some of the stuff that may not work."

The coordinator indicated that the instructor cohort collaboratively scheduled upcoming workshops. The coordinator also described their own significant amount of work to staff workshops. They attempted to balance instructors' teaching loads by encouraging less active instructors to join a workshop. They described watching for signs of burnout among frequent instructors and stepping in to teach when an instructor seemed overloaded. They repeatedly stressed the volunteer nature of Carpentries involvement, even for library employees for whom it was a position responsibility.

As OU's Carpentries membership matured, the coordinator and other individuals developed program-level strategies for sustaining consistent workshop offerings from year to year. The coordinator was involved at every stage of workshop production, a responsibility they associated with their position duties. Instructors could focus on preparation and teaching while the coordinator completed tasks such as creating the workshop webpage, opening registration, and notifying the Carpentries about the workshop. At the time of this interview, the coordinator had begun training some instructors to perform this workshop organizer role.

As OU's Carpentries membership matured, the coordinator and other individuals developed program-level strategies for sustaining consistent workshop offerings from year to year.

The program relied on liaison librarians to distribute targeted workshop promotion to their departments. The coordinator also mentioned announcing workshops on libraries-hosted listservs and regional computing-related mailing lists, as well as including them on the Carpentries' upcoming workshops webpage.⁵⁰ While most workshops took place in OU Libraries' active learning classrooms, the coordinator occasionally chose other locations, including on OU's research campus. The coordinator mentioned that these workshops received less attendance, but believed they contributed to the program's visibility by reaching constituents beyond OU's main campus.

The coordinator demonstrated locally created or adapted document templates and Python scripts that they used for workshop production. Some of these tools interacted with the workshop registration system to support assessment and reporting. These tools and workflows matured during years of producing Carpentries events and were evidence of the complex logistics of staging an ongoing workshop series. Around the time of this interview, technical issues had begun disrupting these workflows.

The coordinator described individual and organizational value in OU's Carpentries activities. They appreciated the community of Carpentries instructors who helped and learned from each other in meetings, workshops, and informal interactions. The coordinator believed that Carpentries pedagogy and instructor cohort activities helped community members understand effective teaching and improve their instruction. The coordinator stressed the importance of the Carpentries ethos and the local Carpentries environment for creating welcoming spaces for instructors and learners: "It's an open and accepting environment for our learners. It's also an open and accepting environment for instructors. So we encourage instructors not to worry about making mistakes." They highlighted the Carpentries' practice of eliminating demotivating language as a game-changing development in instructors' teaching praxis, noting, "We work to get around exclusive language. . . . It really does make an impact. Staying away from the key words: 'Well, that's simple.' 'You just do. . . .' If it was simple, [learners] wouldn't be there."

The coordinator believed these teaching improvements spilled over into other interactions researchers experienced in the library. Researchers attending a consultation on good data practices received a recommendation to learn those practices hands-on in a Carpentries workshop. After attending a workshop, they were referred back to technology-focused library service points to receive more help with what they had learned. The coordinator referred to this intentional cycle as "return business." They shared,

[Users] come to [a library service point] asking for help because they learned about it in the workshop. . . . Whether it be accessing a database or programming in R or Python or trying to get GitHub to work . . . they'll come back. . . . Usually two to three weeks after a workshop, [the service point] has a steady stream on the open office hours. . . . We've even had faculty tell students, 'Hey, they ran that Carpentry stuff over there and there's [the service point], go over and ask for help.'

Workshop Instructors, Helpers, and Organizers

Eight OU affiliates who instructed, assisted with, and/or organized Carpentries workshops participated in a semi-structured focus group. These individuals were students and employees associated with academic and administrative units. Their domain expertise



included STEM, computing, and humanities fields. They represented a range of experience with the Carpentries at OU; some had been involved since the beginning of the membership while others had recently certified as instructors. During the conversation, participants discussed their connections to OU's Carpentries membership, their workshop-related activities, and the value they derived from their Carpentries involvement.

Most of the focus group participants reported that they first got involved in the Carpentries as learners, progressing to helpers and then to instructors. A few mentioned becoming involved because of encouragement from a colleague or supervisor, for CV building, or because their skills matched the lesson content. Most had instructed and/or helped during at least one workshop; a few had also organized workshops under the coordinator's mentorship. Many of the participants instructed a workshop at least once per year and helped once or twice per year. A few reported either helping or instructing at nearly every workshop.

