What Are “The Carpentries” and What Are They Doing in the Library?

Sarah Pugachev

**abstract:** Since 2014, the University Libraries at the University of Oklahoma in Norman has been a member of the Software Carpentry Foundation (now part of “The Carpentries”), a nonprofit organization dedicated to teaching basic computing skills to researchers. Through this partnership, we have taught over a dozen introductory programming workshops to participants across campus and have established a local community of instructors. By centering this training in the University Libraries, we reaffirm the libraries’ position as the intellectual crossroads for research on campus. We also provide professional development opportunities for librarians and other staff to improve their teaching and foster a better understanding of modern research workflows.

**Background**

Greg Wilson, a computer scientist and educator, founded Software Carpentry in 1998 with the goal of helping researchers “get more done with less pain” by equipping them with basic computing skills through hands-on workshops. In early 2018, the Software Carpentry Foundation merged with its sister organization, Data Carpentry, to form “The Carpentries.”

The Carpentries organize interactive, two-day workshops. Volunteer instructors who have been certified through the organization’s training program lead the sessions. A standard Software Carpentry workshop includes an introduction to the command line in the Unix shell, where users enter textual prompts instead of using a mouse to interact with their computer; version control, a system that can track changes to files over time; and a programming language such as python or R, used to write code for data analysis. Data Carpentry’s lessons are more domain-focused and can include working with spreadsheets; cleaning data with OpenRefine; using SQL (structured query language) to interact with databases; and programming in R. The Carpentries’ curriculum is freely available with Creative Commons Attribution licenses. For a lesson to be branded as a
Data or Software Carpentry workshop, however, it must be taught by at least one certified instructor and must use the core curriculum.

The University of Oklahoma in Norman hosted its first Software Carpentry workshop in 2014. Jonah Duckles, then the director of informatics and innovation, a position shared between the University Libraries and campus IT, led the initial effort to bring this training to the university. Duckles, who became the executive director of Software Carpentry in October 2015, was motivated to bring The Carpentries to the university based on his experience working with researchers, where he saw a growing need for computing skills. In a 2017 interview with Library Journal, he said:

For about four years, I was the IT help written into grants at [the University of Oklahoma]. And my role in that situation was to help build the needed infrastructure that the grant required, but also to teach faculty and graduate students “how to fish” a little bit. If I just solved all of their problems for them, I would have become the bottleneck for their progress.

Duckles and other data specialists in the University Libraries noticed that many researchers either lacked the money to hire professional programmers or informatics specialists, or they recognized the need too late (for example, after receiving a grant). Therefore, they handed off much of their coding work to graduate students, who did not have the necessary technical expertise.

Few graduate programs at the University of Oklahoma include introductory programming, and the curriculum provides little room for such courses. Often, students teach themselves programming using tutorials such as Codecademy, an online interactive platform that offers free lessons in several common coding languages. These resources are helpful but generally do not focus on scientific computing, and they may not address the topics that students need most. Also, students may become overwhelmed when there is no instructor to provide motivation, answer questions, or introduce the basic concepts. As a result, the informatics group and other University Libraries experts, such as the research data management specialist and the digital scholarship specialist, struggled with an ever-increasing number of requests to assist with beginning programming problems. We needed to find a way to help these students without overtaxing our resources through individual consultations. The Carpentries seemed like a realistic way to meet this growing need.

Through a long-term assessment survey, Software Carpentry researchers led by Kari Jordan have demonstrated that the organization’s training is an effective way to gain computing skills. According to a report released in October 2017, 65 percent of...
respondents reported gaining confidence in working with data because of completing a Software Carpentry workshop. Fifty-four percent made their analyses more reproducible, meaning that they could be rerun with the same results, and 77 percent felt more confident working with the tools presented in the workshop.

Anyone can host a Software or Data Carpentry workshop without being a member of The Carpentries Foundation. If you join the organization, however, you can self-organize workshops without any hosting fee and can train a designated number of local instructors annually. After holding a trial workshop, the University Libraries decided to pursue a membership. To pay the membership fee, the libraries formed a cross-campus coalition, partnering with organizations at the university including the Office of the Vice President of Research, the Oklahoma Biological Survey, the College of Arts and Sciences, and the South Central Climate Science Center.

As part of the second cohort of local instructors, I became a Software Carpentry certified instructor in 2015. As an early career librarian, participating in this program was formative for my professional development. I was relatively new to computer programming and had taken only one Software Carpentry workshop as a learner. Being a relative novice benefited my teaching because I could remember learning the material myself and was not subject to expert bias, the inability of someone who has mastered a skill to understand how difficult it can be for others. Additionally, teaching helped bolster my confidence and skills. Since becoming a certified instructor, I have taught portions of 10 workshops, including sections on Python, the command line, and version control.

The Role of the University Libraries

Centering The Carpentries in the University Libraries reaffirms our goal of serving as an intellectual crossroads on campus. We provide services to the entire campus related to all stages of the research data life cycle, from finding resources, to computer programming help, to depositing publications in our institutional repository. The Carpentries utilizes our team of in-house specialists, including experts in informatics, research data management, digital scholarship, and emerging technologies. We also use the Data or Software Carpentry workshops as an opportunity to advertise other services, including consultations and classes on data management planning, visualizing data in maps or graphics, virtual reality, and three-dimensional printing.

