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Career Readiness Through an Alumni Lens: Longitudinal Reflections on Skill Development and Impact from FURSCA Participation

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Introduction

Undergraduate research, scholarship, and creative inquiry (URSCI) has been recognized as a high-impact educational practice, one that fosters engagement and a sense of academic identity (Unruh, Haeger, Banks, & Dong, 2024). As Kuh (2008) and Lopatto (2003) have articulated, URSCI contributes to meaningful learning by cultivating students as knowledge producers thereby promoting inquiry-driven learning that supports cognitive and affective development.

Beyond its academic benefits, URSCI is increasingly valued for its role in fostering career readiness (MacDonald, Mekolichick, Hall, Picardo, & Richards, 2024). Scholars have demonstrated that participation in URSCI strengthens transferable skills such as critical thinking, written and oral communication, problem-solving, and collaboration—skills that are essential for success in both the workforce and graduate education (Campbell, 2022; Laursen et al., 2010; Osborn & Karukstis, 2009). As the career landscape evolves to demand greater adaptability, teamwork, and technological fluency, URSCI offers students a developmental pathway to cultivate these competencies in authentic, mentored environments (Vannier, Torok-Storb, Stromholt, & Chowning, 2023).

The National Association of Colleges and Employers (NACE) has identified eight core career readiness competencies that employers value in new college graduates: Career & Self-Development, Communication, Critical Thinking, Equity and Inclusion, Leadership, Professionalism, Teamwork, and Technology (NACE, 2021). In response, the undergraduate research community, led in part by the Council on Undergraduate Research (CUR), has begun to explore how URSCI can explicitly support these competencies. As noted in this *Perspectives on Undergraduate Research and Mentoring* (PURM) special issue, there is a pressing need for systematic, longitudinal research on how URSCI experiences shape students' transitions to careers and graduate study. In particular, alumni voices remain underrepresented in research on URSCI's long-term impact (an exception is found in Johnson & Rifenburg, 2024). Thus, there is an opportunity to advance current understanding of how scholarly and creative inquiry participation translates into sustained career readiness across diverse professional trajectories.

Our research seeks to address that gap by examining 23 years of alumni reflections from the Foundation for Undergraduate Research, Scholarship, and Creative Activity (FURSCA) at Albion College, a residential liberal arts institution in the Midwest with a long-standing commitment to undergraduate research. Established in the late 1990s, FURSCA provides funding, mentoring, and

presentation opportunities for students across all disciplines, supporting original projects in the sciences, social sciences, fine and applied arts, and humanities. While existing internal assessments have highlighted student satisfaction and academic benefits of FURSCA participation, less attention has been given to long-term career development outcomes—particularly through the lens of the NACE competencies.

The purpose of this study is twofold. First, it seeks to showcase how Albion College alumni reflect on their FURSCA experience in relation to the NACE career readiness competencies, identifying which skills they associate most strongly with their research participation. Second, it aims to elevate alumni voices as critical stakeholders in the ongoing development of undergraduate research programming. By analyzing how former FURSCA participants describe the personal, academic, and professional value of their scholarly and creative endeavors, this research offers insights that can guide future programmatic revisions, mentoring approaches, and institutional collaborations designed to more intentionally foster career readiness. Our research was grounded by three research questions:

1. In what ways do Albion alumni perceive their FURSCA participation as contributing to their development of career readiness competencies?
2. Which NACE competencies are most frequently attributed to their URSCI experience?
3. How can alumni perspectives inform future iterations of undergraduate research programming, mentoring, and institutional collaboration?

By centering alumni perspectives and applying the NACE framework as a lens for analysis, this study contributes to a growing body of scholarship that aims to align undergraduate research more directly with post-graduate success. It also offers practical recommendations for educators, administrators, and program designers committed to embedding career readiness more explicitly within the undergraduate research experience.

Undergraduate Research and Skill Development

Recent literature has increasingly explored how URSCI contributes to career readiness, particularly through transferable skills such as communication, confidence, critical thinking, and collaboration. As workforce demands evolve and public confidence in higher education declines, scholars have examined how URSCI can bridge the gap between academic experience and workforce expectations (Mekolichick & MacDonald, 2024).

Communication and Professionalism

A frequently cited benefit of URSCI is the improvement of communication skills. Students engaged in research often write proposals, communicate with mentors, present findings, and translate complex ideas to varied audiences (Osborn & Karukstis, 2009; Laursen et al., 2010). These activities refine written and oral communication and build confidence in professional settings. Miller et al. (2025) found that communication and professionalism were among the top four NACE competencies most improved during an intensive eight-week undergraduate research program with targeted professional development. These findings support the idea that intentionally structured URSCI can serve as a powerful platform for building communication capacity in both discipline-specific and interdisciplinary contexts.