For some participants, Carpentries activities were part of their professional duties. Others who volunteered reported receiving supervisor support to stay involved. Most participants described thematic and practical connections between their Carpentries work and their position responsibilities. These connections resulted in some participants expanding their use of Carpentries lessons, for example, by recommending lessons as self-guided tutorials or by developing intermediate-level workshops for learners ready to progress beyond beginner lessons.

Participants described their Carpentries activities as taking place within a network of OU's computing, research, and learning services that included units specializing in computing and data analysis, Carpentries workshops, and library service points. Some participants described referring individuals to different nodes in the network depending on their needs; these referrals almost always included Carpentries lessons or workshops. One shared,

When people come to me during the semester wanting information on these topics, I usually will tell them, 'Here's the [workshop] website. Save the date. . . . Come ask me if you have questions.' . . . Some people are like, 'I need this now,' and I'm like, 'Cool, read this [Carpentries lesson] and come back if you have questions and we'll talk again,' and then I see them every week.

Another said,

We get new research students in all of the departments every year. We constantly are teaching these small workshops in Linux and how to do a job on our [high performance computing] system, and we'll mention the Carpentries to all those people.

Participants cited increased workloads and further staffing and budget cuts as possible reasons for disengaging from Carpentries activities. However, they cited many reasons for staying engaged in the program, including alignment between the program and their personal values, a feeling of contributing to efforts to solve big problems, and a chance to offer beginners access to necessary technology skills. One participant reflected, "I didn't have any training on how to start out with using the shell or coding at all, and so it's really satisfying for me to see graduate students who have been struggling come in and go, 'Oh, thank goodness someone's here to . . . be with me while I'm learning.'"

Almost all of the participants said they would continue their engagement with the Carpentries even if they moved to a different institution. Some indicated that they would consider the presence of Carpentries activities as a selection criterion for a future destination, or that they would start a Carpentries group if one did not already exist. One commented, "In the future, if I go to some other university . . . either they will have a Carpentry group or they will be having one soon."

Participants used local tools to support organizing, instructing, and helping at workshops. They created an Open Science Framework (OSF) project where instructors and helpers could access documentation including task lists, email templates, and tips for teaching and troubleshooting. Participants indicated that the resource had resulted in more consistent workshop execution. They described the necessity of this documentation as workshop frequency increased over time. Participants attributed an overall increase in workshop attendance to three changes as the program matured: more frequent workshops, a predictable schedule of workshop topics, and liaison librarians' communications between departments and the program. One participant reflected,

When we started things, we had a much higher [attendance] variance. I think we did a workshop where we ended up filling two rooms and decided that was too many. Then, we had workshops where there were five people who showed up and clearly, we never need to do a workshop at this particular time in the semester again. . . . We tell other people when our workshops are, but I think it's also good that those relationships help us plan. . . . I feel like we're more confident about making sure that we know people are coming to [workshops] now than we used to be because we've worked with them.

Experience with workshop production varied widely among focus group participants. Those who had organized workshops mentioned reserving space, preparing registration, creating a workshop webpage, announcing and following up on the event, and creating an event report. Individuals who instructed described studying workshop topics, preparing their computer, software, and display settings, and creating presentation slides and handouts. Participants who helped at workshops described reviewing lesson topics and checking their software installations. Most focus group participants described instances of being "the Windows person" or "the Mac person" in a workshop, helping learners who encountered problems in an operating system unfamiliar to the instructor.

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meetings to plan, schedule, and prepare for upcoming workshops. They reported using post-workshop discussions to review learner feedback and debrief about their successes and mistakes. "The supportiveness of people has helped a lot with being able to teach and make mistakes in public and still be like, 'Hey, they still think I'm competent,'" shared one participant.



Participants praised the inclusive nature of their instructor community and the encouraging ethos of the Carpentries with comments such as,

The mentoring that I received from this group has built my confidence in different ways. And my advisor is amazing, but [Carpentries at OU has] built it in different ways where I'm not dependent on [my advisor] for my options, which I appreciate.

and,

It is such a supportive community that I could feel comfortable inviting students in as helpers. 'Hey, you're going to learn more here. You're going to be surrounded by people who are not going to make fun of you if you don't know how to do this right away,' which is definitely not something you can guarantee in any academic lab.

Participants also praised Carpentries Instructor Training and the local instructor community for providing opportunities to learn and practice teaching. They mentioned benefits such as professional networking, improved teaching and communication skills, and career advancement. Reflected one, "It's the most pedagogy training I got during my time at OU. . . . I do think it helped me land my postdoc because Git and GitHub are a requirement and I learned that through Software Carpentry."

