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A Modular Framework for Embedding NACE Career Competencies in Engineering Courses

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A Modular Framework for Embedding NACE Career Competencies in Engineering Courses

Abstract

This evidence-based practice full paper presents the design and implementation of a modular Career Readiness Framework, grounded in the National Association of Colleges and Employers (NACE) Career Readiness Competencies, across multiple engineering courses. It highlights the collaborative vision among engineering faculty, describes implementation strategies and assessment designs, and reports on the outcomes of embedding career readiness into the engineering curriculum.

Supporting students in achieving career success is a central goal of higher education. Academic programs, particularly in STEM and engineering, strive to equip students with both technical expertise and transferable skills through coursework, internships, cooperative education, and other experiential opportunities. In this context, employers' growing emphasis on skills-based hiring underscores the need for explicit attention to competencies such as communication, teamwork, leadership, professionalism, and critical thinking alongside technical knowledge.

NACE has articulated a widely recognized set of Career Readiness Competencies that employers expect from new graduates. The eight core competencies (career and self-development, communication, critical thinking, equity and inclusion, leadership, professionalism, teamwork, and technology) serve as the foundation for the three-domain Career Readiness Framework used in this work, which organizes course-based efforts into in-course career activities, leveraging campus career resources, and professional and industry engagement. Recent NACE reports highlight employers' prioritization of competency-based hiring and emphasize the critical role of faculty in preparing students for successful careers.

As part of a university-wide mission to support students' career success, faculty from four engineering areas (Computer Science and Engineering, Civil Engineering, Materials Science and Engineering, and Graduate Engineering Professional Development) at the University of Connecticut participated in institution-wide "Career Champion" and "Career Fellow" programs facilitated by the Center for Career Readiness and Life Skills. Drawing on this shared professional development, the authors collaboratively adapted the NACE competencies into the Career Readiness Framework and applied it across multiple courses and levels.

The study examines the implementation of the framework in three undergraduate courses (Algorithms and Complexity, Principles of Construction I, and Materials Characterization and Processing Laboratory) and three graduate courses (Scientific Communication, Engineering Internships and Careers in Industry, and Scientific Writing). In each course, the framework was instantiated through discipline-appropriate activities such as mapped learning outcomes and assignments aligned with NACE competencies, integration of career-center modules, and, in some cases, workshops, reflective writing, and structured interactions with industry professionals. Using a pre–post survey design administered at the beginning and end of the semester, The instructors examined students' familiarity with the NACE competencies, their confidence in securing a job in their chosen field, and their perceptions of how well the course prepared them for their future careers.

Findings show substantial gains in students' reported familiarity with the NACE framework and high levels of perceived preparation across multiple competencies, providing initial evidence that the Career Readiness Framework is a practical, adaptable structure for embedding career readiness into engineering courses. The paper concludes with implications for instructors and programs seeking to scale this framework across curricula and to more systematically integrate NACE-aligned career development into engineering education.

Keywords: NACE Competencies; Career Readiness; Engineering curriculum; Evidence-based practice; Student perception

1 Introduction

Achieving career goals, joining the workforce, and having a meaningful career are important to undergraduate students and their families. Academic programs, particularly in STEM and engineering, strive to provide knowledge, experiences, and skills that support career success. Institutions encourage and provide resources for students seeking internships, co-ops, and work-study, and many STEM disciplines offer undergraduate research opportunities that function as "high-impact practices" linked to student engagement and long-term success [1, 2]. Non-class-based opportunities like these allow students to gain real-world experience in their chosen career prior to graduation and to develop broader professional capacities that employers increasingly value [3]. They also provide strong résumé material, positioning students to be both competitive and ready for their next career step [4].

There has been a growing industry emphasis on skills-based hiring with emphasis on demonstrable "soft" competencies such as communication, teamwork, leadership, professionalism, and critical thinking. This expectation is in parallel with the strong technical knowledge gained from coursework [5]. The National Association of Colleges and Employers (NACE), established in 1956, is a U.S.-based professional association of career services professionals, university leaders, and employers. In 2015, it formed an internal task force to identify the foundational pillars common to a successful career. Seven career competencies were introduced. An eighth was added the following year. The task force also defined concrete observable behaviors to facilitate the teaching of these competencies. In 2018, NACE introduced its career readiness project with a pilot at 80 academic institutions [6].

