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WIP: Undergraduate Career Readiness: Comparing Co-ops, Internships, and the Value of Work-Integrated Learning Participation Among Engineering Students

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I. INTRODUCTION

Experiential learning is widely recognized as a high-impact practice in engineering education [1]. Work-integrated learning (WIL) experiences provide students with opportunities to apply technical knowledge in real-world industry-based contexts while developing professional skills valued by employers. Cooperative education (co-op) and internship programs are among the most long-standing and effective experiential learning models used to support students' transition from academic study to professional practice [2], [3], [4]. Higher education institutions invest significant resources in work-integrated experiences and programs with the expectation participation will enhance students' career readiness and early career success [3], [4].

While prior research demonstrates positive associations between experiential learning participation and employment-related outcomes, fewer studies directly compare co-op and internship pathways using common measures of career readiness and early career outcomes within a single institutional context [5], [6]. Additionally, much of the existing literature emphasizes placement rates or employment status, with less attention to broader, capability-based measures of readiness reflecting students' preparedness to enter professional engineering practice [5].

This work-in-progress study examines the relationship between experiential learning participation in work-integrated learning experiences and engineering students' perceived career readiness and early career outcomes. While prior research demonstrates positive associations between experiential learning and employment outcomes, the mechanisms through which these experiences influence early career outcomes remain less understood. This study addresses this gap by examining both the relationship between experiential learning and early career outcomes, along with the mechanisms underlying these associations.

Using data from a Senior Exit Survey administered at a large research university, the study compares students who participated in co-op experiences, internships, both, or no WIL. Career readiness is examined through students' self-reported agreement with perceived career readiness and job search self-efficacy measures, and early career indicators, including starting salary and employment with prior experiential learning employers.

II. BACKGROUND AND CONTEXT

Experiential learning plays an essential role in the development of future engineering professionals; structured high-impact learning experiences extend the opportunity to students to integrate disciplinary

knowledge with professional practice. Cooperative education and internship programs are widely implemented to expose students to workplace environments, professional norms and expectations, and contextual and applied problem-solving. Exposure and experience in work-integrated learning programs are commonly framed as mechanisms for enhancing career readiness and employability [6], [7], [8].

A substantial body of research in engineering and cooperative education literature has documented positive associations between experiential learning participation and mastery of student learning outcomes, resulting in an impact on early career outcomes [1], [9]-[13]. Engineering students who participate in cooperative education experiences often demonstrate stronger academic performance, higher retention, and improved early career outcomes compared to peers without WIL participation [3], [10]. Moreover, internship participation is associated with increased employability, increased likelihood of receiving job offers, and higher starting salaries, indicating shorter-duration experiential learning opportunities yield meaningful professional benefits [10], [12].

Within the Cooperative and Experiential Education Division (CEED), prior scholarship has emphasized the value of work-integrated learning experiences in supporting students' career readiness and positive early career outcomes. CEED-focused studies have documented relationships between work-integrated experiential learning participation and employment outcomes such as job placement, salary, and early career trajectory, reinforcing the relevance of these measures as indicators of experiential learning impact [5], [9].

A. Experiential Learning and Career Outcomes

Experiential learning programs such as cooperative education and internships are often designed to support the development of career readiness competencies emphasized by engineering accreditation standards and workforce aligned competency frameworks [13], [14], [15]. ABET and the National Association of Colleges and Employers (NACE) identify competencies such as communication, teamwork, critical thinking, professionalism, and career self-management as essential for effective workforce entry and professional performance in engineering roles [14], [15]. Experiential learning environments, notably WILs, provide structured opportunities for students to apply and demonstrate competencies in applied professional contexts [16].

Although both co-op and internship experiences support career readiness, differences exist in structure, duration, and level of immersion in the workplace environments. Co-op programs typically involve extended, full-time engagement in professional engineering roles, by contrast internships are shorter in duration and often occur during academic terms or breaks, or do not require full-time engagement [17], [18]. Additionally, variation across pathways and across industry sectors, employers, roles, and project scope contributes to differences in individual student experiences; these differences provide distinct opportunities for development of professional skills associated with career readiness. As a result, co-op and internship pathways provide distinct opportunities for developing and demonstrating competencies

aligned with National Association of Colleges and Employers (NACE) career readiness frameworks and ABET student outcomes.

