Bridging the Gap Between Academia and Industry: Developing Co-op Best Practices for Student Success

Dr. Boshra Karimi, Northern Kentucky University

Dr. Boshra Karimi is an Associate Professor of Construction Management at Northern Kentucky University. She earned her Ph.D. in Civil and Environmental Engineering with a concentration in Construction Management from Oklahoma State University and joined NKU in August 2018. Prior to that, she earned her B.Sc. in Mechanical Engineering from the University of Tehran and her M.Sc. in Industrial Engineering and Management from Sharif University of Technology. She has also attained the LEED Green Associate accreditation.

Dr. Boshra Karimi has more than nine years of teaching experience. She has served as an instructor at Ershad Damavand University, a visiting instructor in the School of International Studies and Outreach at Oklahoma State University, and a teaching associate in the School of Construction Management Technology at Oklahoma State University.

In addition to her academic experience, Dr. Boshra Karimi has over fourteen years of professional experience in the construction industry. She has worked as an Engineering Expert at Neyrperse Company, a Technical Office Supervisor at the Mapna Group, a Mechanical Engineering Supervisor (Professional Engineer) at the Iranian Construction Engineers Organization, and a Consultant at Roll-2-Roll Technologies LLC in Oklahoma.

Her research interests include sustainable project management, sustainability assessment, sustainable technology implementation, supply chain management, decision-making modeling, and big-data applications in construction. Her research has been published in several peer-reviewed journals and presented at international conferences.

Dr. Boshra Karimi is the recipient of numerous awards, including Wise Women of NKU (2025), the College of Business Outstanding Teaching Award (2024), the ASC Regional Teaching Award (2023),the Robberson Summer Research and Creative Activity Fellowship (2017), the Calvin & Marilyn Vogt Endowed Scholarship (2016), the Outstanding Teaching Performance Award (2014 and 2015), and the Creativity, Innovation, and Entrepreneurship (CIE) Scholarship (2014). She also received numerous internal and external grants such as Open Educational Resource (OER) Instructor Grant (2023, 2024), MCA Fund (2024),NKU Faculty Summer Fellowship, MCAA's 2020 JRGF Students Chapter Grant (2020), and College of Business Summer Funding (2019, 2020, 2022, 2023, 2024).

Dr. Mahdi Yazdanpour, Miami University

Dr. Mahdi Yazdanpour (Senior Member of IEEE, ABET PEV) is an Associate Professor at Miami University. He previously served as an Assistant Professor and the Program Coordinator of Mechatronics Engineering Technology, as well as the Coordinator of the Institute for Student Research and Creative Activity at Northern Kentucky University. During his academic journey, he has had the privilege of exploring various engineering disciplines. His educational path began with a B.S. in Computer Engineering, followed by an M.S. in Industrial Engineering, and a Ph.D. in Electrical Engineering. This diverse academic background has enriched his problem-solving abilities and equipped him with the capacity to approach engineering challenges from different perspectives. He has over 11 years of experience in teaching and research in academia, having worked as an instructor in the School of Electrical and Computer Engineering and as a visiting professor in the School of International Studies and Outreach at Oklahoma State University. In addition to his academic career, Dr. Yazdanpour has over 10 years of professional experience in industry, where he held various technical, managerial, and leadership roles in manufacturing, power plants, and oil & gas companies. As an IEEE Senior Member, Dr. Yazdanpour actively serves as the Chair of the IEEE Cincinnati Section. He has received numerous awards and recognitions, including the "2023 College of Arts and Sciences Outstanding Junior Faculty Award" at Northern Kentucky University and the "College of Engineering, Architecture and Technology Outstanding Teaching Assistant Award" at Oklahoma State University. Additionally, Dr. Yazdanpour is the recipient

of several internal and external research grants, including the National Institutes of Health (NIH) Research Evaluation and Commercialization Hub (REACH) Product Development Grant through KYNETIC Cycle 5, NIH Mid-South REACH, and the Kentucky Commercialization Ventures (KCV) IMPACT Competition Award. His research interests include Intelligent Mechatronic Systems, Human-Robot Interaction, Brain-Computer Interfaces, Mind-Controlled Systems, Medical Robotics, and Computer/Machine Vision.

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Abstract

Experiential learning is one of the most important pillars at Northern Kentucky University. The co-op program is a prime example of experiential learning offered at the university, significantly enhancing student retention, degree completion, and job placement rates. During my sabbatical at Messer Construction Company, I observed that the company is actively seeking best practices to enhance their co-op program, ensuring that students develop the necessary skills before graduation.