Confidence and Scientific Identity

Research also highlights the role of URSCI in developing confidence and identity, particularly among STEM students. Newell and Ulrich (2022) demonstrated that students participating in course-based undergraduate research experiences (CUREs) reported gains in scientific self-efficacy, identity, and intent to pursue STEM careers, with identity emerging as the strongest predictor. These findings underscore the value of URSCI not only in skill acquisition but in shaping how students see

themselves within academic and professional communities. This identity formation contributes to long-term confidence, agency, and navigation of complex career pathways in an evolving workforce.

Critical Thinking and Adaptability

Critical thinking and adaptability are hallmarks of URSCI experiences. Students evaluate sources, formulate questions, analyze data, and iterate on findings—activities mirroring workplace cognitive demands. Newell and Ulrich's (2022) mixed-methods study of STEM alumni revealed critical thinking as the most important NACE competency for current employment. Their findings suggest undergraduate research experiences (UREs) are well suited to foster analytical reasoning and decision-making, especially when projects simulate real-world problem-solving. Miller et al. (2025) further reported critical thinking as among the most significantly developed competencies as rated by students and faculty mentors.

Collaboration and Team-Based Learning

Although undergraduate research is often imagined as solitary, most students engage in collaborative projects requiring teamwork, negotiation, and project management. These experiences offer structured opportunities to practice interpersonal skills and cross-disciplinary communication central to the NACE teamwork competency. Gunnels et al. (2020) found that students at Florida Gulf Coast University participating in research-infused curricula demonstrated higher transferable skills, including collaboration, than those in traditional capstone experiences. Similarly, Newell and Ulrich (2022) emphasized the role of CUREs in fostering shared problem-solving within diverse, team-based learning environments.

Positioning URSCI as a Workforce Strategy

As institutions face increasing pressure to demonstrate return on investment, scholars have positioned URSCI as a workforce development strategy. MacDonald et al. (2024) reported that 85% of employers surveyed by AAC&U were more likely to hire candidates with mentored research experience, though many career readiness frameworks overlook the nuances of scholarly work. Their findings call for recalibrating how higher education defines skill development, situating URSCI as a rigorous and professionally relevant site for cultivating transferable competencies.

Together, these findings reinforce that URSCI is more than academic enrichment; it is a developmental practice that equips students with competencies necessary for diverse post-graduate pathways. By enhancing communication, confidence, critical thinking, and collaboration, URSCI aligns with the NACE framework and responds directly to employer expectations and public demands for career-relevant higher education.

Career Readiness: A Conceptual Framework

The NACE Career Readiness Competency Framework (2021) offers a comprehensive model for understanding the foundational skills that equip students for success beyond college. These eight competencies—Career & Self-Development, Communication, Critical Thinking, Equity and Inclusion, Leadership, Professionalism, Teamwork, and Technology—reflect a growing consensus among employers and higher education professionals regarding the qualities essential for entering and adapting to the modern workforce. As institutions increasingly seek to embed these competencies across the curriculum, URSCI has emerged as a high-impact context for their development. The Council on Undergraduate Research (CUR) and other national bodies have underscored the alignment between URSCI experiences and the NACE framework, positioning research engagement as a pathway to career readiness (Mekolichick & MacDonald, 2024).

Through mentored inquiry, sustained project work, and opportunities for public dissemination, URSCI provides an environment in which students actively practice and refine the competencies employers

value. As students define research questions, manage timelines, troubleshoot challenges, and communicate findings, they cultivate critical thinking, professionalism, leadership, and teamwork in real-world contexts. Importantly, these experiences also support identity development and personal agency—key elements of career and self-development (Miller, Buffington, Fleming, & Hall, 2025). Participation in scholarly and creative endeavors challenges students to navigate ambiguity, build confidence, and engage across differences, all of which contribute to long-term professional growth. In this way, the NACE framework not only helps articulate the value of URSCI to external stakeholders but also provides a useful lens through which institutions can evaluate and enhance the career readiness dimensions of undergraduate research programming.

Methods

While past assessments have underscored student satisfaction and academic growth, this study focuses specifically on how alumni, reflecting years or decades after their participation, describe the program's influence on their professional growth and development. Guided by the NACE career readiness framework and three research questions noted previously, our methodological approach centers alumni voices to illuminate which skills they most commonly attribute to their scholarly and creative experiences and how these insights might inform future program development.