Today, most are familiar with the eight critical core competencies: career and self-development, communication, critical thinking, equity and inclusion, leadership, professionalism, teamwork, and technology. According to the 2025 NACE Career Services Benchmark Quick Poll, over 83% of the academic institutions they contacted have a career competency program [7]. It is clear that the combination of transferable skills and technical knowledge are the foundation for success in the workplace and for lifelong career management.

NACE partnered with the American Association of Colleges and Universities (AAC&U) and the Society for Experiential Education (SEE) to survey college faculty, staff, and administrators about their engagement in career preparation. These findings, published in 2024, show that college faculty already play a critical role in preparing students for successful careers [8, 9, 3]. The report recommends leveraging and building upon this to intentionally integrate career readiness and workforce preparation into the curriculum [10]. Engineering programs are well-positioned for this given their classes often include project-based learning, laboratories, and professional communication experiences. The Career Readiness and Life Skills (CCRLS) center at the University of Connecticut cultivates an active Career Champion Program to help faculty and staff become effective career readiness mentors. As a result, many faculty have integrated career competencies into their individual courses. Some have presented and/or published their experiences [11]. A systematic and scalable approach to embed career readiness across multiple engineering disciplines represents another valuable area for development and research.

This paper documents a study made by faculty members from Computer Science and Engineering, Civil Engineering, Material Science and Engineering, and Professional Development for Graduate Engineering. All four participated in the Career Fellow Workshops and Career Champion program organized by the university's CCRLS. The former introduces faculty and staff to NACE Career Readiness Competencies and helps attendees effectively integrate these into classes and programs. The latter provides additional opportunities for learning and sharing for continued support and growth.

This study involved three undergraduate courses (Algorithms and Complexity, Principles of Construction I, and Materials Characterization and Processing Laboratory) plus three graduate courses (Scientific Communication, Engineering Internships and Careers in Industry, and Scientific Writing). The instructors of the courses used the "Career Readiness Framework" to implement the NACE competencies in the courses. The framework offers several flexible components that allow the instructors to adopt them based on course level, enrollment, or learning outcomes.

A career readiness module developed by CCRLS was embedded into each course so as to familiarize students with the NACE Career Competencies and their relevance to success in the workforce. In several courses, learning outcomes were mapped to NACE competencies, and course assignments were redesigned to incorporate these competencies. Some courses incorporated workshops on the NACE career competencies facilitated by CCRLS professionals, . while others included reflective assignments. An assessment survey was conducted at the beginning and at the end of the semester to capture changes in student perception of the competencies, how to build competency skills while at university and the value of the competencies to their future employment. This paper recounts the survey findings and faculty learnings.

2 Career Readiness Framework

The Career Readiness Framework presented in this paper is a conceptual model for structuring how engineering courses can systematically support students' development of career readiness. Anchored in the NACE Career Readiness Competencies [12, 13], the framework was developed in the context of the University of Connecticut but is intentionally designed to be modular and adaptable across disciplines, institutional types, and course levels. It delineates three complementary domains through which instructors can engage students in career readiness: (1) in-course career activities, (2) campus career resources, and (3) professional and industry engagement. Rather than prescribing a single implementation, the framework offers a set of components that courses may adopt in whole or in part, depending on course level, enrollment, learning outcomes, and local context.

Figure 1 illustrates the framework as three nested domains. In-course activities form the core, as they are directly under the instructor's control and embedded within required coursework. Campus resources provide an intermediate layer that connects students to existing institutional supports such as career centers, student organizations, and co-curricular programs. Professional and industry engagement constitutes the outer layer, extending students' learning beyond the university into authentic professional contexts. Together, these domains create multiple, reinforcing pathways for students to develop and practice the NACE competencies throughout their academic experience.

2.1 In-Course Career Activities

The innermost domain focuses on experiences that can be integrated directly into existing courses with minimal structural change. Instructors design *individual career assignments* (e.g., reflections, short written tasks, or small projects) that explicitly connect course concepts to professional tasks or contexts. *Team-based career projects* provide opportunities for students to work collaboratively on realistic problems, building teamwork, communication, and leadership skills in parallel with technical competence. The framework also encourages the intentional use of *technology and artificial intelligence* (AI) tools. For example, using AI to rehearse interview questions, draft and critique professional communications, or explore alternative solution strategies, with explicit guidance on ethical and effective use [14]. Finally, *reflection and self-assessment* prompts help students identify which competencies they are developing and how these experiences contribute to their emerging professional identity.

