

Mapping Graduate Student Workshops to Career Readiness Frameworks

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Abstract

Along with campus collaborators, the Colorado School of Mines library has facilitated a workshop series for graduate students since 2019. Recent developments inspired us to re-examine past workshop offerings in the context of career readiness. To understand strengths and weaknesses in workshop coverage, we compared our past offerings to frameworks from the Perkins Collaborative Research Network (PCRN) and the National Association of Colleges and Employers (NACE). The results of this effort highlight strengths and weaknesses of the workshop series as a whole and its composition of library-led topics and externally-led topics. This paper examines our analysis, the results of which will help guide future workshop topic selection to better prepare graduate students for their lives after graduation.

Introduction

Over the past four years, our library has facilitated a workshop series in collaboration with Graduate Student Government and the campus Center for Professional Development Education. Typically, these workshops have focused on skills graduate students need while at the Colorado School of Mines, a mid-sized Science, Technology, Engineering, and Mathematics (STEM) focused university. Topics have included *LaTeX*, *Citation Management*, and *Working with Your Advisor*. Recently, campus administration expressed the need for more professional development workshops which has led to growth of the series. Additionally, as part of a Colorado statewide inter-institutional collaboration (GradCO) we are sharing a selection of these workshops beyond our own campus community. These developments have inspired the library to evaluate whether the series is meeting the needs of graduate students. Specifically, we are interested in expanding our scope toward career readiness for scientists and engineers entering careers in industry, research, and academia.

Existing career readiness frameworks address several core competencies. To best understand whether our workshops are meeting career readiness goals, we mapped our catalog of past workshops to these frameworks. Our institution often uses Perkins Collaborative Research Network's (PCRN) Employability Skills framework. However, GradCO uses the National Association of Colleges and Employers' (NACE) Career Readiness framework. These two frameworks have significant overlap; however, to address the needs of all stakeholders, we evaluated our catalog of workshops against both. The literature related to libraries and career readiness is heavily focused on public, school, and community college libraries' work with high school students. Research tends to focus on preparing students for careers in industry and/or success in college. There is a significant gap in the literature about the use of career readiness frameworks to prepare Masters and PhD students for career success. This paper seeks to address that gap and provide librarians with a means of evaluating instruction against prominent frameworks.

Institutional Context

The current workshop series has its roots in a variety of workshops offered under the moniker, Modern Researcher 101, beginning in spring 2018. These workshops were designed by the Scholarly Communications Librarian to supplement skills students were gaining in their STEM-focused coursework. The workshops were intended for graduate students, primarily those in research groups or who were working on a thesis. The first couple semesters focused on topics such as *Copyright*, *Citation Management*, *Open Scholarship*, *Scholarly Identity*, and *LaTeX*. The Scholarly Communications Librarian at that time was a certified Software Carpentries instructor, and the library was able to offer a couple Carpentries workshops as part of the series. In 2019, with the transition to our second Scholarly Communications Librarian, the series expanded beyond the library to include more collaborators across campus. A small, but significant change was also made to the name, becoming Modern Researcher 501. By using the reference to a 500-level course, we emphasized the target audience for the series, graduate students. In fall 2021, the Scholarly Communications Librarian position changed hands for the third time and the series began the transition to a wider career readiness focus. To highlight this expansion, the name was changed one final time to Career Toolkit for Graduate Students.

As the series has evolved, so too has the selection process for workshops. Over the first couple years, workshop topics were selected by an informal committee including the Scholarly Communications Librarian and one or two outside collaborators. In fall 2021, the library began soliciting suggestions for future topics from attendees in the workshop registration form. In spring 2022, we joined GradCO to share virtual workshops. As a result, we started curating a small selection of our workshop offerings to specific NACE Career Readiness frames. Even though this development increased the offerings available to our students, for the purposes of analysis, our study only considers workshops led by our university. In fall 2022, the planning committee grew to include partners from our campus Career Center and the Center for Innovation and Entrepreneurship. Each of these developments has expanded the scope of the series and helped fill gaps in coverage.

