EPiC Series in Built Environment

Volume 7, 2026, Pages 100–109

Proceedings of Associated Schools of Construction 62nd Annual International Conference

Bridging Industry and Academia: Faculty Externship for Applied Construction Education in Electrical Contracting Case Study

Deniz Besiktepe[1], Kyubyung Kang[1], Bradley L. Benhart[1], Emad Elwakil[1], Dan Christopher[2]
[1]Purdue University, [2]Gaylor Electric

This study examines the outcomes of a faculty externship program at Purdue University's Bowen School of Construction, emphasizing faculty and curriculum enhancement through an experiential learning framework. Initiated with the encouragement of the department's Industry Advisory Council, the externship program connects faculty with industry partners each summer to strengthen academia-industry collaboration while translating industry practices into classroom applications. The study employed a qualitative methodology integrating observational research, reflective journals and guided debrief exchanges to document observations and insights. Data was analyzed using content analysis informed by Kolb's experiential learning framework and the American Council for Construction Education's student learning outcomes. The findings were synthesized into teaching units focusing on (i) electrical contracting workflows, (ii) digital technologies and project coordination, (iii) innovation and prefabrication (iv) career pathways, and (v) project delivery dynamics within specialty contracting environments. Beyond units' development, the program deepened faculty understanding of industry methods, technologies, and workforce expectations, thereby enhancing teaching effectiveness and fostering research collaboration. As an ongoing initiative, the next phase will include pre- and post-assessments of the developed units to evaluate their impact on student learning and to refine the externship model for continuous improvement and sustained academia-industry engagement.

Keywords: Faculty externship, Faculty development, Curriculum development, Industry collaboration, Electrical contracting.

Introduction

Connecting academia and industry remains a central priority in construction education as programs strive to prepare graduates who can adapt to the complexities of modern project delivery environments. Despite this shared goal, a persistent gap exists between academic instruction and current industry practices, particularly in understanding the workflows, coordination, and management processes that shape real-world construction projects (Clevenger & Ozbek, 2013; Perrenoud et al., 2020). Faculty members, who often enter academia after years in industry or through traditional research pathways, face the ongoing challenge of maintaining current knowledge of industry practices to ensure that educational content remains both relevant and applied (Hora & Lee, 2024; Perrenoud et al., 2020). While most construction management curricula emphasize general contracting (GC) practices, there is comparatively limited integration of specialty contracting perspectives, as electrical, mechanical, and plumbing (MEP), which play critical roles in project delivery and innovation (Becker et al., 2014). In many programs, it was observed that MEP related content focuses primarily on technical aspects rather than the organizational, coordination, and prefabrication that define how specialty contractors operate.

Externship programs have emerged as an effective mechanism for fostering faculty professional development and aligning classroom instruction with contemporary construction processes (Cribbs & Naganathan, 2023; Cribbs et al., 2023). Such programs provide immersive, hands-on exposure to real-world workflows and innovations, enabling faculty to translate firsthand insights into pedagogical strategies, assignments, and course modules. This approach promotes reflection and transformation of practical experiences into actionable teaching materials that reinforce professional competencies outlined by the American Council for Construction Education (ACCE) standards. Consequently, integrating externship-based experiential learning into faculty development contributes not only to teaching effectiveness but also to broader institutional goals of industry engagement, curriculum innovation, and workforce readiness as well as research excellence with industry collaborations.

The purpose of this study is to propose a methodological framework for structuring externships and translating them into curriculum improvements in construction management education. Specifically, the study seeks to explore how industry immersion experiences captured through observation, reflection, and guided debriefs can be systematically analyzed and translated into teaching units aligned with Kolb's experiential learning framework (Kolb, 1984) and the American Council for Construction Education (ACCE) Student Learning Outcomes (SLOs). The externship was initiated with the objectives of exposing faculty to specialty contracting practices, translating observed workflows into ACCE-aligned instructional units, and demonstrating a repeatable externship-to-curriculum translation framework. The proposed framework emphasizes observational immersion and reflective synthesis, making it especially appropriate for programs aimed at curriculum development and knowledge translation. Finally, the study reflects a strategic initiative endorsed by the department's Industry Advisory Council to strengthen academia-industry collaboration in construction education.