To support both students and industry partners, I developed a survey for construction management students. This study examines the quality of students' co-op/internship experiences through a survey of construction management students, focusing on rotation systems, mentorship, feedback, technology exposure, curriculum alignment, soft skills development, and preparedness for workplace culture. Quantitative and qualitative analyses, including chi-square testing, were used to identify factors significantly associated with overall student satisfaction. Results indicate that mentorship quality, feedback practices, curriculum alignment, and workplace preparedness are strongly related to satisfaction, highlighting key areas for program improvement. Based on these findings, the study proposes a set of best practices aimed at enhancing co-op/internship experiences, supporting student success, and strengthening pathways to degree completion and workforce placement.

Introduction and Background

Experiential learning has long been recognized as a cornerstone of engineering and construction management education. Cooperative education (co-op) and internship programs provide students with structured opportunities to integrate academic knowledge with professional practice, fostering deeper learning, skill development, and career readiness. Prior research consistently demonstrates that participation in co-op or internship experiences positively influences students' academic performance, motivation, retention, and post-graduation employment outcomes [1, 2]. In construction-related disciplines, where project-based work, collaboration, and applied problem-solving are central, experiential learning is particularly critical.

At Northern Kentucky University, the terms *co-op* and *internship* are used interchangeably to describe supervised, discipline-related work experiences; however, internships typically take place during the summer term, while co-op experiences occur during the academic year. Regardless of timing, both experiences share the same educational goals and assessment expectations. Understanding the quality and consistency of these experiences is essential to ensuring that students derive maximum educational benefit.

Existing literature highlights several dimensions that influence the effectiveness of co-op and internship programs. Mentorship quality has been shown to be a key determinant of student satisfaction and learning, with effective mentors providing guidance, feedback, and professional socialization [3]. Similarly, regular feedback and evaluation during experiential learning are associated with improved student performance, confidence, and reflection [4]. Curriculum alignment is another critical factor; when academic coursework aligns with workplace

responsibilities, students are better able to transfer knowledge and perceive greater value in their educational experiences.

Technology exposure has emerged as an increasingly important component of construction and engineering internships, as industry adoption of digital tools, automation, and data-driven processes continues to grow [5]. Studies also emphasize the importance of soft skills development, including communication, teamwork, and problem-solving, which employers consistently rank as essential for early-career professionals [6]. Additionally, preparedness for workplace culture—including understanding professional norms, expectations, and ethics—has been linked to smoother transitions into professional environments and higher levels of student confidence and satisfaction [7].

Prior research in engineering work-integrated learning suggests that internship quality is strongly influenced by workplace support structures such as supervision/mentorship and opportunities for feedback, along with the degree to which academic preparation aligns with workplace expectations and learning outcomes [8]–[10]. Studies also highlight that structured internship design and the presence of an engaged industry mentor are among the key factors contributing to successful internship experiences and student satisfaction [9],[11]. However, while construction management education has examined internships within specific program contexts [12], [13], fewer studies explicitly connect mentorship quality, feedback mechanisms, and preparation–expectation alignment to satisfaction outcomes using clearly operationalized constructs and reported effect sizes.

While prior studies have examined individual aspects of co-op and internship experiences, fewer have empirically explored how multiple experiential factors collectively relate to overall student satisfaction within construction management programs. This study addresses this gap by systematically evaluating students' perceptions of their co-op/internship experiences at Northern Kentucky University and identifying the factors most strongly associated with satisfaction. By doing so, the paper contributes evidence-based insights to support continuous improvement of co-op and internship programs and informs the development of best practices aimed at enhancing student success, degree completion, and workforce readiness.

This study aims to better understand the educational value of co-op/internship experiences within construction engineering and management programs. Specifically, the study addresses the following research questions:

- **RQ1:** What factors are most strongly associated with overall student satisfaction in co-op/internship experiences?
- **RQ2:** How do students perceive mentorship, workplace preparation, technology exposure, and feedback during their co-op/internship?
- **RQ3:** What evidence-based best practices can be derived from the findings to strengthen university–industry collaboration?

Methodology

Co-op experience and academic success are closely connected, as hands-on, real-world work helps students better understand and apply concepts learned in the classroom. By seeing how theory

translates into practice, students often become more engaged, motivated, and purposeful in their coursework. Co-op experiences also build time management, problem-solving, and professional skills that can positively influence academic performance and persistence toward degree completion.

Northern Kentucky University is a student-centered institution committed to supporting student learning and success [14]. To uphold this commitment, I sought to examine the quality of our students' co-op experiences to determine whether enhancements or modifications are needed to further strengthen the program.