In context, prior research indicates experiential learning influences early career outcomes through multiple, interrelated mechanisms, most commonly framed as human capital development, signaling, and career readiness. Human capital theory suggests work-integrated learning experiences enhance productivity through development of transferable skills, including communication, teamwork, and problem-solving [1], [2], [7], [9]. Furthermore, participation also provides exposure to workplace expectations and creates opportunities for sustained engagement with employers in applied contexts. In parallel, signaling theory suggests participation in work-integrated learning functions as an observable indicator of candidate readiness and prior performance; this signaling reduces uncertainty in hiring decisions and influences early career outcomes. Similarly, research on participation in WILs, specifically co-ops and internships, strengthens career readiness, including confidence in navigating the job market and ability to transition into professional roles [2].

In brief, this body of work collectively suggests WIL experiences benefit the participant through a combination of skill development, signaling, and increased readiness for workforce entry; however, the relative contribution of each mechanism remains less well understood.

III. METHODS

A. Study Design and Participants

This work-in-progress study uses data from a Senior Exit Survey administered to undergraduate engineering students at a large research university in the Southeastern United States. The survey is deployed to all graduating seniors through email two weeks prior to their graduation. The survey captures information related to students' academic experiences, experiential learning participation, self-reported competencies, and early career outcomes. The data investigated includes 724 undergraduate engineering students who plan to pursue employment after graduation and who completed the Senior Exit Survey across one of the three survey deployments including Spring 2025, Summer 2025, Fall 2025, and Spring 2026 terms. Participation in the survey is voluntary.

B. Work-Integrated Experiential Learning Participation Groups

Students were categorized into one of four mutually exclusive work-integrated learning participation groups based on self-reported participation:

- **Co-op**: Students who completed one or more co-op rotations and no internships.
- **Internship**: Students who completed one or more off-campus internships and no co-op rotations.
- **Both**: Students who completed at least one co-op rotation and at least one internship.
- **No WIL**: Students who reported no work-integrated learning program participation.

Participation was determined using survey items asking whether students had completed co-op or internship experiences during their undergraduate degree. Each respondent was assigned to a single group based on these responses. This grouping structure allows for direct comparison between different WIL pathways, including students who did not participate in WIL programs.

C. Measures

1) Perceived Career Readiness and Job Search Self-Efficacy Measures: Students answered a Likert scale survey question which asked students to rate their level of agreement with the following:

1) I am confident navigating the job market (e.g., researching roles, networking, applying).
2) I am prepared to pursue employment opportunities after graduation.
3) I am confident in my ability to present myself professionally to employers.
4) I am confident answering interview questions and communicating my strengths.
5) I knew where to find relevant job or internship opportunities in my field.
6) My education and experience at my university prepared me well for the job market.

Responses were recorded on a five-point Likert scale ranging from strongly disagree to strongly agree. Statistical tests were used to examine differences in response distributions across groups.

2) Early Career Outcomes: Early Career Outcomes were assessed using survey questions related to post-graduation employment, including base annual starting salary and whether a full-time position was accepted with an employer where a co-op or internship had previously been completed.

IV. ANALYSIS

A. Perceived Career Readiness

To assess differences in perceived career readiness across WIL participation groups, responses were analyzed using nonparametric statistical tests appropriate for ordinal Likert-scale data. A Kruskal-Wallis test was conducted for each survey item to evaluate if statistically significant differences exist in response distributions between the four groups. For each significant relationship, a Dunn post-hoc test with Holm correction was computed to determine which specific groups differed from each other. Additionally, agreement percentages were calculated for each group to aid in interpreting differences in responses across career readiness statements.

B. Early Career Outcome Analysis

The primary early career outcome analyzed was self-reported base annual starting salary for students pursuing employment after graduation. A Kruskal-Wallis test was conducted to determine if differences in median starting salary between WIL participation groups were statistically significant. The percentage

of WIL participants who accepted a job with the employer where a co-op or internship was completed was also calculated.