In total, the series has included 77 workshops covering 44 unique topics over the course of seven semesters. The library led 33 workshops covering 11 topics while outside departments, including those on the planning committee, led 44 workshops covering 33 topics. Restrictions related to the COVID-19 pandemic forced one workshop to be cancelled; otherwise, the workshops switched to remote from fall 2020 through spring 2021 with some additional workshops transitioning to remote in spring 2022 per university recommendations on gatherings. Since spring 2019 there have been over 900 confirmed attendees.

Literature Review

Career readiness and post-academic success are significant goals of education. Graduate schools typically deploy a mentorship model, where disciplinary experts advise and guide students, preparing them for a career that mirrors their own trajectory into academia [1], [2]. In some

STEM disciplines as many as two thirds of graduate degree recipients leave academia for industry [3], [4]. Ganapati and Ritchie found that there are gaps in the professional development for PhD students who choose not to pursue a career in academics [5]. Learning resources, ranging from credit-bearing coursework to non-curricular mentorship programs are often developed to ensure students receive the training they need to embark on successful careers [1], [6], [7]. As Fong et al. notes, “one solution for expanded learning opportunities might be for campus experts to provide workshops featuring skills that complement and supplement the graduate student curriculum” [7].

Libraries are frequently the center of campus operations for cross-disciplinary work. As Pugachev notes, “[libraries] 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” [8]. As such, libraries often facilitate workshops [7]–[10]. Within libraries the primary focus of such workshops tends to be information literacy, even within the context of career readiness [7], [11]. McKinney et al. found that over 72% of faculty believe it is their job to prepare students for their careers [12]. Additionally, a survey of Rutgers University graduate students found that more than 50% of science students said they would attend workshops on career development topics [7]. As libraries exist at the center of cross-disciplinary work, organizing workshops and soliciting external faculty to provide content beyond librarian expertise may help fill gaps.

Universities have deployed various means to select and assess graduate workshops. Hoffman et al. utilized information from surveys and focus groups to plan their series [9]. Peacemaker and Roseberry relied on a combination of their experiences as librarians in course-integrated instruction, gaps in their own knowledge, and graduate student feedback to select topics [10]. Regardless of the mechanisms of topic selection, such decisions can be improved through utilization of various tools.

The PCRN Employability Skills Framework was developed in 2012 and revised in 2020 by RTI International under contract with the U.S. Department of Education Office of Career, Technical, and Adult Education [13]. It was developed by assessing numerous previous studies; the combined results are presented as a framework. It contains three areas of focus, Applied Knowledge, Effective Relationships, and Workplace Skills divided into nine frames, each of which contains between one and nine lesson components for a total of 42 lesson components [14]. The frames and areas of foci are outlined in Figure 1.