Discussion

The overall impression of OU's Carpentries membership during the period under study is one of a successful operation with benefits for OU affiliates that nevertheless faced complex organizational and administrative challenges. Study participants expressed similar positive themes about Carpentries workshops and instructor training, OU's instructor cohort, the library's creation of a "return business" cycle for researchers seeking computing and data help, and the then-untapped potential for OU's Carpentries membership to spark cross-disciplinary connections. While the coordinator and administrators identified fiscal challenges as the greatest risk to the membership, more subtle challenges emerged in the form of overreliance on a few key partners, tension between fiscal pressure and volunteer labor, and reporting and communication.

Value of workshops, instructor training, and instructor cohort

Administrators, the coordinator, and individual membership participants appreciated the content of Carpentries workshops for enhancing OU affiliates' access to software and digital scholarship training. Administrators praised the workshops' efficient focus on essential skills and the program's contributions to successful grant applications and career placement. The coordinator valued the workshops' ability to meet researchers' immediate needs while also introducing broader reproducibility concepts. Individuals valued the content because they saw it filling training gaps that, in some cases, they had experienced in the past.

Individuals and the coordinator discussed various techniques from Carpentries Instructor Training that influenced their teaching praxis and professional responsibilities. These techniques included adopting formative assessment techniques, eliminating dis-



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Return business

During the study, OU Libraries created an environment focused on researchers' data and technology needs, developed campus partnerships to help meet those needs, assigned professional duties involving research and data skills to librarians, and synchronized these elements with Carpentries programming to create a "return business" cycle of researcher encounters. As described by multiple participants, researchers could start at any point—a service desk, a consultation, a workshop—and be routed through as many additional points as they needed to complete their work. Participants in this study reported that researchers who experienced this environment became advocates for the libraries among their colleagues and within the university.

Cross-disciplinary catalyst

Administrators and the coordinator mentioned the Carpentries as a cross-disciplinary catalyst—an aspect of the collaborative funding model they wished to expand but had not fully explored at the time of this research. Whether through a formal advisory board or an informal network, a membership and its activities can facilitate inter- and multi-disciplinary conversations.

Overreliance on a few

OU's membership relied heavily on the libraries, the membership's coordinating unit, for staffing recurring Carpentries activities. Other sponsoring units did not assign Carpentries activities to employees' position descriptions. This situation raises questions about the membership's long-term sustainability when only the coordinating unit committed employee time to membership activities, especially given participants' mentions of expanding the program. A Memorandum of Understanding could be a tool to formalize an equitable distribution of membership responsibilities among co-sponsors.

OU's membership also relied heavily on the Carpentries coordinator role for maintaining the membership. The coordinator possessed a wealth of knowledge about the Carpentries, the university, and the libraries; their role originated from OU's effort to start its membership with dedicated personnel. However, the coordinator was the only

missive language, and embracing the value of mistakes. Individuals also valued the peer mentorship they gave and received in OU's instructor cohort. They appreciated opportunities to learn pedagogy techniques and practice teaching in a supportive environment. While most individuals discussed intangible benefits and personal value in their Carpentries participation,

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person completing maintenance tasks such as sponsor communication and instructor recruitment and support. While multiple participants described robust documentation for some operational aspects of the program, the coordinator's role was the critical component that kept the entire program functioning. This fragile reality stands in contrast to the coordinator's own statement that membership should not be about one individual. Institutional Carpentries memberships require layers of programmatic support. Over-reliance on one person's deep experience with the program risks burning out that individual and damaging the membership.

Fiscal pressure and volunteer labor

Administrators and the coordinator described feeling some urgency to expand Carpentries programming; this pressure conflicted with the Carpentries' community-minded approach. The Carpentries recruits and trains volunteer instructors to teach open-source computing and data tools using openly licensed curricula. OU's membership largely followed this philosophy, assigning Carpentries responsibilities to a few library positions and recruiting volunteers from staff, faculty, postdocs, and graduate students across the university. However, the campus climate of scarcity demanded pursuit of revenue sources. Administrators wanted more of a successful program that taught in-demand skills and looked for ways to maximize learner participation. The coordinator resisted expanding the program under conditions at the time, which included reliance on volunteer labor and coordination by a unit that could not charge tuition or issue course credit.