V. RESULTS AND FINDINGS

A. Sample Characteristics

This section describes the distribution of students across WIL participation groups to provide context for subsequent statistical comparisons.

TABLE I
DISTRIBUTION OF STUDENTS BY GROUP

Group	Number of Students	Percent of Total
Co-op	164	22.65%
Internship	327	45.17%
Both	52	7.18%
No WIL	181	25.00%

Table I summarizes the count and distribution of students in each WIL participation group in the dataset.

B. Perceptions of Career Readiness

Students across all WIL participation groups reported generally high levels of agreement with career readiness statements. However, Kruskal-Wallis tests indicated statistically significant differences between groups for all career readiness statements. Students who participated in WIL experiences reported higher levels of agreement compared to students with no WIL participation.

TABLE II
KRUSKAL-WALLIS TEST VALUES AND GROUP AGREEMENT RATES FOR CAREER READINESS STATEMENTS

Statement	No WIL Agreement	Internship Agreement	Co-op Agreement	Both Agreement	Kruskal-Wallis H Value	P-Value
1	50.8%	77.9%	70.9%	72.7%	30.1067	0.0000
2	66.2%	89.4%	83.6%	84.8%	32.4584	0.0000
3	80.8%	94.0%	86.6%	90.9%	20.0709	0.0002
4	80.8%	91.0%	80.6%	90.9%	14.2027	0.0026
5	56.9%	82.4%	77.6%	78.8%	27.8775	0.0000
6	60.8%	87.9%	78.4%	81.8%	29.9314	0.0000

Post-hoc pairwise comparisons were conducted using Dunn’s test with Holm adjustment to identify which groups differed from each other for each career readiness statement. Across all statements, statistically significant differences were observed between students with no WIL participation and those who participated in a co-op, internship, or both. Differences between the co-op, internship, and both groups themselves were not statistically significant. These results suggest the observed differences in

perceived career readiness are driven by the contrast between students who participated in WIL experiences and those who did not, rather than differences between specific WIL pathways themselves.

Overall, these findings indicate participation in WIL is associated with consistently higher confidence across all measured dimensions. The lack of statistically significant differences between co-op, internship, and both participation groups suggests the presence of experiential learning itself, rather than the specific type of WIL program, is the primary factor contributing to increased agreement. This pattern highlights the role of experiential learning as a key differentiator in students' perceived career readiness.

C. Early Career Outcome Comparisons

Self-reported starting salary data was examined to assess whether participation in work-integrated experiential learning is associated with differences in starting salary at the time of graduation.