Study Context

FURSCA is a competitive undergraduate research funding program designed to support students in pursuing their own scholarly and creative work as principal investigators rather than research assistants. Since its inception, the program has funded projects across all majors and disciplines, supporting work in every academic department at least once. Over time, FURSCA has included four primary funding pathways: an up to ten-week summer fellowship, semester research grants, Student Research Partners (SRP), and conference grant funding.

The summer fellowship and semester grants place students “in the driver’s seat” of their projects. Students develop and submit detailed grant proposals outlining goals, background, methodology, anticipated outcomes, and a budget; summer applicants must also include a project timeline. Although faculty mentors provide guidance, students are the primary authors and carry out the work independently. The summer fellowship is the most intensive experience, while semester grants often support smaller-scale projects or allow students to extend work begun during the summer.

SRP was designed as an entry point into research, particularly for first- and second-year students. In this model, faculty proposed scholarly projects and students applied to serve as research assistants, typically working 5–6 paid hours per week. Students could continue for a second year with faculty approval. In 2020, SRP was redesigned and moved to the institution’s Career and Internship Center. Conference grant funding has historically supported students presenting research conducted at Albion College; these funds are currently suspended due to budget constraints. Students may participate in one or multiple FURSCA components during their undergraduate careers.

A defining feature of FURSCA is sustained faculty mentorship. Advisors must endorse student proposals and provide a letter of support during the application process. Throughout the project, mentors are expected to engage regularly with students, offer substantive feedback, and guide the work from conception through dissemination. This one-on-one mentorship frequently extends beyond the funded period, with advisors serving as long-term mentors, references, and professional advocates.

Presentation and dissemination are integral components of the program. All participants are required to present their work at the college’s annual Spring research symposium. Summer fellows also meet weekly during the fellowship period, with each student presenting progress once during

the term. Students are strongly encouraged to share their work beyond the institution through conferences, exhibitions, or publications.

FURSCA has evolved in meaningful ways, including early intentional expansion to include the fine and applied arts and, more recently, alignment with the institution's experiential learning requirement, which participation in FURSCA fulfills.

Although projects vary widely—from original music composition to laboratory experimentation to archival and policy research—participation consistently cultivates transferable competencies. Through independent inquiry, structured proposal development, iterative faculty feedback, peer presentations, and public dissemination, students strengthen skills directly aligned with the NACE Career Readiness Competencies, including Critical Thinking, Communication, Professionalism, Leadership, Teamwork, and Career & Self-Development. In this way, FURSCA's design—rooted in student ownership, mentored engagement, and structured dissemination—helps explain how research participation translates into long-term academic and professional preparation.

Study Design

This study employed a qualitative, survey-based design to gather alumni reflections on their participation in FURSCA, with a particular focus on career readiness outcomes. Following the conclusion of the 2023 summer programming cycle, FURSCA staff identified a need to update marketing and outreach materials by incorporating more current alumni perspectives and post-graduate experiences. To achieve this, the program collaborated with the College's Institutional Advancement Office to develop and distribute a retrospective survey targeting former FURSCA participants.

Since 1999 there have been approximately 465 academic year grants (spring and fall), and 1121 summer grants awarded through FURSCA. In December 2023, an electronic survey was distributed via Slate to all known alumni for whom the College maintained valid contact information. The survey was designed to elicit open-ended responses that captured the academic, professional, and personal impact of FURSCA. A total of 74 alumni completed the survey, yielding a response rate of approximately 13% (based on the number of valid contacts available).

Of import, the original intent of this data collection effort was for alumni engagement and marketing purposes. At the time the survey was administered, alumni were informed that their insights could be used for both internal and external marketing communications and programmatic improvements; permission to use their quotes and responses was explicitly gathered. As we prepared this manuscript, we consulted with the Chair of the Institutional Review Board (IRB) at Albion College who confirmed that ethical approval was not required given the original purpose and context of the data collection. No identifying information was collected as part of the survey administration, and alumni were informed that their participation was voluntary and that responses would remain confidential.

Open-ended questions invited participants to describe their original scholarly or creative project, detail their post-graduation career paths, and reflect on the program's influence. Specific prompts included:

- Please describe your FURSCA research/creative project.
- What did you do directly after graduation? What are you doing now for your career?
- How did participating in FURSCA impact you and your career path?
- What was your favorite part about participating in FURSCA?
- Is there anything else you would like to share about your FURSCA experience

These qualitative responses formed the primary data source for the current analysis.