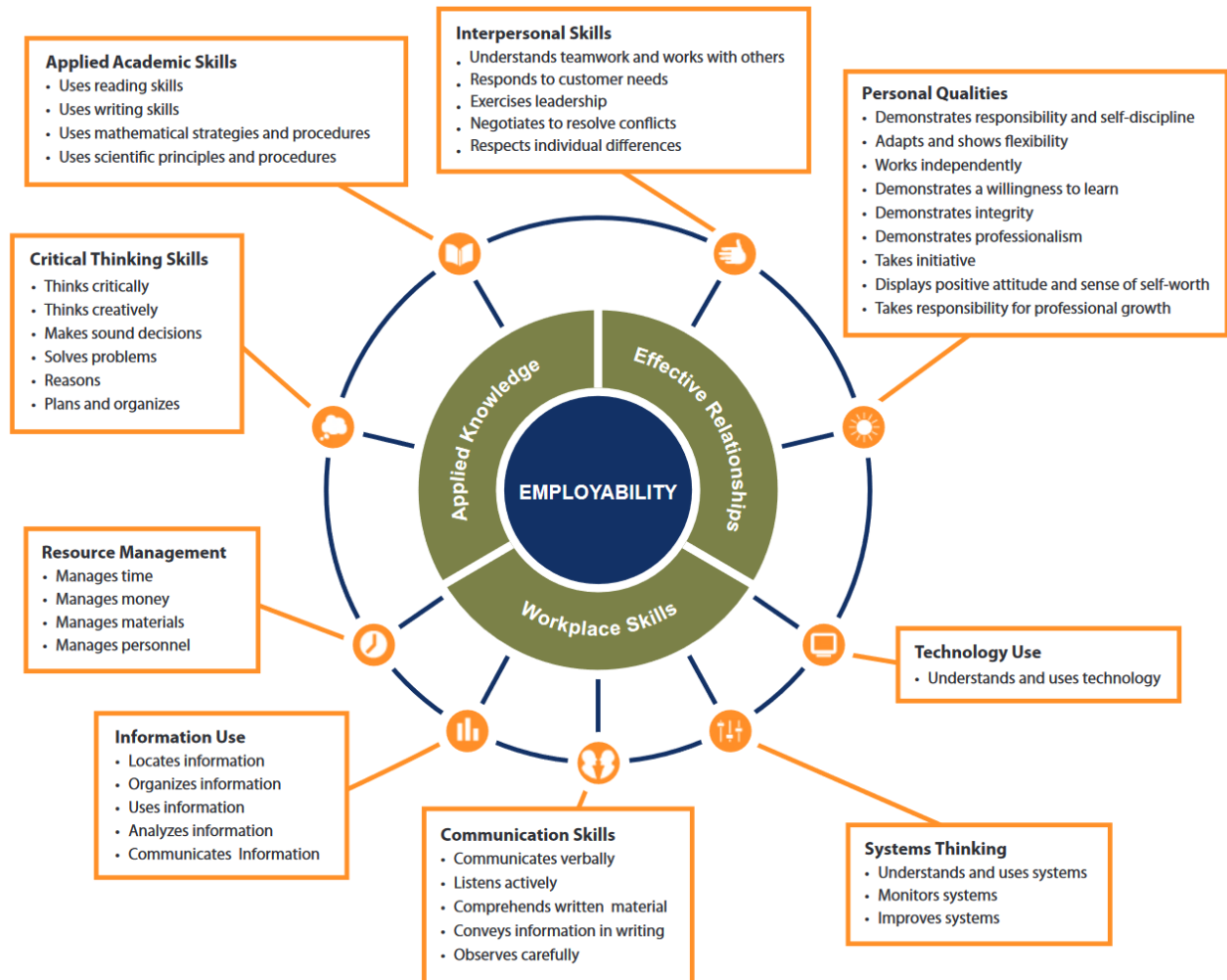


Figure 1. PCRN Framework [14]

The National Association of Colleges and Employers (NACE) Career Readiness Framework was derived from a 2006 report from the Partnership for 21st Century Skills [15]. There are eight frames [16]:

1. Career and Self-Development
2. Communication
3. Critical Thinking
4. Equity and Inclusion
5. Leadership
6. Professionalism
7. Teamwork
8. Technology

Recent NACE surveys found 95.6 percent of employers and 96.8 percent of students cite Communication as the most important competency while fewer than half of employers rated students as very/extremely proficient in Communication [18], [19]. Newell and Ulrich's study of

employed STEM undergraduate degree recipients found that Critical Thinking is their most important employability skill followed by Communication [17]. Similarities between the PCRN and NACE frameworks are not incidental. Beyond similar coverage in purpose and scope, both PCRN and NACE rely, at least in part, on the Partnership for 21st Century Skills [13], [17]. Workshops focusing on these skills may be more impactful for students' career development.