How often an individual participated in membership activities, such as teaching workshops, seemed to depend on whether they were professionally responsible for Carpentries activities or were volunteering. Those with more job-related involvement seemed at the greatest risk of burnout. The coordinator attempted to mitigate this risk by relieving instructors of workshop organizing tasks, but few individuals were able to relieve the coordinator. OU offered a fixed schedule of workshops, regardless of how many instructors were active at a given time. As the focus group reported, the predictable schedule improved workshop attendance and raised the program's profile, but no one mentioned how the regular schedule impacted the instructor cohort.

Member institutions and those interested in membership will encounter complexities when recruiting employees and volunteers as instructors. Employees cannot say no, while volunteers are not compensated for saying yes. Libraries, in particular, that choose to build Carpentries activities into employees' position descriptions, need to account for those responsibilities when distributing other instruction and outreach duties. Employees should have opportunities to step away from their Carpentries involvement as their positions and interests evolve.

Organizations looking for ways to compensate volunteers need to consider limitations on postdoctoral researchers' and graduate students' funding and working hours, which may prohibit these individuals from receiving stipends. Current and potential membership programs can explore providing volunteers support for career development and enhanced mentorship opportunities, even if financial compensation is not possible. Volunteers should have time-limited terms of engagement, with the option of extending a term if desired.



Reporting and Communication

Communication challenges emerged from participants' different understandings of the content, frequency, and delivery mechanisms of reports about the membership. Technical and privacy concerns limited granular reporting. The membership needed a reporting mechanism that informed sponsors without overwhelming the coordinator or compromising the privacy of learners, helpers, and instructors. Differing levels of institutional memory about the membership's history and structure further complicated these technical and privacy issues. The coordinator relied on personal relationships with sponsoring administrators when reporting about the membership and depended on administrators' existing familiarity with the Carpentries to facilitate membership renewal.

This reliance on personal relationships and prior knowledge contradicts a central tenet of the Carpentries' approach to teaching. The applicable principle, the "expert awareness gap," refers to a state of knowledge in which an expert cannot remember not knowing something and is no longer aware of all the steps necessary for arriving at an understanding of the thing.⁵¹ This study's qualitative data reveals how much knowledge is required to maintain a Carpentries membership; it is understandable that, over time, a membership expert would elide important details when communicating with others. Member institutions should operate their Carpentries memberships using Carpentries methods. To avoid expert awareness gaps as a member institution, do not assume prior knowledge, intentionally onboard individuals new to the membership, and seek input on membership communication and operations.

Limitations

This study's primary limitation is the time period under review, 2015–2020. OU's first five years of Carpentries membership and the study's qualitative data collection occurred prior to the start of the COVID-19 global pandemic in 2020. The pandemic radically changed instruction delivery and affected student and employee engagement. Carpentries membership pricing changed in 2022 and the Carpentries organization downsized in late 2023 due to financial constraints.⁵² These changes created a very different membership landscape from the time period studied.

The makeup of the focus group is another limitation of this study. Individuals self-selected to participate in the focus group, potentially skewing the data toward positive experiences in the instructor cohort. Individuals who had negative experiences may not have attended the focus group or discussed their experiences in the presence of other study participants.

Finally, the qualitative data analysis took place with only one coder. The study's informed consent agreement granted data access only to the primary researcher. It is possible that additional insights could have emerged from comparing multiple researchers' coding of the data.

Future Research

Volunteer participation in the Carpentries is an area for further research. The theme of volunteer labor emerged from most conversations with participants. This theme is also



present in an older qualitative study of Carpentries instructors, which contains a prescient quote by a respondent: “Volunteer-led initiatives can rely heavily on people with more altruism than self-preservation.”⁵³ Volunteerism is a well-studied phenomenon with a robust body of literature.⁵⁴ Further research into the intersection of volunteerism with the Carpentries would assist member organizations with ethically engaging both employees and volunteers in Carpentries membership activities.

Conclusions

This case study of the University of Oklahoma’s Carpentries membership reveals a complex interplay of membership coordination, cooperative sponsorship, and volunteer and employee participation in Carpentries activities. Membership operations are labor-intensive and require programmatic support and ongoing evaluation to keep the distribution of work equitable. While membership can provide benefits, core Carpentries principles can come into conflict with common university pressures and business models. Membership sponsors can encourage cross-disciplinary and multi-disciplinary collaborations by connecting groups through Carpentries activities.