A survey consisting of 12 multiple-choice and open-ended questions was developed to assess the quality of co-op experiences, focusing on the rotation system, mentorship, development of hard and soft skills, and alignment with the curriculum. This study employed a cross-sectional survey design to evaluate student perceptions of co-op/internship experiences in a Construction Engineering and Management program at a mid-sized public university. The survey was administered to three classes in Fall 2025, yielding 41 anonymous responses. While the sample size is modest, it represents a substantial portion of the eligible student population for the academic year.

Rotation system, software preparedness, and curriculum alignment were measured using a 10-point Likert-type scale (1 = very dissatisfied; 10 = extremely satisfied). Mentorship quality and overall satisfaction were measured using a 5-point ordinal scale (terrible, poor, average, good, excellent). Preparedness for professional environment was measure by extremely prepared, somewhat prepared, neither prepared nor unprepared, unprepared.

The survey instrument was reviewed by two faculty members and one industry advisory board member to ensure content validity. Minor wording adjustments were made based on feedback. Internal consistency was evaluated and found to be acceptable.

The study was reviewed by the university's Institutional Review Board and determined to be exempt. Participation was voluntary, and no identifying information was collected. Data were stored on a password-protected device and reported only in aggregate form.

Data Analysis

In this section, Excel software was used to analyze and interpret the collected data.

1- Rotation System

Within a company, a co-op rotation system refers to the practice of placing students in multiple departments, teams, or functional areas during their co-op term. This approach allows co-op students to gain exposure to different roles, workflows, and organizational functions, helping them develop a broader skill set and a better understanding of how the company operates as a whole. Moreover, it helps students gain insight into identifying their areas of interest for future career paths. In order to address this, the first question was how effective the rotation system was if applicable.

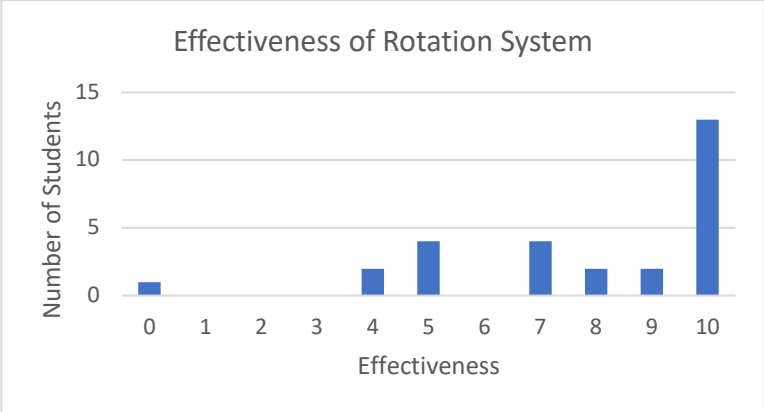

Figure 1. Effectiveness of Rotation System

An average rating of 7.85 suggests that students generally perceive the rotation system within the company as effective for their co-op experience. This indicates an overall positive evaluation rather than a neutral or negative one.

The standard deviation of 2.64 reflects a moderate level of variability in responses. While many students rated the rotation system favorably, the spread suggests that individual experiences differed, with some students finding the rotation system very effective and others reporting less positive experiences.

2- Industry Software Exposure and Preparedness

Software plays a critical role in modern construction by improving planning, coordination, and decision-making throughout a project's lifecycle. Tools such as scheduling, estimating, Building Information Modeling (BIM), and project management software enhance accuracy, efficiency, and collaboration among project stakeholders. As construction projects grow in complexity, the effective use of software helps reduce errors, control costs, improve safety, and support timely project delivery. The next question addressed the industry-specific software used during the co-op experience.