Methodology

Each author independently took a list of all workshops held and their respective abstracts, where available, for analysis against the PCRN and NACE frameworks. Authors noted PCRN and NACE frames addressed by each workshop. Results from this activity were compiled. Repeated workshop topics were combined, resulting in 44 unique offerings. They were mapped to 42 PCRN Lesson Components and eight NACE Career Competency frames representing the most granular degree of assessment possible within the respective frameworks. In total, this created 2200 possible data points per author. As such, analyzing the degree of agreement among authors is beyond the scope of this work. For our purposes, any author tagging a workshop topic as addressing a frame was sufficient regardless of agreement with the other two authors.

Here are two examples of how the authors coded the workshops. All authors found the *Citation Management* library-led workshop covered the NACE frames Technology and Critical Thinking, two authors found it covered Communication, and one author found it covered Teamwork. Similarly, all authors agreed the externally-led workshop *Working with Your Advisor* covered the NACE frames Professionalism and Teamwork, while two authors found it covered Career and Self-Development and Communication. In each case despite different levels of agreement, no weight was applied to agreement and all author-selected frames were considered covered.

After analyzing overall alignment to the frameworks, workshops were organized by semester offered to determine how the focus and coverage of the series has shifted over time. Additionally, library-led workshops and workshops led by other campus entities were separated to assess gaps in coverage. Moving forward, the library will be able to cover some topics, but must rely on external partners to more fully support the career readiness preparation of graduate students. If a workshop topic was offered more than once in a single semester, the workshop was still treated as though it was offered only once as it is unlikely students would attend the same workshop twice. Seven semesters were included in this analysis, fall 2019 through fall 2022.

Despite obtaining information on 42 PCRN Lesson Components, we combined these into the nine PCRN frames to aid with visualization. As the quantity of Lesson Components was inconsistent across all PCRN frames, we divided covered Lesson Components in a frame by the total number of Lesson Components in that frame. For example, the Communication Skills frame contains four Lesson components, so we tallied all points of coverage across all four Communication Skills Lesson Components and divided that total by four to determine the coverage of that frame each semester. This reduced granularity but increased the readability of visualizations and helped us determine where efforts might be expended more broadly.

Discussion

Mapping past workshops to career readiness frameworks revealed several trends. Despite turnover in the Scholarly Communications position and evolution of the topic selection process, broadly speaking, career readiness coverage has remained consistent over time. Specifically, almost all frames have been covered every semester and to a proportionally similar degree. For example, PCRN Critical Thinking Skills accounted for between eight and twelve percent of total workshop coverage each semester. Figure 2 shows the series makeup by PCRN frame and NACE frame over time.

Spring 2021 and spring 2022 were the only two semesters with missing coverage in either framework; interestingly, these semesters were missing coverage in both PCRN (Systems Thinking) and NACE (Equity and Inclusion). Even beyond these two semesters with missing coverage, the authors found fewer overall instances of PCRN Systems Thinking across workshops. This is a little unusual as Systems Thinking could be alternatively labeled as team management, especially given that we found the NACE frame Teamwork has been generally well covered over time. This discrepancy between the frameworks may be due to the language used in PCRN and that Lesson Components were more specifically geared toward classroom settings which made it challenging to apply them to workshops. For example, the PCRN Lesson Component- Understands and Uses Systems under the Systems Thinking frame states, “Students understand their roles and assignments when collaborating as a team (system) and contribute to the organizational structure and function of the team” [14].

Though consistent over time, there are several areas where we might build out coverage through additional topics or inclusion of new materials in existing topics. We can enhance coverage of the NACE frame Equity and Inclusion by incorporating work already performed within the library and across campus into the series. Our lesser coverage of Leadership and Professionalism might also be improved by our recent partnerships with the Career Center. Career and Self-Development coverage has also appeared to grow slightly over time but has had significant coverage over the run of the series.

With the exception of Systems Thinking in PCRN, coverage appears consistent and evenly distributed. Still, a granular assessment of PCRN frames identified a couple poorly covered Lesson Components. Specifically, Works Independently and Manages Money were each only covered by five and four workshop topics respectively out of 44 total topics. Although some of these Lesson Components were addressed in fewer topics, they were frequently offered more than one semester throughout the study period. For example, Works Independently was covered by the topic *Working with Your Advisor* which was taught for three semesters. Our analysis of overall workshop makeup can provide direction to future planning sessions.