Academic libraries involved or potentially involved in Carpentries membership can study OU Libraries’ approach to the membership and related activities. OU Libraries’ other programs benefitted from the effects of instructor training cited by multiple study participants, in which Carpentries pedagogy influenced their evolving teaching practice. Carpentries activities were one piece of the libraries’ suite of researcher services that meshed with services from other campus units, creating a “return business” model designed to enhance the libraries’ reputation among OU researchers.

One of the most powerful conclusions to this case study is also its most obvious. Run a Carpentries membership using the same practices as a Carpentries workshop. Be alert to expert awareness gaps, intentionally introduce new sponsors to the membership and its activities, and avoid exclusionary and dismissive language when talking about the membership. Maintaining an institutional Carpentries membership means committing to a practice, not only operating a program.

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Notes

1. Stephanie Labou, Reid Otsuji, and David Minor, *UC San Diego Ithaka S+R Research Study: Supporting Big Data Research* (UC San Diego Library, October 8, 2021), <https://escholarship.org/uc/item/8kr7p2c0>.
2. Greg Wilson, "Software Carpentry: Getting Scientists to Write Better Code by Making Them More Productive," *Computing in Science Engineering* (November/December 2006), <https://doi.org/10.1109/MCSE.2006.122>; Greg Wilson, "Software Carpentry: Lessons Learned [version 2]," *F1000Research* 3, no. 62 (January 2016), <https://doi.org/10.12688/f1000research.3-62.v2>; Tracy K. Teal, Karen A. Cranston, Hilmar Lapp, Ethan White, Greg Wilson, Karthik Ram, and Aleksandra Pawlik, "Data Carpentry: Workshops to Increase Data Literacy for Researchers," *International Journal of Digital Curation* 10, no. 1 (2015), <https://doi.org/10.2218/ijdc.v10i1.351>; James Baker, Caitlin Moore, Ernesto Priego, Raquel Alegre, Jez Cope, Ludi Price, Owen Stephens, Daniel van Strien, and Greg Wilson, "Library Carpentry: Software Skills Training for Library Professionals," *LIBER Quarterly* 26, no. 3 (2016), <https://doi.org/10.18352/lq.10176>.
3. "Our Community," The Carpentries, accessed November 28, 2024, <https://carpentries.org/community/>.
4. Kari L. Jordan, Marianne Corvellec, Elizabeth D. Wickes, Naupaka B. Zimmerman, Jonah M. Duckles, and Tracy K. Teal, "Short-Format Workshops Build Skills and Confidence for Researchers to Work with Data," (conference paper, 2018 ASEE Annual Conference & Exposition, Salt Lake City, UT, June 2018), <https://doi.org/10.18260/1-2-30960>.
5. Kelly Barnes, Erin Becker, and Karen Word, *The Carpentries Instructor Training Assessment Report* (August 26, 2021), https://carpentries.github.io/2021_IT_report/index.html.
6. Beth M. Duckles, *Value of Software Carpentry to Instructors Report* (January 2016), <https://doi.org/10.5281/zenodo.556194>; Cody Hennesy, Caitlin Bakker, Nicholas J. H. Dunn, David Naughton, Franklin Sayre, and Stacie Traill, "Building, Sustaining, and Growing Multidisciplinary, Multi-Departmental Partnerships to Teach Open Science Tools," in *Handbook of Research on Academic Libraries as Partners in Data Science Ecosystems*, ed. Nandita S. Mani and Michelle A. Cawley (IGI Global, 2022), 175-76, <https://doi.org/10.4018/978-1-7998-9702-6.ch009>.
7. Duckles, *Value of Software Carpentry*.
8. "The Carpentries Memberships," The Carpentries, accessed April 2, 2025, <https://carpentries.org/support/membership/>.
9. Ibid.
10. Carol Tenopir, Dane Hughes, Suzie Allard, Mike Frame, Ben Birch, Lynn Baird, Robert Sandusky, Madison Langseth, and Andrew Lundeen, "Research Data Services in Academic Libraries: Data Intensive Roles for the Future?" *Journal of eScience Librarianship* 4, no. 2 (2015), <https://doi.org/10.7191/jeslib.2015.1085>.
11. Matt Burton, Liz Lyon, Chris Erdman, and Bonnie Tijerina, *Shifting to Data Savvy: The Future of Data Science in Libraries* (D-Scholarship @ Pitt, 2018), <http://d-scholarship.pitt.edu/33891/>; Sarah K. Oelker, Thea P. Atwood, Andrew T. Creamer, Margaret Henderson, Kristin Lee, and Lora C. Leligdon, *NN/LM NER e-Science Program, Researcher Support Committee White Paper on Supporting Researcher Needs* (white paper, ScholarWorks@UMassAmherst, May 4, 2018), <http://dx.doi.org/10.7275/wk2m-9m39>.
12. Burton et al., *Shifting to Data Savvy*, 11.
13. Jake Carlson and Lisa Johnston, eds., *Data Information Literacy: Librarians, Data, and the Education of a New Generation of Researchers*, Purdue Information Literacy Handbooks (Purdue University Press, 2015), <http://www.jstor.org/stable/j.ctt6wq2vh>.
14. Abigail Gobin and Megan R. Sapp Nelson, "The Data Engagement Opportunities Scaffold: Development and Implementation," *Journal of eScience Librarianship* 7, no. 2 (2018), <https://doi.org/10.7191/jeslib.2018.1128>.
15. Ari Gofman, "A Carpentries Approach to ACRL Framework Instruction," *Journal of eScience Librarianship* 8, no. 2 (2019), <https://doi.org/10.7191/jeslib.2019.1173>.