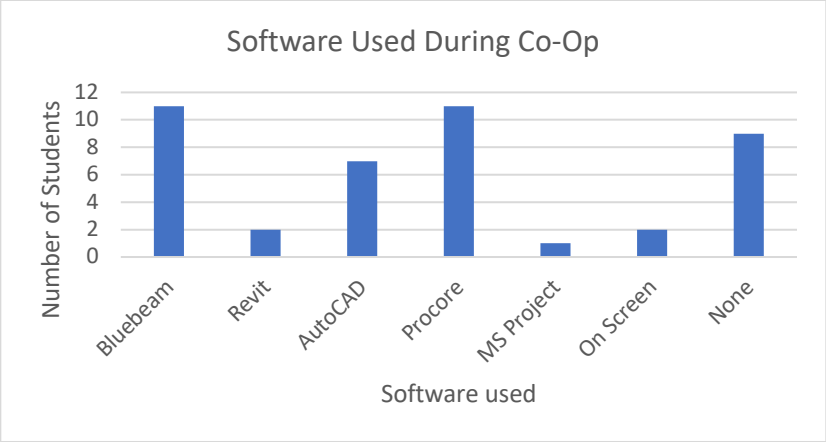

Figure 2. Software Used During Co-Op

According to Figure 2, Bluebeam, AutoCAD, and Procore were the most commonly used software across companies. However, the industry sector and departmental placement may have influenced these responses. As expected, several customized and specialized software tools were also used in construction, including Deltek ComputerEase, various design tools, DOT software, Sage Estimating, AGTEK HeavyBid, Maximo, ARGUS, and Design Lite.

Follow up question was on how well your university coursework prepared you to use these tools. The average score was 5.79 out of 10 with a variance of 2.9. As figure 3 suggests, the respondents felt their university coursework moderately prepared them to use these tools, but not to a strong or comprehensive extent. This indicates that while some foundational exposure may have been provided, many students likely felt gaps between what they learned in coursework and the practical skills needed to use the tools effectively. The variance of 2.9 shows a noticeable spread in responses, implying that students' experiences varied—some felt well prepared, while others felt significantly underprepared—pointing to inconsistencies in coursework coverage or learning opportunities.

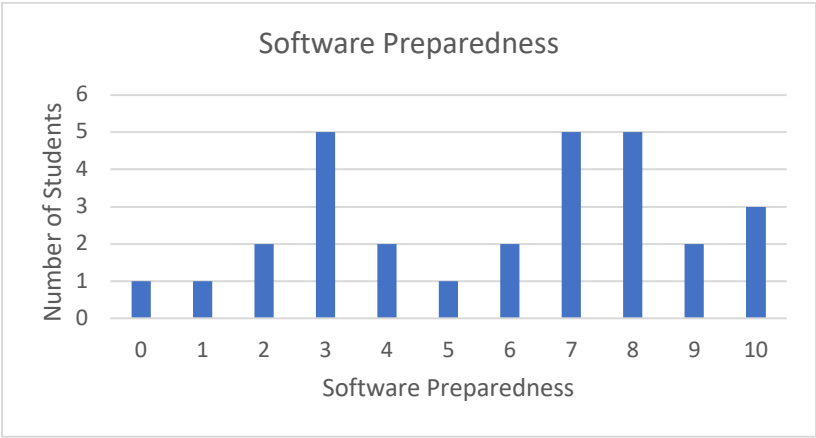

Figure 3. Software Preparedness

The most frequently used software is currently taught at our institution. However, it may be beneficial to incorporate additional software into the curriculum where feasible to better align with industry practices and fill the gaps.

3- *Technology Exposure*

Technology exposure during co-op experiences is especially important for construction management students, as it allows them to apply classroom knowledge in real-world, technology-driven environments. Through co-ops, students gain hands-on experience with technologies such as drones for site surveying, progress monitoring, and safety inspections, which deepens their technical competence and confidence. This practical exposure not only enhances their job readiness but also helps bridge the gap between academic coursework and the technological demands of the construction industry. Therefore, students were asked about the technologies they were exposed to.