Participant Details

A total of 74 alumni responded to the survey. Each of them participated in FURSCA in a variety of ways. As shown in Table 1, the majority of survey respondents were participants in the summer fellowship program (n=61), followed by conference grants (n=22), and semester grants (n=19). SPR participation had the lowest number of respondents (n=11). 11 of the 61 respondents that participated in the summer fellowship program participated for two summers. 2 of the respondents for conference grants attended two conferences, and 5 of the 11 SPR respondents participated for more than one year.

Table 1. *Ways alumni participated in FURSCA*

Program participation options	Number of responses
Summer Fellowship	61
Semester Grants	19
Student Research Partners	11
Conference Grants	22

The alumni that responded represented a broad range of graduation years and academic disciplines. As shown in Table 2, respondents graduated between 2000 and 2023, with the largest number of responses from alumni in the 2010–2014 cohort (n = 22), followed by those from 2015–2019 (n = 17) and 2005–2009 (n = 14). Table 3 presents the distribution of respondents by academic division at the time of their participation in the FURSCA. Alumni from the natural sciences comprised the largest group (n = 26), followed by social sciences (n = 21), fine and applied arts (n = 11), interdisciplinary fields (n = 9), and humanities (n = 5). This distribution reflects the multidisciplinary nature of the FURSCA and its reach across diverse areas of study (See Table 2)

Table 2. *Demographic details of alumni respondents*

Graduation years	Number of responses	Division of study	Number of responses
2000-2004	9	Fine and applied arts	11
2005-2009	14	Humanities	5
2010-2014	22	Social sciences	21
2015-2019	17	Natural sciences	26
2020-2023	8	Interdisciplinary	9

As evidenced in Table 3, alumni respondents reported a wide range of career paths, reflecting the diverse academic backgrounds and professional trajectories supported by the FURSCA. The most commonly reported sectors were education (n = 21), health care (n = 12), and STEM fields (n = 12). Additional respondents were employed in non-profits, the arts, museums, or libraries (n = 5), marketing and publishing (n = 3), business and finance (n = 1), and technology (n = 2). Notably, 7 respondents indicated they were still in school, and 10 selected “other” to describe their current professional setting. These findings underscore the broad applicability of undergraduate research experiences across multiple career sectors.

Table 3. *Industry representation of alumni respondents*

Career sector	Number of responses
Business and Finance	1
Education	21
Technology	2
Health care	12
Non-profits/fine arts/museums & libraries	5
STEM	12
Marketing & publishing	3
Still in school	7
Other	10

Data Analysis

The open-ended questions from the alumni survey were analyzed using a hybrid thematic analysis approach that combined both deductive and inductive coding strategies (Fereday & Muir-Cochrane, 2006; Skjott Linneberg & Korsgaard, 2019). Deductive codes were drawn from the National Association of Colleges and Employers (NACE) career readiness competencies, which provided a structured framework for examining how alumni described the long-term impact of their FURSCA experience. Each response was reviewed for references to the eight NACE competencies: communication, critical thinking, teamwork, professionalism, technology, leadership, career and self-development, and equity and inclusion.

To complement this deductive process, inductive coding was used to identify emergent themes not captured within the NACE framework. This allowed for the discovery of unanticipated insights related to alumni experiences, particularly in areas such as the *quality of faculty mentorship*, *institutional support*, and *unexpected long-term benefits* such as increased self-confidence, clarity of purpose, and expanded professional networks. This hybrid methodological approach enabled a more comprehensive understanding of the impact of scholarly and creative inquiry by balancing theory-driven analysis with openness to novel themes (Fereday & Muir-Cochrane, 2006).

In addition to thematic coding, a basic frequency analysis was conducted to determine how often specific NACE competencies were mentioned across participant responses. This analysis incorporated both targeted survey questions that explicitly aligned with individual competencies and spontaneous references that emerged within open-ended reflections. By quantifying these patterns, we were able to assess the relative salience of each competency in the alumni narratives (Skjott Linneberg & Korsgaard, 2019).

Together, this mixed-methods approach provided both a structured lens for analyzing post-hoc assessments related to career readiness development and the flexibility to surface deeper, more nuanced insights into the lasting value of the FURSCA experience.