2.2 Campus Career Resources

The middle domain highlights the importance of connecting course-based learning to existing campus infrastructure for career development. Instructors can *integrate career-related modules or materials* developed by the institution's career center or other units (e.g., online modules on résumés, networking, or interviewing; recorded workshops; or curated resource guides) [15].

In addition, they can regularly promote *campus opportunities and events*, such as career fairs, employer information sessions, student organizations, mentoring programs, and skills workshops. Even brief in-class announcements or learning management system posts can lower barriers to participation and reinforce the message that career development is a normal and expected part of students' academic journeys.

The Center for Career Readiness and Life Skills at the University of Connecticut exemplifies this domain in practice. The center aligns with a campus-wide "Career Everywhere" mission to ensure that students receive essential resources for career success after graduation. Through Career Everywhere initiatives, faculty collaborate with industry partners and alumni to share current job requirements and expectations with undergraduate and graduate students across the College of Engineering. The center also designs modular career resources that faculty and students can adopt to learn about career readiness, networking, résumés, and interviews [15]. The "Career Champion" and "Career Fellow" programs fall under this umbrella: they cultivate a community of faculty, alumni, and employers who focus on career planning and help students shape their career goals. All faculty involved in this study are Career Champions, and some are also Career Fellows who completed a series of workshops on embedding the NACE Career Readiness Competencies into their courses.

2.3 Professional and Industry Engagement

The outer domain involves structured opportunities for students to interact with professionals beyond the classroom. These may include *talks and panels with professionals and alumni*, guest lectures from industry partners, or virtual Q&A sessions that explicitly connect course content to real-world practice. Where feasible, the framework also recognizes *internships and other work-based learning experiences* (e.g., co-ops, undergraduate research, community-engaged projects) as powerful contexts in which students can apply and further develop the NACE competencies in authentic settings [16]. Courses can support these experiences by helping students reflect on what they are learning in the workplace and how it relates to their academic and professional goals.

Overall, the framework is intended as a flexible structure rather than a prescriptive checklist. Instructors can start by implementing one or two components that align with their course goals and constraints (e.g., an in-course reflection and a single guest speaker), and then expand their use of the framework over time. Across the courses described in this paper, different combinations of in-course activities, campus resources, and professional engagement illustrate how the same framework can be adapted to diverse disciplinary, institutional, and student contexts.

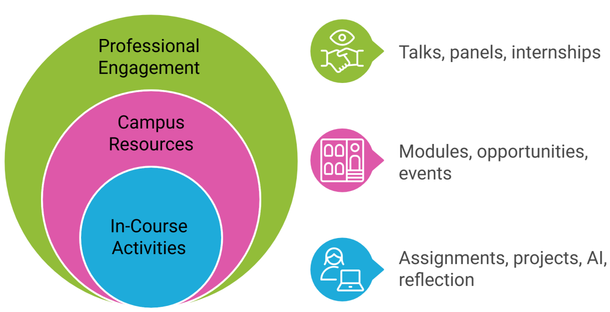

Figure 1: Career Readiness Framework with three nested domains: in-course activities (e.g., assignments, projects, AI-supported practice, reflection), campus resources (e.g., career modules, opportunities, events), and professional engagement (e.g., talks, panels, internships).

3 Study Design and Methods

This evidence-based practice study used a pre–post survey design during the Fall 2025 semester at the University of Connecticut. Career readiness activities organized by the Career Readiness Framework (Section 2) were embedded in six engineering courses, including three undergraduate core and three graduate professional-development courses.Table 1 summarizes course enrollment and survey participation.

The surveys were delivered online via Microsoft Forms. Instructors shared the survey link in class and/or through the learning management system and allowed students time to respond either during or outside of class. Participation was voluntary; no credit, grade, or incentives were offered. Responses were fully anonymous, and no identifiers were collected, so pre- and post-survey responses were not linked at the individual level.

The pre-survey was administered within the first three weeks of the Fall 2025 semester, after students were introduced to the NACE Career Readiness Competencies, and the post-survey was administered during the final week of classes and the final exam period, after students had engaged in the career readiness activities and assignments described in Table 2. The pre- and post-surveys consisted of both closed-ended and open-ended questions. Survey questions were designed to assess students' awareness of the NACE competencies, self-perceived preparedness on selected competencies, confidence in securing a job in their chosen field, and perceptions of how well the course supported their career readiness.