Background

Educator externships and faculty residencies are recognized as essential forms of professional development designed to ensure that teaching practices and curriculum content remain relevant to current industry demands (Lin et al., 2010; Luft & Vidoni, 2000; Mani, 2022). These learning opportunities allow participants to engage in direct observation or "job shadowing" of practitioners in their field, emphasizing observation rather than the fixed, longer-term responsibilities typically found in internships (Kinsella & Waite, 2021). The core goal is to bridge the divide between academic instruction and the workforce, preparing students for the job market (Luft & Vidoni, 2000; Mani, 2022). One of the primary outcomes of educator externships is enhanced relevance in classroom instruction (Luft & Vidoni, 2000) where participants frequently report an increased understanding of skills and attributes necessary in the workplace and subsequently make relevant changes to their classroom practices (Anderson, 2004).

The Associated General Contractors of America (AGC) Faculty Internship Program was developed to help alleviate the shortage of industry experience in faculty for construction management programs (Holliday et al., 2014). This paid residency is structured as a three-way partnership where the AGC Foundation, the faculty institution, and a contractor each contribute to the faculty member's summer salary, ensuring buy-in and commitment to their success (Holliday et al., 2014; Palomera-Arias &

Capano, 2014). These residencies help faculty develop new technical skills in areas like Virtual Design and Construction (VDC) or Building Information Modeling (BIM) (Cribbs & Naganathan, 2023; Holliday et al., 2014). In addition, it enables the rapid integration of industry knowledge into the curriculum by using active industry projects as course content (Cribbs & Naganathan, 2023). This approach helps programs develop agile curricula and potentially new concentrations or specializations responsive to industry needs (Cribbs et al., 2023).

In construction education, the need for faculty industry experience is critical, as degree requirements increasingly demand a doctoral degree, leading to a shortage of faculty possessing both advanced degrees and field experience (Holliday et al., 2014; Palomera-Arias & Capano, 2014). Beyond improving teaching methods, faculty externships in construction education are shown to enhance the richness, quality, and scope of scholarly research and provide value to industry sponsors (Lin et al., 2010). For example, faculty working on Building Information Modeling (BIM) or lean construction were able to collaborate with hosts to develop theoretical foundations for industry practices or expand their own research domains (Lin et al., 2012).

Limited studies in construction education have emphasized the role of faculty externships as catalysts for bridging the gap between academic instruction and industry practice. For instance, Cribbs and Naganathan (2023) introduced the "Live Knowledge Transfer Pedagogy", a model in which faculty engage in short-term industry residencies, such as those focused on VDC, while concurrently integrating insights into classroom instruction. This approach, further expanded by Cribbs, Naganathan, O'Neil, and D'Agostino (2023), enables real-time translation of field experiences into academic learning, ensuring that students receive current, practice-based knowledge during the same term. Their studies demonstrated that such alignment accelerates curricular innovation and supports the development of new concentrations or specializations responsive to emerging industry trends (Cribbs et al., 2023). Collectively, these findings position faculty externships not only as a form of professional development but also as an active pedagogical strategy that strengthens the relevance and agility of construction management programs.

Furthermore, early-career construction faculty development programs, often addressing foundational topics like project management and virtual design, are necessary because graduate schools often fall short in preparing students for academic roles, particularly concerning teaching pedagogy and mentorship (Heydari et al., 2024; Rokooei et al., 2025). These short training programs show a significant potential (over 60% high or very high impact) in improving a junior faculty member's competency in areas such as course layout, increasing student motivation, and enhancing problem-solving skills (Rokooei et al., 2025). With the construction industry evolving rapidly and facing an increasing demand for a skilled workforce, construction education must remain closely aligned with current industry practices to effectively prepare graduates to meet workforce needs (Zheng et al., 2025).

Methodology

This case study adopted a qualitative, experiential research design to examine how a structured faculty externship program informs curriculum enhancement and teaching innovation in construction management education. The externship was implemented through the Bowen School of Construction at Purdue University, in collaboration with an established electrical contracting firm Gaylor Electric. The program was supported and encouraged by the department's Industry Advisory Council and designed to immerse faculty in specialty contracting engineering, innovation and operations to bridge the gap between academic instruction and evolving industry practices. Figure 1 represents the steps of the methodology implemented in this study.