Limitations

This study has several limitations that should be considered when interpreting the findings. First, the sample size and response rate present constraints. Participation was limited to alumni for whom active or recent email addresses were on file, which necessarily narrowed the potential pool of respondents. The resulting response rate of 13%, while not uncommon in alumni research, is lower than ideal and limits the generalizability of the findings. Relatedly, participant recruitment relied on a single strategy—email outreach—rather than a multi-modal approach that might have included

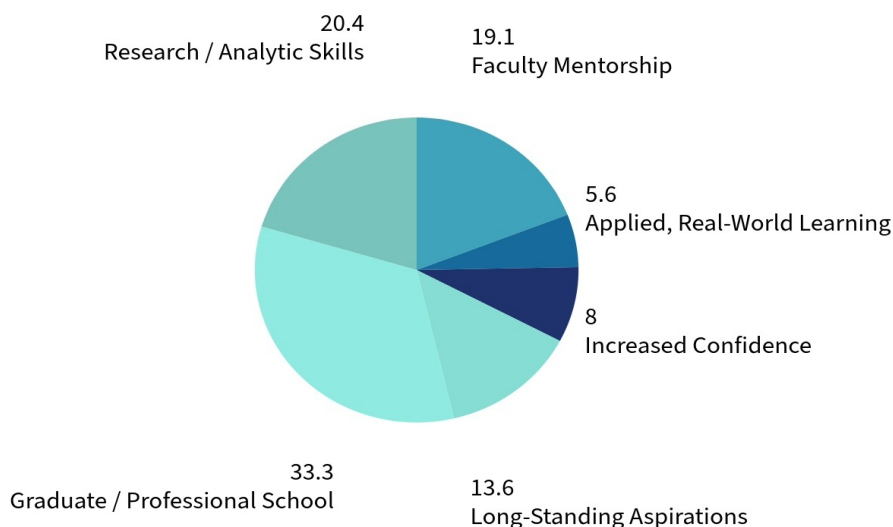
alumni network platforms (e.g., Facebook or LinkedIn), institutional alumni boards, or other engagement channels.

Second, the study is subject to potential self-selection bias. Alumni who chose to respond may differ systematically from those who did not, particularly in their level of engagement with the institution or their perceptions of the undergraduate research program. As such, careful attention was given to honoring and contextualizing the perspectives of respondents, recognizing that their experiences may not fully represent the broader alumni population. Conversely, limited attention was paid to non-respondents, whose absence may reflect a range of factors including time constraints, limited interest in institutional engagement, or less positive program experiences.

Findings

In the following section, we outline knowledge gleaned from 23 years of alumni reflections on their experiences with FURSCA at Albion College. We argue that a compelling portrait emerges, illustrating the powerful and multifaceted impact of undergraduate research on career readiness. This section organizes those insights thematically, weaving alumni voices and patterns of professional development into a broader understanding of how FURSCA supported the NACE career readiness competencies and facilitated other career preparation experiences in meaningful ways. Refer to Figure 1 for a summary of the main themes that emerged from alumni responses.

Figure 1. *Themes and NACE Career Readiness Competencies (in percentages)*



Graduate and Professional School Preparation: Career & Self-Development

From medical and pharmacy programs to doctoral study in psychology, biology, law, and theology, alumni cited research experience as a clear advantage in the admissions process. Alumni emphasized how their FURSCA experience enhanced application materials, strengthened personal statements, and provided writing samples, presentations, or publications that distinguished them from peers. Alumni noted that FURSCA helped them articulate research interests with clarity and confidence which, in turn, sharpened their career goals and motivation to pursue advanced study.

This theme speaks directly to NACE's Career & Self-Development competency, which emphasizes the proactive pursuit of career goals, self-awareness, and continuous learning (NACE, 2021). Alumni consistently described FURSCA as a foundational experience that shaped their ability to navigate complex career landscapes with confidence and intentionality. Many credited the program with helping them identify long-term professional aspirations and equipping them with the motivation and

tools to pursue them: “I took a gap year, taking odd jobs before grad school in experimental psychology. I now work as a feasibility strategist, helping to create site strategies for clinical trials.” Others described how their research experience enabled them to clarify or pivot their goals: “I had not yet pin-pointed what I wanted to do career wise after graduation. I am currently in the Service Industry... and am actively saving to go back to school for a graduate certificate in Museum Studies.” Several noted that completing independent research sparked a lasting sense of intellectual curiosity and adaptability—qualities essential to self-development in an evolving workforce. As one graduate reflected, “I’m currently working in an [field] lab... where I assist physicians with cardiac ablation procedures,” tracing a path from a master’s in physiology to nursing and specialized clinical care. Across disciplines, alumni described a continuous arc of growth initiated by FURSCA, showing how research served not only as preparation for graduate study, but also as a platform for sustained career reflection, skill-building, and self-directed advancement.

Research, Writing, and Analytical Skill Development: Critical Thinking & Communication

From hypothesis formation and fieldwork to literature reviews and data synthesis, participants described themselves as novice researchers who gained technical competence and intellectual rigor. Alumni recalled mastering lab procedures, analyzing complex data sets, composing grant proposals, and producing work that met professional standards—skills they continued to use in graduate programs, professional roles, and interdisciplinary collaborations.