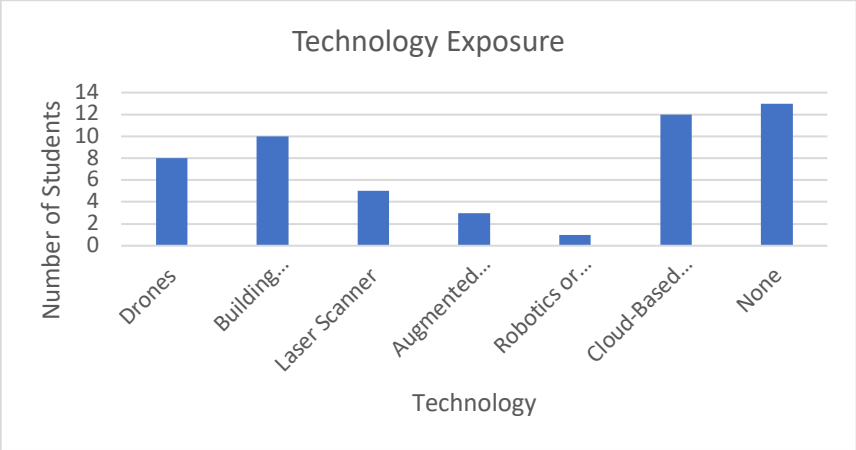

Figure 4. Technology Exposure

Figure 3 results indicate that construction management students have uneven exposure to technology. Cloud-based project management tools and Building Information Modeling (BIM) appear to be the most commonly experienced technologies, suggesting that students are more frequently exposed to widely adopted, industry-standard platforms. A moderate number of students reported exposure to drones, while fewer indicated experience with laser scanners, augmented reality, or robotics and automation, highlighting limited hands-on interaction with emerging and advanced technologies. Notably, a relatively large number of respondents selected "none," which suggests that a significant portion of students had little to no exposure to construction-related technologies, pointing to an opportunity to expand technological integration through coursework and co-op experiences.

4- *Curriculum Alignment*

Aligning academic curriculum with internship activities is essential to ensure that students can effectively apply classroom knowledge in real-world professional settings. When coursework reflects the tools, technologies, and practices used during internships, students gain deeper understanding, stronger skill development, and greater confidence. This alignment also enhances students' career readiness and helps employers see clearer value in internship and co-op experiences. The distribution of responses is shown in figure 5.

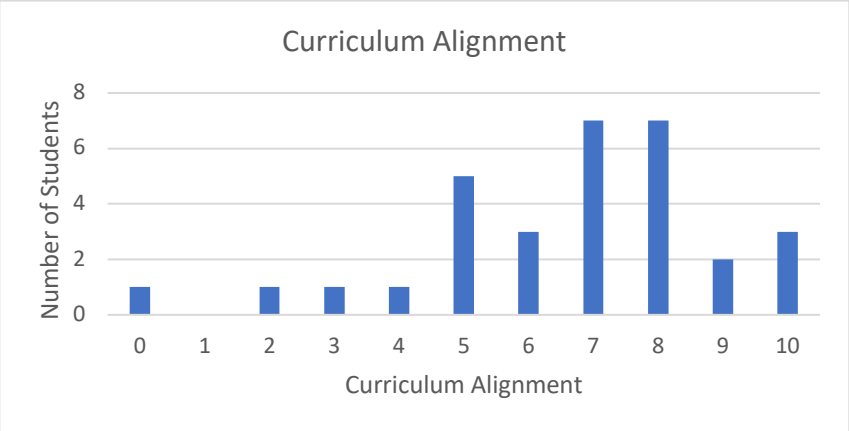

Figure 5. Curriculum Alignment

An average score of 6.61 out of 10 suggests that students generally perceive a fairly strong alignment between their curriculum and their internship responsibilities, though there is still room for improvement. This indicates that coursework is helping prepare students for many of the tasks they encounter during internships, but it may not fully cover all practical expectations. The variance of 2.3 reflects some variability in student experiences, suggesting that alignment may differ depending on the type of internship, employer, or specific coursework completed.

5- *Mentorship Quality*

The quality of mentorship during a co-op experience plays a critical role in student learning and professional development. Strong mentorship provides guidance, feedback, and support that help students connect academic knowledge to real-world practice. Effective mentors also foster confidence, skill development, and professional growth, making the co-op experience more meaningful and impactful for students. This led us to ask students about the quality of mentorship provided during their co-op experiences.

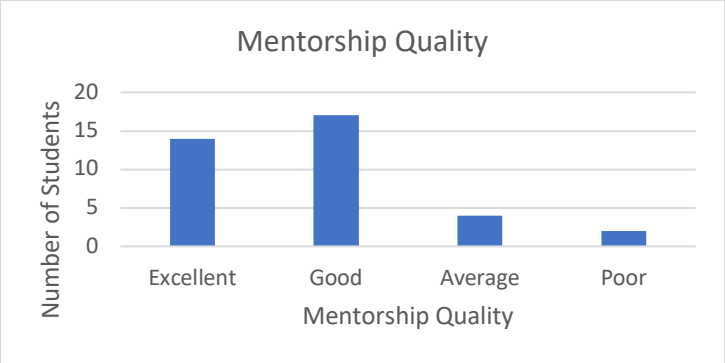

Figure 6. Mentorship Quality

The results indicate that most students had a positive mentorship experience during their co-op placements. A strong majority rated the quality of mentorship as either good or excellent, suggesting that many students received effective guidance, support, and professional development opportunities. In contrast, relatively few students reported average or poor mentorship, indicating that negative experiences were less common but still present. Overall, these findings highlight mentorship as a strength of the co-op experience, while also suggesting a need to ensure more consistent mentorship quality across all placements. Therefore, students were asked about the skills they developed during their internship experiences.