Most closed-ended items used Likert-type response formats to support descriptive analysis of trends and shifts in student perceptions. The instrument also included single-choice categorical items, check-all-that-apply questions, and a small number of open-ended prompts for qualitative feedback. Most constructs were measured using single-item indicators, while the NACE competency development section used a multi-item 5-point Likert-type scale to assess several aspects of career readiness. Survey responses were compiled and exported for analysis. Quantitative data were analyzed using descriptive statistics, with attention to pre–post changes in means and response distributions, while open-ended responses were reviewed for themes that complemented the quantitative findings. Details of specific analyses are described alongside the corresponding results in Section 5.

Ethical considerations

This project was reviewed by the University of Connecticut Human Research Protection Program / IRB and was determined not to constitute human subjects research (Protocol NHSR26-0103).

Course	Enrolled	Pre	Post
Algorithms and Complexity	57	55	49
Principles of Construction I	100	90	56
Materials Processing and Characterization	21	19	10
Scientific Communication	19	19	19
Engineering Internships and Careers	20	20	16
Scientific Writing	15	15	14

Note: "Pre" and "Post" indicate the number of students who completed the pre- and post-surveys, respectively.

Table 1: Summary of participating courses and survey participation.

4 Implementation - Course content and competencies

Across the College of Engineering, the Career Readiness Framework was implemented across six engineering courses spanning multiple levels and disciplinary contexts (Table 2). The following subsections describe how each course integrated framework components and mapped its activities to relevant NACE Career Readiness Competencies.

4.1 Algorithms and Complexity (School of Computing)

CSE3500: Algorithms and Complexity is a 3-credit core course in the Computer Science and Engineering curriculum that introduces students to the rigorous design and analysis of algorithms and their computational complexity. It serves as a foundational requirement for students in the School of Engineering, Cognitive Science majors, and declared Computer Science minors. In the semester reported here, 57 students were enrolled: approximately 77% juniors, 18% seniors, and 5% sophomores, most of whom were actively preparing for internships, co-ops, or full-time positions. On the first day, students are introduced to the NACE Career Competencies and the idea that STEM coursework develops transferable skills valued by employers [12, 13]. The syllabus highlights where assignments explicitly target these competencies and aligns with institutional guidance on integrating career competencies into coursework and collaborating with career services [15, 16]. Within the Career Readiness Framework described earlier, the course contributes primarily through the In-Course Career Activities and Campus Resources domains (see Table 2). Career readiness is embedded through a small set of recurring structures rather than stand-alone add-ons. Students complete a semester-long team project and an end-of-the-semester team presentation, a sequence of homework assignments that include interview-style questions and optional use of AI tools, and an individual video presentation on a self-selected algorithm. These activities are designed to promote teamwork, communication, critical thinking, technology use, and professionalism in parallel with technical learning [13, 17, 14, 18, 19].

Class time is periodically reserved for team coordination, and career-center modules and announcements about career fairs, networking events, and student organizations connect course work to broader campus resources. Collectively, these design choices position the course as a context where students develop algorithmic reasoning alongside clearly articulated career readiness competencies that can be communicated to future employers.

4.2 Principles of Construction I (School of Civil and Environmental Engineering)

CE 3220: Principles of Construction I is a 3-credit course offered by the School of Civil and Environmental Engineering within the College of Engineering. This is a required course for the undergraduate civil engineering major as well as the Construction Engineering and Management minor. It provides an overview of the construction industry including organization and stakeholders, construction process and procedures, and types of contracts and delivery methods. Students also learn about project planning and scheduling, cost estimation, project monitoring and control. Toward the end, project change management and construction safety issues are covered.

This is an upper-level course taken primarily by juniors and seniors. The Fall 2025 cohort had a total of 100 students enrolled in the course. 60% of those were juniors, 36% were seniors, and the remaining 4% students were sophomores. Most of the students were either civil engineering majors or dual degree majors (mainly civil/ environmental engineering). 18% of the enrolled students were pursuing the Construction Engineering & Management minor.

After the end of the course add/drop period (the 10th day of class), students were introduced to the NACE Competencies and their relevance to becoming career ready. Table 2 outlines how these competencies were embedded in the course through various in-class and out-of-class activities. The group term project helped students strengthen their leadership, communication, teamwork, and technology skills, while in-class activities with open-ended questions emphasized the importance of critical thinking. The in-class group work (think-pair-share) further reinforced leadership, teamwork, and communication skills. Additionally, professionalism was highlighted before the site visits and career fairs.