16. Kay Bjornen and Clarke Iakovakis, "A Recipe for Improving Online Instruction for the Carpentries," in *The Data Literacy Cookbook*, ed. Kelly Getz and Meryl Brodsky (Association of College & Research Libraries, 2022), 73-76; Peace Ossom-Williamson, Shiloh Williams, and Hammad Rauf Khan, "Software Carpentry Al Dente," in Getz and Brodsky, *Data Literacy Cookbook*, 70-72; Zachary W. Painter, "Combining The Carpentries, Library Instruction, and Research Computing," in *The Scholarly Communications Cookbook*, ed. Brianna Buljung and Emily Bongiovanni (Association of College & Research Libraries, 2021), 325-328.
17. Hennesy et al., "Building, Sustaining, and Growing," 180; Bjornen and Iakovakis, "Recipe for Improving," 75; Ben B. Chiewphasa and Anna K. Moeller, "Reflections from Transitioning Carpentries Workshops Online," *Journal of eScience Librarianship* 10, no. 4 (2021), <https://doi.org/10.7191/jeslib.2021.1217>; Ossom-Williamson, Williams, and Khan, "Software Carpentry Al Dente," 70.
18. Thea P. Atwood, Andrew T. Creamer, Joshua Dull, Julie Goldman, Kristin Lee, Lora C. Leligdon, and Sarah K. Oelker, "Joining Together to Build More: The New England Software Carpentry Library Consortium," *Journal of eScience Librarianship* 8, no. 1 (2019), <https://doi.org/10.7191/jeslib.2019.1161>; Cameron Cook, Heather Shimon, Sarah Stevens, Trisha L. Adamus, and Clare Michaud, "People Who Need Data People: A Case Study in Building Cross-Campus Data Support," in Mani and Cawley, *Handbook of Research*, 45-60, <https://doi.org/10.4018/978-1-7998-9702-6.ch003>; Hilary A. Craiglow and Kelly M. LaVoice, "Bridging Gaps: Libraries and Software Computing for MBAs," *Ticker: The Academic Business Librarianship Review* 4, no. 2 (2020), <https://doi.org/10.3998/ticker.16481003.0004.203>; Hennesy et al., "Building, Sustaining, and Growing;" Stephanie Labou and Reid Otsuji, "Expanding Library Resources for Data and Compute-Intensive Education and Research," in *Proceedings: IEEE 15th International Conference on eScience (eScience 2019)*, (IEEE, 2019), 646-47, <https://doi.org/10.1109/eScience.2019.00100>; Sarah Pugachev, "What Are 'The Carpentries' and What Are They Doing in the Library?," *portal: Libraries and the Academy* 19, no. 2 (2019), <https://doi.org/10.1353/pla.2019.0011>; Plato L. Smith II, Sara Gonzalez, and Jean Bossart, "Data Management and the Role of Librarians," in *GL20 Proceedings: Twentieth International Conference on Grey Literature, Loyola University, New Orleans, December 3-4, 2018* (TextRelease, 2019), 75-82, <https://doi.org/10.26069/GREYNET-2019-000.065-GG>.
19. Craiglow and LaVoice, "Bridging Gaps," 6; Hennesy et al., "Building, Sustaining, and Growing," 173; Labou and Otsuji, "Expanding Library Resources," 646; Pugachev, "What Are 'The Carpentries,'" 211.
20. Hennesy et al., "Building, Sustaining, and Growing," 173; Labou and Otsuji, "Expanding Library Resources," 646; Pugachev, "What Are 'The Carpentries,'" 211; Smith, Gonzalez, and Bossart, "Data Management," 80.
21. Atwood et al., "Joining Together."
22. Labou and Otsuji, "Expanding Library Resources," 647; Pugachev, "What Are 'The Carpentries,'" 211.
23. Atwood et al., "Joining Together," 4-5; Cook et al., "People Who Need," 49; Hennesy et al., "Building, Sustaining, and Growing," 173; Labou and Otsuji, "Expanding Library Resources," 647.
24. Atwood et al., "Joining Together," 6; Cook et al., "People Who Need," 49, 53; Hennesy et al., "Building, Sustaining, and Growing," 175-76; Labou and Otsuji, "Expanding Library Resources," 647; Pugachev, "What Are 'The Carpentries,'" 211.
25. Hennesy et al., "Building, Sustaining, and Growing," 179; Pugachev, "What Are 'The Carpentries,'" 212.
26. Atwood et al., "Joining Together," 6; Cook et al., "People Who Need," 52-3; Craiglow and LaVoice, "Bridging Gaps," 8; Hennesy et al., "Building, Sustaining, and Growing," 176, 182; Labou and Otsuji, "Expanding Library Resources," 647; Pugachev, "What Are 'The Carpentries,'" 212-13.