These reflections map directly onto multiple NACE Career Readiness Competencies including Critical Thinking and Communication (NACE, 2021). Alumni didn’t merely describe discrete skills; they reflected on transformative learning moments that shaped their confidence, adaptability, and professional identities. As one graduate noted, “FURSCA taught me how to work on a larger project and how to schedule that project,” underscoring initiative and time management central to Professionalism. Others emphasized how the program catalyzed independent thinking and persistence: “FURSCA gave me the opportunity to delve into a true research project. I learned so much... about methods, dead ends, and perseverance.”

The iterative nature of research demanded continual self-assessment and reflection, hallmarks of critical thinking. One alum shared, “It helped me gain an appreciation of the research process, which paved my road to pursuing a professorship in a liberal arts setting.” Even alumni who changed paths spoke to how the experience shaped their understanding of what they did—or did not—want in a career: “FURSCA taught me that I absolutely did not want to pursue a career in academic research... It also kindled my love of birdwatching, a hobby I’ve kept to this day.”

The emphasis on presenting at conferences and producing written work reinforced Communication and audience awareness. One alum recalled, “The FURSCA and senior thesis experience gave me a leg up when I went to grad school. I had designed an entire study, ran it, presented the results at two conferences, and published the results in a peer-reviewed journal.” Another shared, “Participating in FURSCA... helped me to better understand the professional discipline I was intending to pursue and further excited me about my career plans.”

A Multidisciplinary Perspective: Advancing Equity & Inclusion

Alumni narratives illuminated how FURSCA contributed to a broader array of NACE career readiness competencies, including *Equity & Inclusion* (NACE, 2021). For students from marginalized backgrounds or working across disciplines, the program offered a validating space to connect identity with purpose. Several alumni noted the importance of shared intellectual community: “My advisory panel included a music professor, an English professor, and an administrator... In my current career, I’m often challenged to find subject matter experts based on their skills rather than their backgrounds.” These reflections speak to the value of interdisciplinary teamwork and inclusive

practice. Such skills are increasingly vital in workplaces that prioritize innovation, equity, and collective problem-solving.

Moreover, FURSCA empowered students to draw interdisciplinary connections, often tying their research to broader social impact. One alum reflected: “I realized the impact of human behavior on conservation and became interested in environmental social science,” after witnessing firsthand the disconnect between ecological science and local stakeholder values. In this way, FURSCA served not only as a technical training ground but as a transformative space for developing the habits of heart and mind essential to ethical, adaptive, and self-aware professionals – all hallmarks of a liberal arts college education (Baker, 2020).

Confidence, Independence, and Academic Identity: Professionalism, Teamwork & Leadership

Describing their projects as their first “real” academic endeavor, many respondents credited FURSCA with helping them see themselves as capable of leading intellectual work. Several cited their projects as early opportunities to manage timelines, balance responsibilities, and take ownership of a complex process from design to execution. These experiences often paralleled those of early-career professionals—writing proposals, responding to feedback, and presenting work—instilling a sense of academic and professional maturity. These experiences reflect the core tenets of Professionalism, as alumni consistently cited FURSCA as their first experience managing a project with the independence, accountability, and attention to detail expected in professional environments (NACE, 2021).

Many described their research as “a step up toward adulthood,” requiring them to “structure [their] time in order to carry out a research project” and “hit milestones while still [participating] in other extracurricular activities.” These reflections demonstrate that professionalism emerged not only from the work itself but also from how alumni learned to manage deadlines, communicate with mentors, and persist through challenges. One alum wrote, “It was the first time I felt like an expert in something,” pointing to the confidence that arises from sustained, self-directed inquiry. Another emphasized the long-term impact: “My favorite part of participating in FURSCA was the amount of control I had on my research... I was given the final say,” highlighting the balance between independence and mentorship that mirrors workplace collaboration.

While many projects were completed individually, teamwork and leadership emerged in moments of shared learning and cross-disciplinary engagement. “Spending the summer with other FURSCA students, learning about others’ projects, and being immersed in research” cultivated a collaborative culture supporting professional growth. Alumni described working in labs, field sites, and shared spaces, learning how to “troubleshoot and investigate unknown substances/results” and navigate “constructive feedback” in mentor-mentee and peer relationships. One alum captured this synergy succinctly: “We had fun, of course, but it was also more academically-minded than usual, and I got to interact with people I wouldn’t have really encountered... during the regular semesters.” These environments fostered intellectual leadership and interpersonal fluency—key components of professionalism alumni carried into graduate programs, teaching roles, and industry careers.