4.3 Materials Characterization and Processing Laboratory (Materials Science and Engineering)

MSE 2053: Materials Processing and Characterization Laboratory is the first in a series of required lab classes for Materials Science & Engineering (MSE) undergraduate students. This 2-credit class contains four lab "research" modules focused on metals, ceramics and polymers. Its original purpose was to demonstrate materials concepts taught in the MSE lecture classes. Now the class is very hands-on with high student-instrument contact. It provides a gateway to undergraduate research. Although sophomore-focused, the class can include freshmen and juniors (transfer students).

The career module contains five assignments. Each includes a separate reflection to help students connect content to their career aspirations. In the first assignment, students complete Focus 2 [20] to identify personal values, skill strengths, and work interests. Thereafter, they complete two CCRLS learning modules: "Becoming Career Ready" and "Crafting your major and charting career paths". With the former, students rework their resumes in preparation for the campus career fair. With the latter, they are asked to concentrate on the career path content. Students set up career platform alerts to identify interesting summer internships. As part of the reflection, they chose their top two for a skills gap analysis. Upperclassmen join a class lecture to talk about their experiences as student researcher and students explore faculty research websites to find research areas that resonate. As part of the reflection assignment, students write an introductory email to express interest in joining the research group of their choice. They are not required to send this email, but often do. Subsequent lab classes build upon this foundation.

4.4 Scientific Communication (Professional Development)

ENGR 5410: Scientific Communications is a 1-credit core course as part of the Professional Development Course Series, for all graduate students across multiple engineering fields at the College of Engineering. The course formalizes the practice and improves professional development skills related to communicating scientific data and research related topics. Topics include: developing the skill to build a story around the students' research with relevant information to communicate scientific data, developing the art of public speaking and communicating scientific ideas to the research community and the general public, and creating a proper template for presentations, talks, or posters. Students learned how to create lasting impressions of their research by transforming complex research into meaningful experiences and memorable scientific stories through the art of storytelling. Each topic invited students to actively apply the skills and tools introduced in lectures through dynamic class presentations. This hands-on approach boosted student engagement and strengthened practical training.

In the Fall 2025 semester reported here, 19 graduate students enrolled in the class. All students were enrolled in the Ph.D. program from Material Science, Mechanical, Chemical, Biomedical Engineering, Engineering Education and Polymer Science. In-Course Career Activities and Campus Career Resources domains outlined in the framework were implemented in the course and summarized in Table 1. Each learning outcome of the course was mapped to multiple NACE Competencies. This gave the students an opportunity to familiarize themselves with the competencies from the first day of class, and the students were aware of what to expect from the course and what competencies they would practice throughout the semester. Students were required to complete the Career Readiness Module designed by the Career Center within the first two weeks of the course. Additionally, as highlighted in Table 2, students completed multiple assignments (e.g. 7-minute presentation (in class), developing visuals, 3-minute thesis, posters, 7-minute recorded presentation, peer feedback) and described how each assignment helped them practice the competencies in the reflection papers.

4.5 Engineering Internships and Careers (Professional Development)

ENGR 5420: Engineering Internships and Career in the Industry is a 1-credit course within the Professional Development Course Series, designed for all engineering graduate students. The course is designed to build and refine the professional skills students need to successfully pursue internships and long-term careers in industry or national laboratories. Throughout the semester, university alumni from various industries are invited to the class to provide guidance about the job-market and what industries are looking for at the moment. Students in teams of three/four host the industry and facilitate class discussion to enhance their leadership, teamwork, and communication skills.

In the semester reported here, 20 graduate students enrolled in the course. Students ranged from Master's and Ph.D. programs in Civil, Chemical, Biomedical, Electrical, and Computer Science and Engineering Education. Some of the students were close to their degree completion, and they were eager to learn about the current job market and prepare accordingly.

Each learning outcome of the course was mapped to multiple NACE Competencies to introduce students to the career competencies. Table 2 summarizes the various aspects of how the Career Readiness Framework was implemented in the course. Students self-paced through the LinkedIn, Resume, and Interview modules and wrote reflections on how they practiced the career competencies.