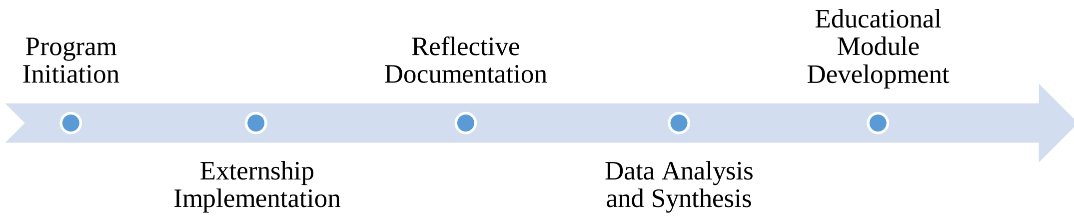

Figure 1. Steps of the Experiential Research Design for the Faculty Externship Program

The research followed an observational and reflective methodology, grounded in Kolb's (1984) Experiential Learning Cycle, which comprises four iterative phases: (i) Concrete Experience, (ii) Reflective Observation, (iii) Abstract Conceptualization, and (iv) Active Experimentation. Faculty participants (n=2) engaged directly in workplace learning through project meetings, coordination sessions, and field observations, gaining firsthand insights into construction workflows, digital coordination platforms, and organizational dynamics. Observations were systematically documented through reflective journals, field notes, and guided debrief exchanges with company mentors and project managers. These debrief sessions allowed faculty to contextualize experiences, clarify workflow nuances, and align insights with potential curricular applications. The alignment of the Kolb's steps and the fundamental parts of the externship study are presented in Table 1.

Table 1. Alignment of the Faculty Externship Study with Kolb's Experiential Learning Cycle

Kolb's Learning Stage	Kolb's Description	Externship Study Alignment
Concrete Experience	Engaging in a new experience or situation provides direct exposure to real-world contexts.	Faculty participated in the externship, engaging in project meetings, coordination sessions, site visits, and field observations of specialty contracting operations, technologies, and innovation practices.
Reflective Observation	Observing and reflecting on the experience from different perspectives to identify lessons learned.	Faculty maintained reflective journals and field notes, documenting daily observations, questions, and critical reflections. Guided debrief sessions with company mentors and project managers encouraged structured reflection and contextual understanding.
Abstract Conceptualization	Formulating theories, frameworks, or generalizations from reflections to connect experience with knowledge.	Using content analysis, faculty synthesized the data into conceptual insights aligned with ACCE SLOs and curriculum needs.
Active Experimentation	Applying newly formed concepts or models to plan and implement changes or improvements.	Faculty translated insights into five ACCE-aligned teaching units, integrating them into classroom instruction and planning pre/post assessments to evaluate their effectiveness.

Collected qualitative data were analyzed using content analysis, emphasizing thematic coding (Braun & Clarke, 2006) guided by the stages of Kolb's (1984) model. This approach enabled the identification of recurring patterns related to learning processes, industry-academia intersections, and instructional relevance. Through this analysis, the study synthesized actionable knowledge to inform curricular translation. The data were systematically translated into five ACCE-aligned teaching units that integrate specialty contracting practices into construction education.

Results and Discussion

The externship experience resulted in the development of five integrated teaching units aligning with the externship objectives by demonstrating how industry exposure can be systematically translated into ACCE-aligned instructional content through a repeatable framework. The units were designed to strengthen curriculum relevance, promote experiential learning, and improve student readiness for modern construction industry demands. The analysis of reflective journals, debrief exchanges, and field observations revealed patterns consistent with Kolb's Experiential Learning Cycle beginning with Concrete Experience in the field, followed by Reflective Observation, Abstract Conceptualization, and Active Experimentation through curriculum application. The units were aligned with the American ACCE 17 SLOs to ensure accreditation compliance and measurable educational impact.

Unit 1: Electrical Contracting Workflows

This unit originated from faculty participation in engineering meetings and project reviews, prefabrication activities, project sequencing meetings, and safety reviews *(Concrete Experience)*. Faculty identified coordination dependencies which were analyzed through reflective journaling and mentor debriefs *(Reflective Observation)*. The insights informed conceptual mapping of workflow efficiency and project delivery dynamics *(Abstract Conceptualization)*. Classroom implementation includes workflow simulations and stakeholder collaboration exercises *(Active Experimentation)*. This unit addresses SLO 7 (Methods, Materials, Equipment), SLO 10 (Project Delivery Methods), and SLO 17 (MEP Systems Understanding).