The University Libraries also provides the space to foster a local community of learners and instructors in an active learning classroom that enables technology to be more easily incorporated in teaching. Most workshops are held in that classroom. By hosting Software Carpentry and Data Carpentry in the libraries, we help learners to become familiar with the locations of related services. For example, the Digital Scholarship Laboratory is next-door to the active learning classroom, so workshop participants can visit it and know exactly where to go for more help.

The Carpentries have taught our librarians instructional techniques that we have applied to other workshops. For example, we give participants red and green sticky notes at the beginning of each day. When they understand the lesson and can follow along, they put up a green sticky note. When they need assistance or more time, they put up a red note. We have applied this technique to other workshops, which has helped us improve our pacing.
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The University Libraries and our local Carpentries community have adopted strategies to increase the visibility of the workshops. We offer three sessions a semester, one at the beginning, one in the middle, and one toward the end. Workshops during spring break and the week of Thanksgiving are particularly popular because they do not compete with classes.

The workshops are capped at 40 attendees, and most have between 20 and 25 participants. Since the University Libraries has become a member of the foundation, over 400 faculty, students, and staff representing more than 30 departments and research groups have attended the workshops. Some have attended multiple sessions.

We assess the workshops through two different mechanisms. First, participants write one positive comment and one suggestion on the green and red sticky notes at the end of each day. Local instructors use the qualitative comments on the sticky notes to improve their teaching. Second, learners take pre- and post-workshop surveys that we administer through The Carpentries. We use the survey data for long-term learner assessment.

The most common participant comments are related to pacing. In most workshops, some participants describe the pace as “too fast,” while others label the same workshop as “too slow.” This discrepancy may be due to the diversity of preexisting skills among workshop participants, which range from already knowing a programming language to using computers for little more than e-mail and word processing. Workshop helpers are the main resource for managing this disparity, and they receive the most positive comments. Helpers work with individuals who miss a step, have an error, or have an installation problem, all without interrupting the workshop. We aim to have one helper per table of learners.

We encourage learners to think about becoming an instructor or helper after going through a workshop. We train 10 instructors per year. About half are employees of the University Libraries, and half come from other units on campus, including the High Performance Computer Center, the Oklahoma Biological Survey, and the Office of the Vice President for Research. Graduate students and faculty from biology and geography have also become certified instructors.

The University Libraries works to cultivate a supportive local community. Research Data Specialist Mark Laufersweiler, who took over the leadership of the local Carpentries program after Duckles left, organizes monthly instructor meetings. At these meetings, instructors plan upcoming workshops, debrief after teaching, and share new tools or tips. We also host an e-mail list for discussion outside the monthly meetings.

Benefits to a Professional Librarian

The Carpentries broaden the reach of the University Libraries and provide professional development opportunities for librarians. The Carpentries’ instructor training focuses on pedagogy instead of the specifics of teaching any one tool because technology will change, but the foundations of good teaching will not. The information and exercises over the two-day training workshop can benefit anyone who teaches.
Instructor training is needed because many new librarians lack formal training in teaching. This need has led to the creation of such programs as the Association of College and Research Libraries Information Literacy Immersion Program and local programs in libraries for new hires. However, the demand for training outweighs the current resources. The Carpentries offers a way for librarians, and especially those who focus on technology, to build a pedagogical foundation. The lessons learned in the instructor training can easily be applied to other workshops and classes.

Participating in a workshop can also give librarians a better sense of their communities’ needs. Not every librarian need become an expert coder, but understanding the concepts and terminology can enable librarians to direct patrons to relevant resources. Because writing code is now an essential part of most research workflows, information professionals must be conversant in coding and understand how it ties to modern research practices.

Additionally, after learning some basic programming, librarians can automate some of their workflows. Following The Carpentries’ model, Library Carpentry has developed lessons specifically for training information professionals. Topics include cleaning messy data, programming in Python, and Web scraping, a technique that allows users to use programming to download data from websites. Library Carpentry was incorporated as an official lesson program in November 2018.

Over the past four years, I have found The Carpentries’ community an informative, supportive, and inclusive network. The community develops the lessons collaboratively; in fact, all new instructors must contribute to become certified. Instructors from around the world share their knowledge through The Carpentries’ online workshop debriefing sessions. The e-mail list offers questions, tips, and opportunities, and the blog provides helpful resources and perspectives.

Participating in The Carpentries has served a need for the students and faculty at the University of Oklahoma, has reaffirmed the University Libraries’ position as the intellectual crossroads on campus, and has given me and other instructors professional development opportunities that have enhanced our other work. I highly recommend that other libraries investigate the program.

Sarah Pugachev is a digital scholarship specialist at the University of Oklahoma Libraries in Norman; she may be reached by e-mail at: sarah.clayton@ou.edu.
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