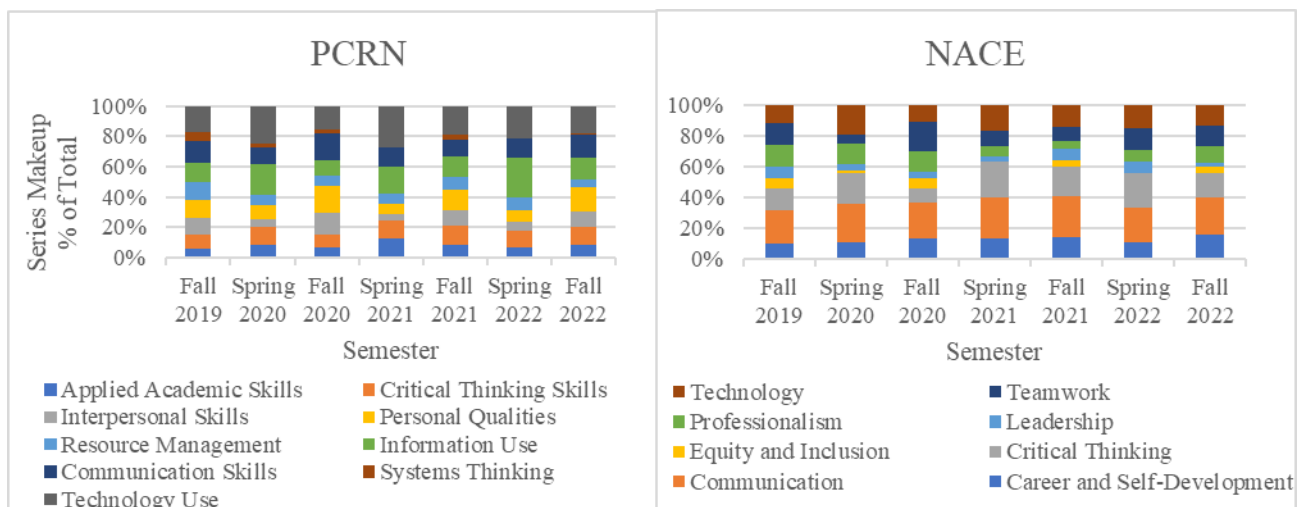


Figure 2. Summary of Workshop Coverage by Frame and Semester

Across internally and externally-led workshops, all 42 PCRN Lesson Components and all eight NACE Career Competencies had some degree of coverage. In fact, every PCRN Lesson Component and NACE Career Competency were covered to some extent by externally-led workshops alone. This was not true for library-led workshops, which offered no coverage of five Lesson Components. Externally-led workshops account for three quarters of topics and a broader spectrum of total campus expertise, so gaps in library coverage relative to external coverage were expected. The library must rely on campus relationships and partnerships because we cannot cover all topics.

Despite gaps in certain Lesson Components, the frame-level assessment outlined in Figure 3 shows the library covered all nine PCRN frames and all eight NACE frames in at least one workshop over the duration of the series. Technology has been a hallmark of the library's contribution to the series as it helps supplement students' STEM-focused curriculum. In general, the library has focused largely on technology and teamwork, but less on individual enrichment. This trend is particularly apparent when investigating the NACE mapping. The NACE Communication and Technology frames were covered by all 11 library topics, Critical Thinking by 10, and Teamwork by five. Tools essential to collaboration like *LaTeX* and *Citation Management* workshops were offered every semester of the series, ensuring Teamwork was consistently covered by the library despite fewer topics covering this frame. A single library workshop topic covered the NACE Leadership frame and only two library workshops covered skills related to Equity and Inclusion. The library offered no coverage in PCRN's Systems Thinking between spring 2020 through spring 2022 and no coverage of Interpersonal Skills from fall 2020 through fall 2021. Revising broad topics like *Literature Reviews* might provide opportunities to fill the gaps in our offerings without needing to develop entirely new topics.