Unit 2: Digital Technologies and Project Coordination

Faculty engagement with Gaylor Electric's Virtual Design and Construction (VDC) systems and digital coordination tools provided insight into BIM-driven communication and real-time clash detection *(Concrete Experience)*. Reflective exchanges focused on information flow between design, prefabrication and field teams and the role of data accuracy in project management efficiency *(Reflective Observation).* These observations were first abstracted into instructional principles before being translated into coordination labs and exercises *(Abstract Conceptualization).*Abstracting these lessons informed unit development around BIM coordination, digital communication, and data integration with coordination labs and data management exercises *(Active Experimentation),* addressing SLO 8 (Electronic-Based Technology), SLO 10 (Project Delivery Roles), and SLO 13 (Project Control Processes).

Unit 3: Innovation and Prefabrication

Through observing prefabrication operations in the Innovation Center *(Concrete Experience),* faculty reflected on the relationships between material logistics, quality assurance and control, and waste reduction *(Reflective Observation). Abstract Conceptualization* highlighted innovation as both a cultural and operational process and connected these observations to sustainability and continuous improvement frameworks. Classroom implementation includes lean process mapping, modular construction case studies, and reflections on the impact of prefabrication *(Active Experimentation).*

This unit supports SLO 7 (Methods, Materials, Equipment), SLO 12 (Quality Assurance and Control), and SLO 15 (Sustainable Construction Principles).

Unit 4: Career Pathways and Workforce Development

Interactions with various level employees in Gaylor Electric provided firsthand insight into career progression models, leadership development, and apprenticeship structures (Concrete Experience). Reflection focused on professional growth, ethics, and communication competencies, recruitment pipelines, diversity initiatives, and leadership training (Reflective Observation). Abstract conceptualization identified transferable skills and the integration of ethical decision-making and teamwork principles into course objectives. Implementation activities include leadership reflections, peer mentoring, and communication workshops (Active Experimentation). This unit aligns with SLO 1 (Written Communication), SLO 2 (Oral Communication), SLO 6 (Ethical Decision-Making), and SLO 9 (Team Skills through Collaboration).

Unit 5: Project Delivery Dynamics

Participation in subcontractor and GC coordination meetings allowed faculty to observe risk-sharing, cost control, and legal compliance in practice (*Concrete Experience*). Reflective notes highlighted communication patterns and project accountability structures (*Reflective Observation*). *Abstract conceptualization* involved synthesizing frameworks for integrated delivery, cost management, and contractual relationships. Classroom activities include project delivery method analysis, team-based simulations, and contract interpretation workshops (*Active Experimentation*). The unit aligns with SLO 10 (Project Delivery Methods), SLO 11 (Accounting and Cost Control), SLO 13 (Project Control Processes), and SLO 14 (Legal Implications in Construction). The alignment of the units, classroom activities and ACCE SLO's are presented in Table 2.

Table 2. Externship-Derived Instructional Units, Classroom Activities, Alignment with ACCE SLOs

Instructional Unit	**Classroom Activity**	**Aligned ACCE SLOs**
1- Electrical Contracting Workflows	Workflow simulation illustrating sequencing, internal coordination and outcomes. (Group activity)	7,10,17
2- Digital Technologies & Project Coordination	BIM coordination lab demonstrating clash detection and ACC* flow for stakeholder collaboration. (Group activity)	8,10,13
3- Innovation and Prefabrication	Identification of prefabrication items and conceptual cost-benefit & sustainability analysis. (Individual + group activity)	7,12,15
4- Career Pathways and Workforce Development	Reflective career path mapping in specialty contracting connecting professional ethics and teamwork principles. (Group activity)	1,2,6,9
5- Project Delivery Dynamics	Case-based in-class discussions analyzing risk allocation and contract relationships in specialty contracting. (Group activity)	10,11,13,14