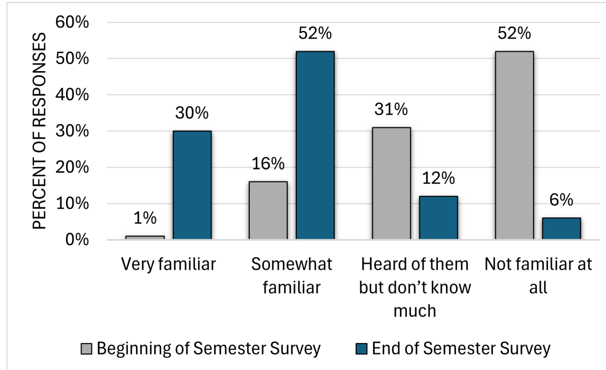

Figure 2: Pre- and post-survey familiarity with the NACE Career Readiness Competencies.

4.6 Scientific Writing (Professional Development)

ENGR 5300: Special Topics in Scientific Writing is a 2-credit course within the Professional Development Course Series, designed for all engineering graduate students to educate them about writing their scientific manuscripts. The course teaches graduate students to learn and practice good writing habits and transform complex scientific research into clear, compelling narratives. Students in the course explore key writing genres and practice how to shape their ideas into cohesive and effective texts. Students also draft their manuscripts and work with peers to edit, revise, and refine the scientific content to ensure their work is both impactful and professionally polished.

15 graduate students across multiple engineering disciplines enrolled in the course during Fall 2025. Students are composed of both Master's and Ph.D programs from the Material Science Engineering, Mechanical, Civil, Electrical and Computer Engineering, and Biomedical Engineering Departments, and Architecture. Like the other professional development courses, the learning outcome of the course was mapped to multiple NACE Competencies. The course also integrated assessments, feedback, and peer reviews to facilitate continuous improvement as summarized in Table 2.

5 Results

5.1 Students' views of essential career skills (pre-survey)

Before any explicit discussion of NACE, students already placed a strong value on a broad set of professional skills. When asked which skills they considered most essential for success in their future careers, 90% selected *communication skills* and 90% selected *problem-solving and critical thinking*. *Teamwork and collaboration* and *technical skills specific to their major* were each endorsed by 80% of respondents, followed by *adaptability and flexibility* (70%), *professionalism and work ethic* (70%), and *leadership and management* (60%). Taken together, these responses indicate that students already see success as requiring a combination of technical ability and a wide range of transferable skills, with particular emphasis on communication and analytical thinking.

5.2 Change in familiarity with NACE competencies

Students reported higher familiarity with the NACE Career Readiness Competencies by the end of the semester. At the beginning of the semester, only 1% of respondents described themselves as *very familiar* with the competencies and 16% as *somewhat familiar*, while 31% reported that they had merely *heard of them but do not know much*, and over half (52%) indicated that they were *not familiar at all*. By the end of the semester, this pattern was essentially reversed (Figure 2). A combined 82% of students reported being either *very familiar* (30%) or *somewhat familiar* (52%), whereas only 12% selected *heard of them but do not know much* and 6% *not familiar at all*. In other words, the proportion of students with at least moderate familiarity increased from 17% to 82%, suggesting a positive association with the implementation of the career readiness framework and reported student awareness.

	UNDERGRADUATE			GRADUATE		
Schools, Departments, Programs	**Computer Science and Engineering**	**Civil Engineering**	**Materials Science and Engineering**	**Professional Development (all engineering)**		
Course Number	**CSE 3500**	**CE 3220**	**MSE 2053**	**ENGR 5410**	**ENGR 5420**	**ENGR 5300**
Courses	Algorithms and Complexity	Principles of Construction I	Materials Laboratory	Scientific Communication	Engineering Internships and Careers	Scientific Writing
Requirement	YES	YES	YES	NO	NO	NO
Enrollment	57	100	21	19	20	15
Credits	3	3	2	1	1	2
Professional Engagement		In-class presentation an industry professional Site visits in coordination with industry (Optional)	Student research & internship		Students invite and host industry for in-class lectures	
Campus Resources	Career-center modules Networking events & Career fair Student organization class visits	In-class presentation by a career center professional Career fairs (optional) Career center modules (optional)	Career-center modules Networking events & Career fair Focus 2 assignment	Career-center modules Networking events announcements	Career-center modules Career fair attendance Networking events announcements	Career-center modules
In-Class Activities	Semester-long team project Think-pair-share, Interview questions in assignments Video presentation In-class presentations	Term project in groups Think-pair-share activities with open-ended questions Individual work with open-ended questions		In-class presentations Assignments Peer discussions, feedback Reflection papers	Peer discussions, feedback Reflection papers	Assignments Peer discussions, feedback Reflection papers

Table 2: Summary of participating courses and the unified Implementation of the Career Readiness Framework across the courses for the Fall 2025 semester.