27. "Become a Partner," Software Carpentry (Internet Archive, May 31, 2016), <https://web.archive.org/web/20160531213820/http://software-carpentry.org/scf/join/>.
28. Atwood et al., "Joining Together," 5.
29. Sarah M. Brown et al., *carpentries/instructor-training: The Carpentries Instructor Training*, version 2023.02.06 (Zenodo, February 6, 2023), <https://doi.org/10.5281/zenodo.7612756>.
30. Gene Perry, "Oklahoma Already Led the Nation in Cuts to K-12 Education. Now We Lead in Cuts to Higher Ed Too," Oklahoma Policy Institute (July 11, 2017), <https://okpolicy.org/oklahoma-already-led-nation-cuts-k-12-education-now-lead-cuts-higher-ed/>; "Norman Campus Total Budgeted Revenues," University of Oklahoma (Internet Archive, December 23, 2019), https://web.archive.org/web/20191223054931/http://www.ou.edu/budget/general_information1/Revenuedashboards/Revenuetabular.
31. K.S. McNutt, "OU Regents OK 5% Tuition Increase for Next Academic Year," *Oklahoman*, June 21, 2017, <https://oklahoman.com/article/5553606/ou-regents-ok-5-tuition-increase-for-next-academic-year/>; Sarah Terry-Cobo, "OU Cuts \$14.4M from HSC, Tulsa Campus Budgets," *Journal Record* (Oklahoma City, OK), June 21, 2016, ProQuest.
32. Michael Vasquez and Katherine Mangan, "Hired to Fix Finances, Oklahoma's New President Now Faces a More Delicate Task," *Chronicle of Higher Education* 65, no. 21 (February 8, 2019), EBSCOhost; Katherine Mangan and Michael Vasquez, "Did Bad Blood Between U. of Oklahoma's President and His Predecessor Hasten Sudden Departure?," *Chronicle of Higher Education* 65, no. 33 (May 24, 2019), EBSCOhost.
33. Sarah Clayton and Jeffrey M. Widener, "Beyond Embedded Librarianship: Co-Teaching with Faculty to Integrate Digital Scholarship in Undergraduate Research," in *Undergraduate Research and the Academic Librarian: Case Studies and Best Practices*, ed. Merinda Kay Hensley and Stephanie Davis-Kahl (Association of College & Research Libraries, 2017), 1-17, <https://www.ala.org/acrl/sites/ala.org/acrl/files/content/publications/booksanddigitalresources/digital/9780838989098.pdf>.
34. Carl Grant, "We Are the Change We Want to See," *Information Services & Use* 38, no. 1/2 (2018), 49, <https://doi.org/10.3233/ISU-180011>; University of Oklahoma Libraries, *The New Horizon for OU Libraries* (University of Oklahoma, 2012), <https://lib.ou.edu/documents/OU-Libraries-Digital-PDF.pdf>.
35. University of Oklahoma Libraries, *A Progress Report* (University of Oklahoma, December 2014), (Internet Archive, November 14, 2015), https://web.archive.org/web/20151114164438/https://plan4future.libraries.ou.edu/sites/default/files/OULibraries_ProgressReport.pdf; University of Oklahoma Libraries, *Path to Excellence: 2015-2016 Progress Report* (University of Oklahoma), <https://libraries.ou.edu/sites/default/files/2023-04/2015-OU-Libraries-Progress-Report.pdf>; University of Oklahoma Libraries, *2017-2018 Progress Report* (University of Oklahoma), <https://libraries.ou.edu/sites/default/files/2023-04/OU%20Libraries%20Progress%20Report%202017-Digital.pdf>; University of Oklahoma Libraries, *Path to Excellence: 2018-2019 Progress Report* (University of Oklahoma), <https://libraries.ou.edu/sites/default/files/2023-04/OU%20Libraries%20Progress%20Report%202018.pdf>.
36. University of Oklahoma Libraries, *2017-2018 Progress Report*; University of Oklahoma Libraries, *Path to Excellence: 2018-2019*; Matt Enis, "Technology: OU, Software Carpentry Build Coding Skills," *Library Journal* 141, no. 1 (January 1, 2017), ProQuest; Sarah Clayton and Carl Grant, "Software Carpentry in the Library: Partnering to Give Researchers Needed Technical Skills" (conference presentation, Coalition for Networked Information (CNI) Spring 2017 Membership Meeting, Albuquerque, NM, April 3, 2017), <https://www.cni.org/topics/teaching-learning/software-carpentry-in-the-library-partnering-to-give-researchers-needed-technical-skills>; Pugachev, "What Are 'The Carpentries.'"
37. Interview with OU Carpentries Coordinator, March 10, 2020.
38. "Our Partners," Software Carpentry (Internet Archive, October 16, 2016), <https://web.archive.org/web/20161016222957/http://software-carpentry.org:80/scf/partners>.
39. Interview with OU Carpentries Coordinator, March 10, 2020.