6- *Soft Skills Development*

Soft skills development is a vital component of the co-op experience, as it prepares students to function effectively in professional work environments. Through co-ops, students strengthen skills such as communication, teamwork, problem-solving, and professionalism, which are essential for career success in construction management. These skills complement technical knowledge and help students adapt to workplace expectations, collaborate with diverse teams, and grow into effective future leaders.

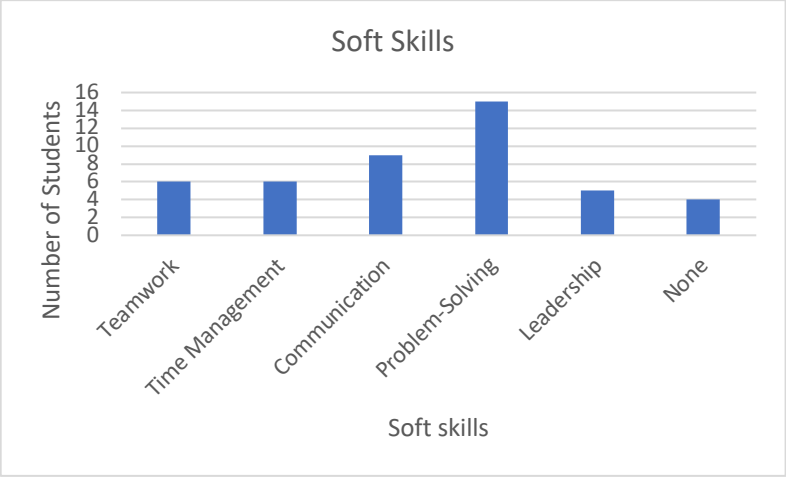

Figure 7. Soft Skills

The results show that co-op experiences played a significant role in developing students' soft skills. Problem-solving was the most frequently reported skill, indicating that students were regularly challenged to address real-world issues and make practical decisions in professional settings. Communication skills were also commonly developed, followed by teamwork and time management, suggesting that co-ops provided opportunities for collaboration and managing responsibilities. Fewer students reported leadership development, and a small number indicated no soft skills development, highlighting an opportunity to more intentionally incorporate leadership and broader skill-building opportunities into co-op experiences.

7- *Preparedness for Workplace Culture*

Preparedness for workplace culture is essential for student success during co-op and early career experiences. Understanding professional expectations, communication norms, teamwork dynamics, and ethical behavior helps students adapt more quickly and function effectively in organizational settings. Strong cultural preparedness also enhances confidence, reduces adjustment challenges, and supports positive relationships with supervisors and colleagues.

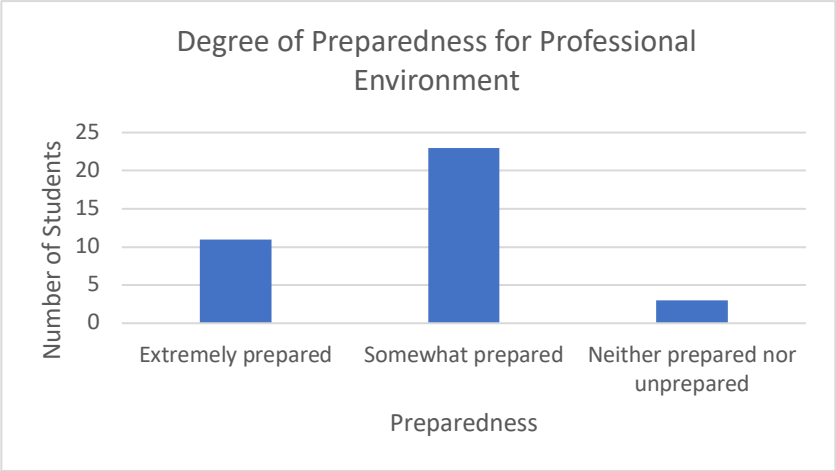

Figure 8. Preparedness for Workplace Culture

The results indicate that most students (92%) felt at least somewhat prepared for workplace culture, with the majority (62%) selecting "somewhat prepared." A smaller portion reported feeling extremely prepared (32%), while very few students (8%) felt neither prepared nor unprepared, suggesting that outright lack of preparedness was uncommon. Overall, these findings suggest that students enter co-op experiences with a basic understanding of professional culture but may lack confidence or depth in certain areas.