Applied Learning and Real-World Relevance: Technology & Critical Thinking

Whether through lab work, digital archiving, fieldwork, or public policy research, students developed technical and analytical skills that directly translated into their post-graduate work. These stories underscore how FURSCA prepared students to engage with real problems, tools, and environments helping them be more agile and adaptable professionals.

These outcomes strongly align with the *Technology* competency, as alumni described gaining early exposure to tools, platforms, and technical processes that closely mirrored professional and

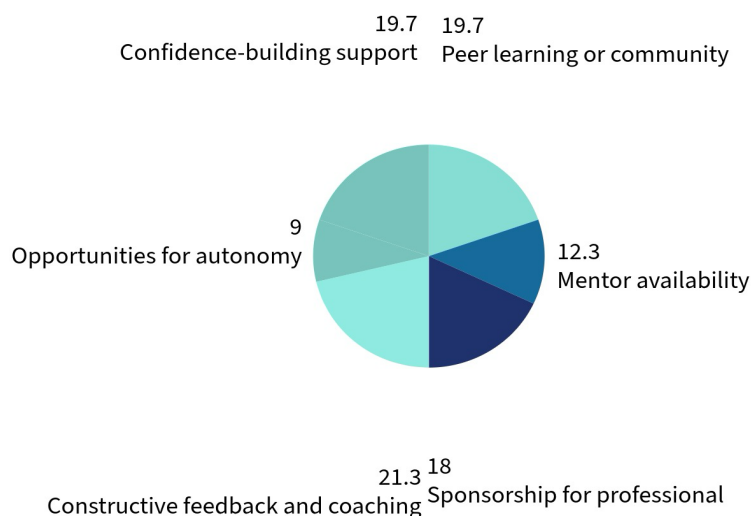
graduate-level expectations (NACE, 2021). One graduate reflected, “Working as a participant in FURSCA helped teach me how to properly record experiments in a lab notebook, keep a clean and organized workspace in the lab, [and] analyze/investigate GC/MS data of unknown substances using my knowledge of organic chemistry.” Others spoke to the transferability of these experiences across disciplines and roles: “Digitization skills from working both in the archives and the field definitely helped me become more tech savvy. I use these skills almost every day.” This applied technical learning often made alumni stand out in competitive environments. As one noted, “My MS and PhD advisor had explicitly told me that I stood out among candidates for the position because I had conducted research and wrote a thesis during my undergraduate studies.”

FURSCA projects also encouraged iterative reasoning, pattern recognition, and data-driven inquiry—foundational to *Critical Thinking* (NACE, 2021). One alum shared, “Participating in FURSCA helped to solidify my love for data analysis and finding the hidden patterns in complex data sets,” while another emphasized how the program prepared them to “ask questions and determine new ways to answer those questions.” Whether through coding, lab instrumentation, or archival technologies, students learned how to solve real-world problems using specialized tools—a key competency in today’s evolving workforce. Importantly, these experiences were not just technical rehearsals but acts of intellectual agency. As one participant put it, “FURSCA gave me the opportunity to work in a lab that was more open-ended than most courses... It gave me a definite step up on my coworkers almost immediately after being hired.” These reflections highlight the value of applied research not only for knowledge generation, but also for cultivating technological agility and confidence in navigating unfamiliar systems.

Mentorship, Identity, and Long-Term Impact: Transformative Experiences

Across the alumni responses analyzed, the most frequently cited mentorship-related qualities are summarized in Figure 2. Not included in Figure 2, however, are the negative mentoring experiences or poor mentor–student fit that were rarely reported (2%), suggesting that while outcomes were largely positive, they may vary depending on the quality and alignment of the mentoring relationship.

Figure 2. Most Frequently Cited Mentorship Behaviors (in percentages)



These patterns help clarify how outcomes associated with career readiness are realized within FURSCA. Alumni consistently described the program as an integrated ecosystem of faculty mentorship, professional development programming, and peer learning, rather than a single intervention. Faculty mentors played a central role by engaging regularly with students, providing substantive feedback, and guiding projects from conception through dissemination. Although mentors were not formally trained in the NACE framework, their expectations and practices—rooted in a liberal arts approach to education and disciplinary norms—naturally fostered competencies such as critical thinking, professionalism, communication, and self-direction through authentic research practice.

Professional development programming for student participants further reinforced these outcomes by making implicit learning explicit. Summer sessions focused on building scholarly or creative portfolios, articulating research experiences for graduate applications and interviews, and translating research into resume-ready language, directly supporting Career & Self-Development and Communication competencies. Weekly peer presentations created structured opportunities for students to practice public communication, receive feedback, and learn about others' scholarly and creative work. Together, mentorship, professional development, and peer engagement explain how FURSCA functions as a high-impact, integrative practice that cultivates transferable competencies through sustained, authentic participation in undergraduate research.