40. Interview with OU Carpentries coordinator, March 11, 2020; Conversation with focus group, March 13, 2020.
41. Pugachev, "What Are 'The Carpentries.'"
42. Interview with OU Carpentries Coordinator, March 10, 2020.
43. Interview with OU Carpentries coordinator, March 11, 2020.
44. Robert E. Stake, "Qualitative Case Studies," in *The Sage Handbook of Qualitative Research*, 3rd ed., ed. Norman K. Denzin and Yvonna S. Lincoln (Sage Publications, 2005), 443–66.
45. Sarah M. Brown et al., "Building Skill with Practice," *The Carpentries Instructor Training*, version 2023.02.06 (Zenodo, February 6, 2023), episode 2, <https://doi.org/10.5281/zenodo.7612756>.
46. Colin Curtain, *QualCoder*, version 3.3 (GitHub, May 18, 2023), <https://github.com/cbogel/QualCoder/releases/tag/3.3>.
47. Nicole M. Deterding and Mary C. Waters, "Flexible Coding of In-Depth Interviews: A Twenty-First-Century Approach," *Sociological Methods & Research* 50, no. 2 (2021), <https://doi.org/10.1177/0049124118799377>.
48. *Ibid.*, 722-25.
49. Jamene Brooks-Kieffer, *Library-Coordinated Institutional Membership in the Carpentries: A Qualitative Case Study (Interview questions and coding scheme)*, (KU ScholarWorks, April 18, 2025), <https://hdl.handle.net/1808/36036>.
50. "Upcoming Workshops," The Carpentries, accessed April 2, 2025, <https://carpentries.org/workshops/upcoming-workshops/>.
51. Sarah M. Brown et al., "Expertise and Instruction," *The Carpentries Instructor Training*, version 2023.02.06 (Zenodo, February 6, 2023), episode 4, <https://doi.org/10.5281/zenodo.7612756>.
52. *The Carpentries* (blog); "Pricing Update for 2022," by Erin Becker, posted November 17, 2021, <https://carpentries.org/blog/2021/11/membership-pricing-update/>; *The Carpentries* (blog); "Saying Farewell to 7 Carpentries Core Team Members: Navigating Change Together," by Kari Jordan, posted, December 7, 2023, <https://carpentries.org/blog/2023/12/saying-farewell-to-seven-carpentries-core-team-members/>.
53. Duckles, *Value of Software Carpentry*, 32.
54. Benedikt Englert and Bernd Helmig, "Volunteer Performance in the Light of Organizational Success: A Systematic Literature Review," *Voluntas: International Journal of Voluntary & Nonprofit Organizations* 29, no. 1 (2018), <https://doi.org/10.1007/s11266-017-9889-2>.

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