8- *Feedback and Evaluation*

Feedback and evaluation during co-op experiences are essential for supporting student growth and professional development. Regular, constructive feedback helps students understand their strengths, identify areas for improvement, and adjust their performance in real time. Effective evaluation also promotes learning, accountability, and continuous improvement, making the co-op experience more meaningful and beneficial for students. This led us to ask students whether they received any feedback during their internship experiences.

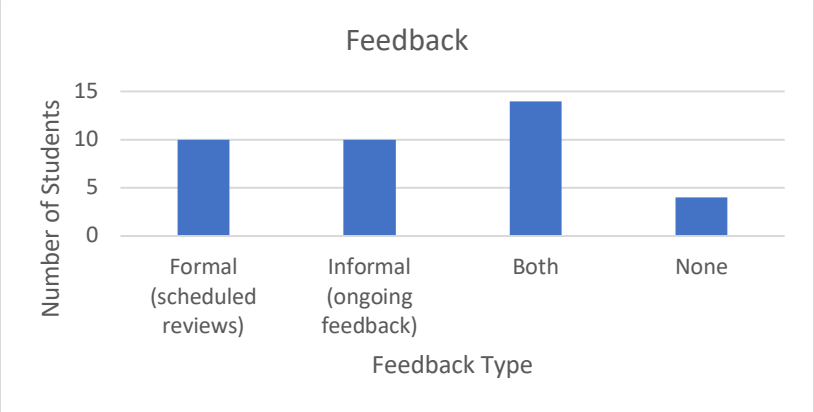

Figure 9. Feedback

The results show that most students received some form of feedback during their co-op experiences, with the largest group reporting that they received both formal and informal feedback (37%).This suggests that many employers recognize the importance of providing structured evaluations alongside ongoing guidance. A comparable number of students reported receiving only formal or only informal feedback (26% each), indicating some variation in how feedback is delivered across placements. However, a small number of students indicated receiving no feedback, highlighting a gap that could limit learning and professional growth.

9- *Suggestions for Improvement*

Students were asked to provide suggestions to improve their co-op experience, and their responses were categorized into two areas: actions by the university and actions by companies. Students suggested that companies provide more opportunities to develop skills such as leadership, project control, and technology use, as well as greater exposure to pre-construction activities. Some students also requested more flexibility from both the university and employers, along with increased time in the office to review plans and bids. In addition, students recommended that the university offer more hands-on learning opportunities, increased exposure to software, greater flexibility with classes, and more in-depth courses focused on individual construction trades.

10- *Overall Experience*

The responses regarding overall experience are compiled below (Figure 10).

Figure 10. Satisfaction

The results demonstrate a very high level of overall satisfaction with the co-op experience. The majority of students rated their experience as either excellent (46%) or good (43%), indicating that the program is effectively supporting student learning, professional development, and industry engagement. Only a small number of students rated their experience as average (11%), and none reported a poor experience, suggesting that while minor improvements may be beneficial, the co-op experience is overwhelmingly positive.

11- *Relationship Between Variables*

Chi-square test was performed to determine whether there is a significant association between two categorical variables. All expected cell counts met chi-square assumptions (expected frequency ≥ 5)

The results are shown in table1.

Table1. Summary of Chi-Square Tests

Comparison	p-value	Cramér's V	Result
Mentorship vs. Satisfaction	<0.001	0.87	Strong-Significant
Feedback vs. Satisfaction	<0.001	0.64	Strong-Significant
Culture Preparedness vs. Satisfaction	<0.001	0.61	Strong-Significant
Curriculum Alignment vs. Satisfaction	0.036	0.69	Significant

In a chi-square analysis, the p-value indicates whether a relationship between variables is statistically significant, while Cramér's V measures the strength of that relationship. A smaller p-

value (typically less than 0.05) suggests that the observed association is unlikely to have occurred by chance, whereas a larger Cramér's V value (closer to 1) indicates a stronger association between the variables.

Based on this analysis, statistically significant relationships were found between several co-op experience factors and overall student satisfaction. Mentorship quality showed the strongest association with satisfaction ($p < 0.001$, Cramér's $V = 0.87$), highlighting mentorship as a critical determinant of positive co-op experiences. Feedback also demonstrated a strong and significant relationship with satisfaction ($p < 0.001$, Cramér's $V = 0.64$), suggesting that both formal and informal feedback play an important role in shaping students' perceptions of their co-op experience.