Future Directions and Implications

As the landscape of higher education continues to evolve amid changing workforce demands and increased public scrutiny, institutions must more clearly articulate the value of high-impact practices such as undergraduate research, scholarship, and creative inquiry (URSCI). Findings from this study underscore the importance of alumni perspectives in illuminating not only which career readiness competencies students develop through URSCI, but how those outcomes are realized over time. By applying the NACE career readiness framework to alumni reflections from FURSCA, this research identifies competencies most frequently attributed to URSCI participation and clarifies the programmatic and relational mechanisms that support their development.

Implications for Practice

A central implication of this study is that career readiness outcomes emerge through an integrated ecosystem of mentorship, professional development programming, and peer learning, rather than through any single intervention. Alumni reflections indicate that competencies aligned with the NACE framework are cultivated primarily through the nature of undergraduate research itself—sustained inquiry, iterative feedback, project ownership, and public dissemination—supported by consistent faculty engagement and structured opportunities for reflection and communication.

While mentors in FURSCA are not formally trained in the NACE framework, they are expected to meet regularly with students, provide substantive feedback, and guide projects from conception through dissemination. Alumni most frequently cited constructive feedback, confidence-building support, and sponsorship for professional opportunities (e.g., conference presentations, publications) as impactful mentoring qualities. These findings suggest an opportunity to enhance mentoring practices by offering faculty light-touch resources—such as mentoring guides or reflection prompts—that help mentors more intentionally name and reinforce the competencies students are developing through disciplinary research practices.

Professional development programming further strengthens these outcomes by making implicit learning explicit. Summer seminars focused on building scholarly or creative portfolios, translating research experiences into resumes, and articulating research narratives for graduate school or employment directly support Career & Self-Development and Communication competencies.

Required peer presentations and public dissemination serve as critical pedagogical moments, reinforcing professionalism, audience awareness, and confidence. Together, these elements demonstrate that outcomes are realized through both the inherent demands of undergraduate research and intentionally designed program structures that scaffold skill articulation and reflection.

Implications for Policy

From a policy perspective, these findings support embedding career readiness language and expectations across URSCI programs without reducing research experiences to competency checklists. Proposal guidelines, assessment rubrics, mentor expectations, and final deliverables can all benefit from explicitly referencing NACE competencies as learning outcomes, while still honoring disciplinary norms and scholarly rigor. Although formal mentor training may not be necessary, establishing shared mentoring expectations—such as regular meetings, feedback standards, and support for dissemination—can help ensure more consistent student experiences across mentors and disciplines.

Additionally, alumni data should be leveraged systematically in program assessment and reporting. Integrating NACE-aligned questions into alumni surveys and post-graduation follow-ups can strengthen the evidence base for URSCI's long-term impact and make outcomes more legible to accreditors, funders, families, and employers.

Implications for Future Research

Finally, future research would benefit from intentionally capturing variation in alumni engagement and experience. While most alumni in this study described positive mentoring relationships and strong professional outcomes, a small number noted challenges related to mentor fit or engagement. Examining these variations—alongside differences in discipline, identity, and level of post-program engagement—would provide a more nuanced understanding of how and for whom URSCI is most effective. Such efforts would strengthen institutional capacity to refine, assess, and more equitably evaluate undergraduate research programming.

Multi-institutional and longitudinal studies that examine how mentoring structures, professional development offerings, and dissemination requirements interact across contexts would further advance the field. By attending not only to outcomes but also to the conditions under which those outcomes emerge, future scholarship can better inform the design of undergraduate research programs that are both inclusive and transformative.

Conclusion

This study affirms the value of centering alumni voices in assessing the long-term impact of URSCI. Their reflections illustrate not only which competencies are developed through research, but how those competencies shape professional identity, adaptability, and confidence in the years following graduation. For FURSCA, these insights provide a roadmap for refining mentoring practices, expanding institutional collaboration, and aligning program goals with national career readiness frameworks.

More broadly, this work challenges institutions to move beyond counting participation toward intentionally designing undergraduate research ecosystems that integrate mentorship, professional development, and peer learning. As institutions seek to make undergraduate education more relevant, inclusive, and outcomes-driven, FURSCA stands as a replicable model for building URSCI programs that foster meaningful and measurable career readiness. By bridging scholarly inquiry with professional preparation—and by systematically listening to those who have lived its long-term impact—such programs can reaffirm the enduring value of a liberal arts education in a rapidly changing world.

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