5.3 Perceived preparation on specific competencies

Students were also asked, at the end of the semester, how well their course had prepared them with respect to specific NACE-related competencies (technology and ethical considerations, professionalism, equity and inclusion, leadership, problem-solving and critical thinking, teamwork, communication, and technical skills). As shown in Figure 3, response distributions for all eight areas are heavily weighted toward the positive end of the scale: the vast majority of ratings fall in the *moderately well*, *very well*, or *extremely well* categories. Technical skills, communication, teamwork, and problem-solving/critical thinking show particularly strong concentrations of *very well* and *extremely well* responses, while leadership, professionalism, equity and inclusion, and technology/ethics are also viewed as being supported, though with somewhat more responses in the *moderately well* range. These patterns are consistent with the emphasis on both technical and professional skills in the participating courses.

5.4 Overall perceived preparation for future careers

Finally, students provided a global judgment of the impact of the course on their career readiness. Figure 4 summarizes responses to the item, "Overall,

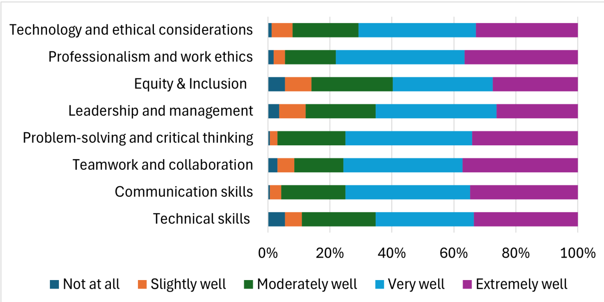

Figure 3: Post-survey ratings of how well courses prepared students in each NACE-related competency.

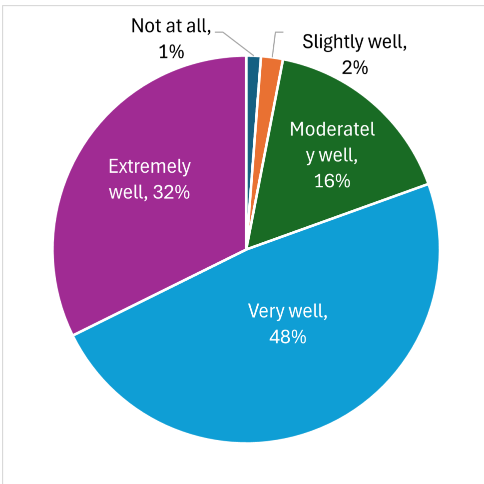

Figure 4: Post-survey responses to overall course preparation for future careers.

how well did this course prepare you for your future career?" Nearly half of the students (48%) reported that the course prepared them *very well*, and almost one third (32%) indicated *extremely well*. A smaller group selected *moderately well* (16%), while only 2% chose *slightly well* and 1% *not at all*. Thus, more than three quarters of respondents (80%) rated their course as preparing them *very* or *extremely* well for their future careers, which is consistent with the competency-specific findings reported above.

Taken together, these findings suggest that students across multiple engineering courses studied in this paper reported higher awareness of the NACE Career Competencies and perceived the framework to be a contributing factor toward their future career preparation. Students entered the semester already valuing a broad set of technical and professional skills, and by the end of the term, most reported being familiar with the NACE framework, feeling well prepared across multiple competencies, and viewing their course as preparing them very or extremely well for their future careers.

6 Implications

6.1 Interpretation of Main Findings vis-à-vis the Framework and NACE Competencies

The results align with the intended goals of the Career Readiness Framework. By incorporating NACE Career Readiness Competencies into the engineering curriculum, students' awareness and perceived preparation for professional success can be enhanced. Although students recognized the value of transferable skills such as communication and problem-solving at the beginning of the semester before any intervention took place, their familiarity with the formal NACE framework was minimal. Post interventions across the three domains of the framework, students reported significantly higher familiarity with the NACE Competencies. They also reported better preparation for their future careers.