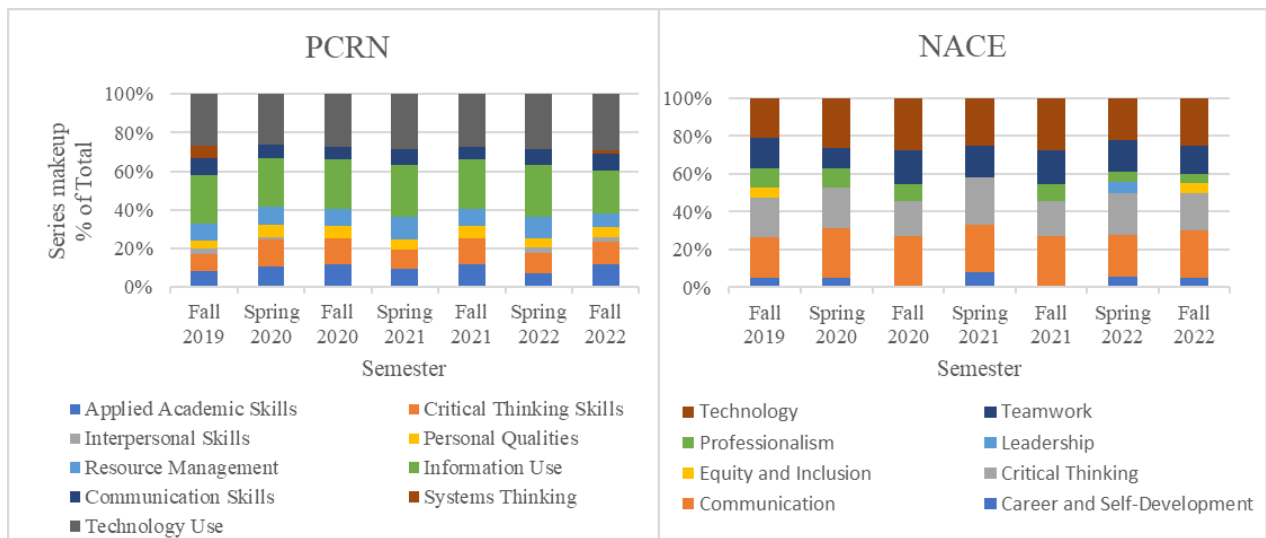


Figure 3. Library-Led Workshop Coverage by Frame and Semester

Externally-led workshops have offered more complete coverage over time than library-led offerings. Figure 4 shows externally-led workshop coverage by frame and semester. However, our analysis revealed some surprising areas for growth. PCRN Resource Management might need some additional focus. This is a skill the library covers well but could use more campus input. For example, past workshops on lab safety, financial planning, and effective instruction techniques all helped provide coverage of Resource Management and are all outside the typical expertise of librarians. Additionally, the NACE Equity and Inclusion frame is poorly covered by both library and externally-led workshops. Though the library can certainly bring this frame into our offerings, it necessarily requires external input to provide diverse perspectives. The library has led two workshops touching on Equity and Inclusion (*Communicating Science to Non-Experts* and *Introduction to Managing and Sharing Research Data*), while externally-led workshops like *An Open Discussion on Diversity, Equity, and Inclusion* have provided more focused coverage of this frame.