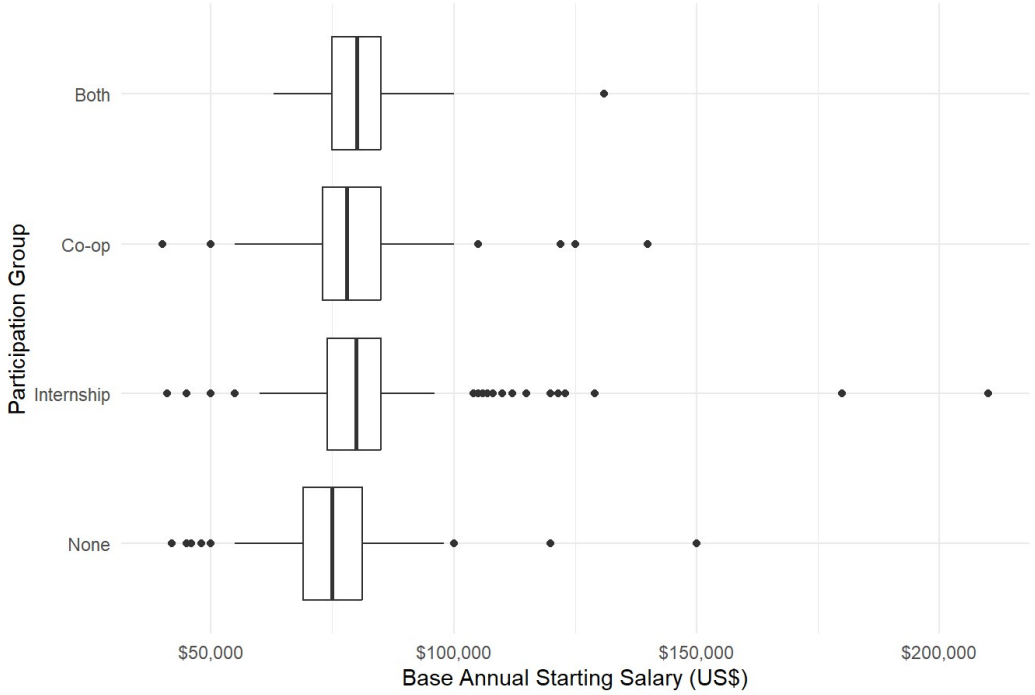

Fig. 1 Box Plot of Starting Salary Data by Participation Group

Fig. I summarizes starting salary distributions by participation group. Median salary was selected as the primary measure of central tendency due to the right-skewed nature of salary data. To evaluate whether the observed differences in starting salary were statistically significant across participation groups, a Kruskal-Wallis test was conducted. The test result ($\chi^2 = 12.3184$, p-value = 0.0064) indicated a statistically significant difference in starting salary across the groups.

Post-hoc pairwise comparisons were conducted using Dunn's test with Holm adjustment to examine which groups differed from each other. Results showed students who completed a co-op, internship, and

those who completed both a co-op and internship experience reported significantly higher starting salaries compared to students with no WIL participation. No statistically significant differences were observed between the co-op, internship, and both groups themselves. These findings suggest differences in starting salary are primarily driven by the contrast between students who participated in WIL experiences and those who did not, rather than the specific type of WIL program.

Additionally, over half (54.08%) of students who participated in WIL accepted a position with an employer where a prior co-op or internship was completed. This result highlights WIL as a potential pathway to employment continuity and suggests co-op and internship experiences may function as extended recruitment and evaluation mechanisms for employers.

D. Limitations

As a work in progress, the results of this study should be viewed as preliminary, and several limitations should be considered when interpreting the findings. First, the analysis is based on data from a single institution and reflects early survey deployments, which limits generalizability and statistical power for subgroup analyses. Second, survey items used in this study were developed internally and are not nationally normed, which may limit external comparability. Third, the study relies on self-reported survey data, which may be subject to response bias. Furthermore, while self-report measures are commonly used in experiential learning research, these measures may not capture differences in demonstrated performance or externally assessed competence. Finally, WIL experiences vary substantially across employers, roles, and supervisory contexts. The quality of the student–supervisor relationship, the nature of and structure of assigned work, and organizational factors were not captured in this analysis and may influence both perceived readiness and early career outcomes. Differences in duration and intensity between co-op and internship experiences may also contribute to observed outcome variation.

VI. NEXT STEPS AND CONCLUSION

Future work will focus on expanding the dataset through continued deployment of the Senior Exit Survey to increase sample size and improve the robustness of statistical analyses. Moreover, as data availability increases, additional early career indicators and individual ABET student outcomes will be analyzed. Therefore, continued efforts will enable a more rigorous and holistic examination of the relationships between work-integrated learning participation, perceived career readiness, and early career outcomes among engineering graduates.

Overall, differences in perceived career readiness and early career outcomes appear primarily associated with participation in WIL experiences, rather than variation across specific WIL pathways. The absence of statistically significant differences among co-op, internship, and combined participation groups suggests the presence of WILs itself serves as the primary contributing factor. Moreover, similar patterns

observed in starting salary outcomes further reinforce WILs as a key differentiator and a potential pathway to employment. Additional exploration is warranted; however, this study provides institutional-level evidence complementing national findings, suggesting experiential learning influences early career outcomes through mechanisms such as employer signaling, job search efficacy, and career readiness.

These results offer potential implications for engineering education programs. WIL presents an opportunity for institutions to develop direct partnerships with companies who employ students in WIL environments. Expanding access to high-quality WIL experiences may enhance students' confidence, improve workforce preparedness, and strengthen the overall value proposition of undergraduate engineering degree programs.

Preliminary insights into the associations between WIL participation and early career outcomes highlights the importance of understanding and implementing effective experiential learning pathways grounded in real-world context and application to support engineering graduates' successful transition to the workforce.

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