6.2 What Worked Well Across Disciplines: Easy Wins

Several interventions emerged as effective across the six courses investigated in this paper. In-course career activities, including assignments and the addition of NACE language to syllabi, were perceived as helpful for making clear connections between coursework and career readiness without requiring major course redesign. Utilizing industry engagement and leveraging existing campus career resources, such as career center modules and career workshops, reinforced the importance of career readiness as part of the academic experience while requiring minimal instructor time. Overall, these "easy wins" demonstrate that meaningful integration of career readiness can improve students' perceived career preparedness significantly without the need for a major course overhaul.

6.3 Challenges and Lessons Learned

Despite receiving overwhelmingly positive feedback from students, the instructors faced several challenges in the course of this project. The major challenge they faced was the instruction time—the career readiness activities had to be incorporated within already crowded syllabi. Also, covering transferable skills meaningfully within technical courses required careful design and prioritization. To have consistency in approach across six different courses in four different disciplines with varied levels of students (undergraduate vs. graduate) proved to be challenging, as well, requiring sustained communication among the faculty. Another complication stemmed from students entering the courses with very different levels of prior career exposure. Some had already completed internships, while others were just beginning to consider career options, which made it difficult to design activities appropriate for everyone. The instructors also spent a significant amount of time attending workshops and training sessions on NACE Competencies and their integration into the coursework. Scaling this effort at the department or college level with faculty buy-in will require systemic changes, significant coordination, and institutional support.

6.4 Practical recommendations for instructors, departments, and institutions

To support effective integration of career readiness into the curriculum, several practical steps can be taken at different levels. Instead of covering all eight NACE Competencies in one course, an instructor can focus on a few of the competencies and design activities and assignments around those competencies to reinforce connections between the course and career readiness.

Instructors can also coordinate with one another across courses so that, while each course emphasizes only a few competencies, the full set of NACE Competencies is covered across the program. Departments should keep a database of assignment examples to reduce individual workload and recognize the time spent by faculty to receive training on the career readiness framework. At the institutional level, embedding NACE competencies into program-level learning outcomes and assessment plans, offering centralized support through instructional design and professional development, are critical for sustaining and scaling these initiatives.

7 Limitations and Future Work

This study has several limitations that should be considered when interpreting the findings. First, the work was conducted at the University of Connecticut, within one college of engineering, and results may not generalize to other institutional types, student populations, or program structures. Second, the data are based on self-report measures collected over a single semester; students' perceptions of familiarity and preparedness may not fully capture actual competence or subsequent employment outcomes. Third, although the framework was implemented across multiple courses, the specific activities, emphasis, and depth of integration varied by instructor and context, which introduces heterogeneity that is not fully disentangled in the present analysis. In addition, the present analysis aggregates responses across undergraduate and graduate students, which may obscure potential differences by level that could provide further insight into how the framework functions in distinct educational contexts. Finally, survey participation was voluntary, and post-survey response rates were lower than pre-survey rates, raising the possibility of response bias.

Future work will extend and refine this effort in several directions. One priority is to implement the Career Readiness Framework in additional disciplines and courses, both within engineering and in other STEM and non-STEM programs, to examine its adaptability and impact across diverse curricular contexts. Expanding the number of participating courses will also allow more fine-grained comparisons by level (undergraduate vs. graduate), course type, and framework components. Longer-term, we aim to incorporate longitudinal measures that track students' career trajectories, internships, and early employment outcomes, as well as more direct assessments of selected competencies. Finally, iterative refinement of the framework, in partnership with students, faculty, and career services, will focus on identifying the most impactful and scalable elements, developing supporting resources, and integrating career readiness more systematically into program- and institution-level assessment practices.

8 Conclusions

This study illustrates how the Career Readiness Framework developed using the NACE (National Association of Colleges and Employers) Competencies and structured around in-course activities, campus resources, and professional engagement, can be effectively implemented across multiple engineering courses. By the end of the semester, students reported substantially higher familiarity with NACE Competencies and their perceived preparation for future careers. For instructors, three key takeaways stand out: start small by mapping existing activities and assignments to NACE Competencies, use modular elements such as reflection prompts and competency framing, and partner with career centers and industry to extend learning beyond the classroom.

Broader adoption will require collaboration among faculty, departments, and institutions to embed career readiness into program-level outcomes and provide necessary support to faculty. By working collectively, educators can ensure that students graduate not only with technical expertise but also with the transferable skills essential for success in a rapidly evolving workforce.

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