Preparedness for workplace culture was similarly found to have a strong and significant association with satisfaction ($p < 0.001$, Cramér's $V = 0.61$), indicating that students who felt more prepared for professional environments tended to report higher satisfaction. Curriculum alignment with internship responsibilities was also significantly related to satisfaction ($p = 0.036$, Cramér's $V = 0.69$). Although several effect sizes were large (e.g., Cramér's $V > 0.60$), interpretation should be approached cautiously given the modest sample size. Overall, these results emphasize the importance of mentorship, feedback, cultural preparedness, and curriculum alignment in enhancing student satisfaction with co-op experiences. Mentorship quality demonstrated the strongest association with overall satisfaction within this sample, followed by feedback practices, workplace culture preparedness, and curriculum alignment

Discussion

Overall, the findings indicate that the rotation system is effective for most students; however, inconsistencies in implementation across companies and departments reveal opportunities for improvement. While co-op experiences generally support student learning and professional growth, variations in mentorship quality, feedback practices, curriculum alignment, technology exposure, and workplace preparedness suggest a need for greater structure and coordination. To strengthen program effectiveness, several best practices emerge from the findings.

1- *Strengthen Mentorship Quality*

Given the strong relationship between mentorship quality and student satisfaction, each co-op placement should include a designated mentor with clearly defined responsibilities. Mentors should provide guidance, support professional development, and meet regularly with students to discuss progress and expectations. Offering brief mentor orientation or guidelines can help ensure consistency across employers.

2- Ensure Regular and Structured Feedback

Employers should be encouraged to provide both formal and informal feedback throughout the co-op experience. At a minimum, structured mid-term and final evaluations should be required, complemented by ongoing informal feedback. Clear feedback expectations help students reflect on their performance, address challenges early, and continuously improve.

3- *Improve Curriculum Alignment with Internship Responsibilities*

To strengthen the connection between coursework and workplace responsibilities, academic content should be periodically reviewed and aligned with industry practices encountered during co-ops. Collaboration with industry partners can help ensure students are exposed to relevant tools, workflows, and expectations prior to and during their internships.

4- *Expand Technology Exposure*

Survey results revealed uneven exposure to construction-related technologies. Co-op placements should intentionally provide opportunities for students to engage with current and emerging technologies, such as drones, BIM, cloud-based project management tools, and pre-construction processes. Similarly, the curriculum should reinforce these technologies to better prepare students for hands-on application.

5- *Enhance Preparedness for Workplace Culture*

Since many students felt only somewhat prepared for professional environments, pre–co-op training should emphasize workplace culture, professional communication, teamwork, ethics, and expectations. Workshops, case studies, and reflective activities implemented in courses can help students transition more confidently into professional settings.

To improve preparedness, programs could place greater emphasis on professional norms, workplace communication, and organizational expectations through case studies, and reflective activities implemented in courses pre–co-op workshops, mock workplace scenarios, and employer-led sessions. Integrating reflective activities during and after co-ops, as well as providing clearer guidance on professional conduct and expectations, could also help students transition from being somewhat prepared to feeling fully confident in professional environments.

6- Emphasize Soft Skills Development

Co-op experiences should intentionally support the development of soft skills, particularly problem-solving, communication, teamwork, and leadership. Employers can be encouraged to assign responsibilities that require collaboration, decision-making, and accountability, while faculty can reinforce these skills through reflection and assessment.

7- Increase Flexibility and Coordination Between University and Employers

Students expressed a need for greater flexibility from both the university and employers. Improved coordination regarding schedules, course loads, and work responsibilities can reduce stress and improve academic persistence. Flexible course offerings and clear co-op expectations can support timely degree completion.

8- *Expand Hands-On and Applied Learning Opportunities*

Both the university and employers should prioritize hands-on learning. On-campus instruction should incorporate more applied projects, software training, and trade-specific content, while co-op placements can increase office-based learning such as plan review, bid analysis, and pre-construction exposure.

9- *Use Continuous Assessment to Improve the Program*

Ongoing collection of student feedback and outcome data should be used to regularly assess and refine the co-op program. Tracking satisfaction, skill development, and placement outcomes will help identify gaps, measure effectiveness, and ensure the program continues to evolve in response to student and industry needs.

Implementing these best practices will create a more structured, supportive, and aligned co-op/internship experience that enhances student learning, increases satisfaction, and strengthens pathways to degree completion and successful job placement.

Conclusion

This study examined student perceptions of co-op/internship experiences within a Construction Engineering and Management program. Results suggest that mentorship quality and structured feedback are strongly associated with overall satisfaction. While findings should be interpreted cautiously due to sample size limitations, the study provides actionable insights for strengthening university–industry partnerships. Future research should expand sample size and incorporate longitudinal assessment of workplace preparation and emerging technologies such as AI.

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