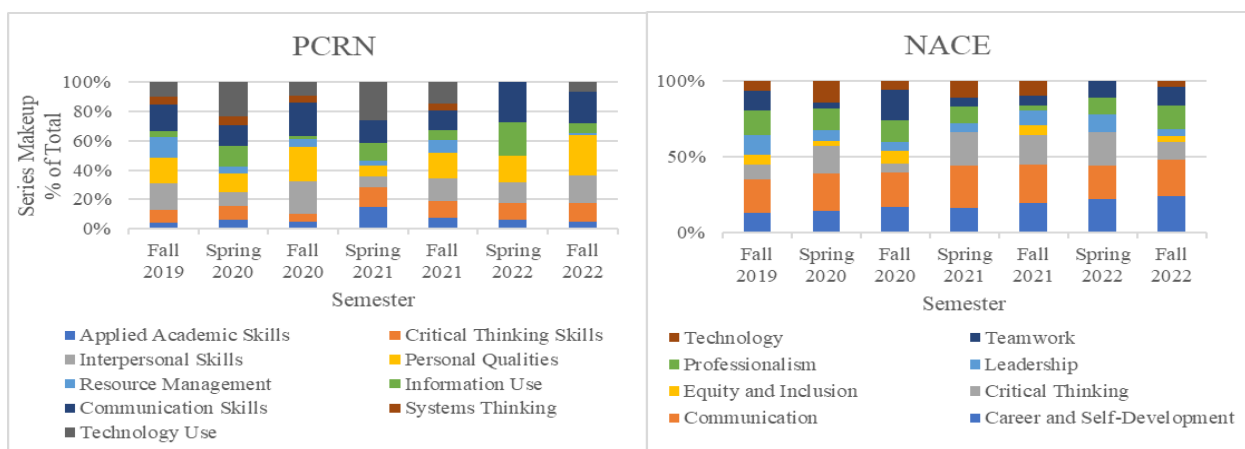


Figure 4. Externally-Led Workshop Coverage by Frame and Semester

Past workshops have tended to focus on supplementing classroom education. The curriculum at our institution is highly STEM-focused, so the workshops tend to support STEM activities while not directly targeting skills students obtain in their curricular programs. For instance, numerous workshops focus on tools like Zotero, GitHub, GIS, and LaTeX as well as heavily targeting the communication component of research. Additionally, the workshops serve as a venue to break down the departmental barriers present in graduate school. In alignment with this goal, the final workshop each semester has been a purely social gathering to allow students to visit with past workshop leaders and other students. As this is a social event, it was excluded from the mapping exercise, but in purpose it is intended to promote community, teamwork, and conversation which are certainly skills outlined by the frameworks.

PCRN advocates for practical experience supplementing what is learned in the classroom. Workshops are not a substitute for practical experience and the one-off nature of workshop instruction makes practical experiences challenging to implement. Additionally, these frameworks are imperfect and imprecise tools to understand the full scope of what might and should be done to ensure preparation for life after graduate school. GradCO, which partly inspired this work has noted that NACE lacks appropriate coverage of wellness and self-care. PCRN also provides little guidance on this topic. Wellness and self-care are important aspects of nurturing the whole student and helping prepare them to address struggles with work-life balance. Despite this gap in both frameworks, we intend to develop offerings which provide coverage in this area.

Conclusions

Within the library, we can make a concerted effort to include broader career skills coverage in workshops. Additionally, workshop selection can and should migrate toward gaps in coverage. While we found this study a useful first step for understanding the strengths and limitations of the series, it is not a substitute for student feedback. Future studies might relate to student perceptions of skills and gaps in coverage. Additionally, the methodology can be made more robust by inclusion of mapping from workshop leaders and analysis of the degree of agreement or disagreement between authors. Students are likely to take away different topics or themes from each workshop, just as we did in our individual analyses. This type of exercise is most useful for preliminary investigation into such offerings. Future work might include surveys of students and recently graduated alumni to determine perceptions of career preparedness.

We found the NACE framework easier to use for mapping purposes. The language was clearer and eight frames were easier to place than 42 PCRN Lesson Components. Additionally, PCRN generally focuses on classroom attainment of skills in the language used which proved challenging to interpret in the context of non-curricular workshops. Despite these challenges, the granular level of assessment obtained from PCRN will enable us to focus efforts in the future more than mapping to NACE alone would have done. Each framework has its advantages and

being able to better communicate the value of offerings to stakeholders will help to enhance program visibility.

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