*Autodesk Construction Cloud

The five instructional units developed through the faculty externship collectively demonstrate the transformative potential of experiential learning in bridging the academic and industry divide within construction education. Each unit followed the iterative structure of Kolb's Experiential Learning Cycle, enabling faculty to move from authentic field immersion to reflective interpretation, conceptual synthesis, and classroom application. Through engagement with Gaylor Electric's operations, faculty deepened their understanding of specialty contracting workflows, digital coordination tools, and interdisciplinary project delivery practices. The integration of these insights into structured teaching units directly addressed multiple ACCE SLOs, reinforcing core competencies in safety, technology, quality control, sustainability, and professional ethics. In particular, the units promoted a systems-thinking (Grohs et al., 2018) approach by connecting operational realities, technological processes, and human factors across project phases. The reflective process also enhanced faculty pedagogical awareness, supporting curriculum relevance while cultivating students' practical and ethical reasoning. Collectively, the externship experience highlighted how faculty industry engagement not only enhances instructional content but also generates richer discussions around teamwork, leadership, and innovation which are essential dimensions for preparing graduates to navigate the evolving construction landscape.

Future Directions

Building on the initial outcomes of the externship program, future directions will focus on expanding both the scope and the longitudinal impact of faculty & industry engagement. A key next step involves implementing systematic pre- and post-assessments of the developed teaching units to evaluate their effects on student learning, engagement, and transfer of industry-relevant competencies. Longitudinal tracking of student performance and feedback will provide evidence of how experiential, industry-informed content enhances problem-solving, collaboration, and ethical reasoning in construction management education. Additionally, subsequent externships will involve a broader range of specialty contractors including mechanical, plumbing, and integrated service firms to diversify insights and facilitate interdisciplinary curriculum development. Cross-institutional collaborations are also envisioned to create a national framework or consortium for faculty externship models, enabling shared best practices, co-developed instructional materials, and research outputs. Finally, integrating emerging technologies such as artificial intelligence, digital twins, and immersive simulation environments into externship-based learning will extend the framework into data-driven and virtualized teaching contexts, ensuring continued alignment of construction education with the rapidly transforming industry ecosystem.

Moreover, the externship model is envisioned to evolve into a sustained framework supporting workforce development, technological innovation, and research collaboration between academia and industry. Potential opportunities include developing doctoral level fellowships and internships that allow students to engage in real-world problem-solving within industry settings. Additional efforts may involve integrating authentic case studies and workflow challenges into capstone and experiential learning courses and facilitating mentorship connections between professionals and students to strengthen technical and managerial competencies. Collaborative research could explore emerging areas such as BIM integration, AI-enabled workflows, robotics and automation, and predictive data analytics to enhance prefabrication and logistics efficiency. Additional possibilities involve using augmented and virtual reality (XR) tools for immersive training and visualization of complex assemblies and safety procedures. On a broader scale, establishing annual innovation forums, co-authored publications, and joint proposals for workforce or technology development grants could further institutionalize the partnership and expand its impact. Collectively, these recommendations outline pathways for extending the externship model into a sustained, research-informed collaboration that enhances curriculum relevance, advances applied construction knowledge and strengthens the connection between academic inquiry and industry practice.

Conclusion

This case study demonstrates the value of a structured faculty externship as a mechanism for enhancing faculty development, curriculum innovation, and academia & industry collaboration in construction management education. Guided by Kolb's (1984) Experiential Learning Cycle, the externship model enabled faculty to translate firsthand industry experiences into five targeted teaching units aligned with the American Council for Construction Education (ACCE) Student Learning Outcomes (SLOs). These units, covering electrical contracting workflows, digital technologies and coordination, innovation and prefabrication, career pathways, and project delivery dynamics, demonstrated how faculty engagement in specialty contracting environments can inform and enrich curriculum design. The study outcomes align with the externship objectives by demonstrating how industry exposure can be systematically translated into ACCE-aligned instructional content through a repeatable framework. The process strengthened faculty understanding of real-world project operations, improved the relevance of course materials, and supported the alignment of teaching outcomes with professional accreditation standards. Across faculty debriefs, the most impactful aspects were exposure to coordination workflows and prefabrication strategy, while the main challenges involved time compression and translating tacit knowledge into teachable structures; these insights are informing the next iteration of the model.

Considering limitations of the study, the pilot externship involved a small sample size (n=2 faculty) and a single specialty contracting firm, which may constrain the generalizability of findings across broader construction education contexts. Additionally, the study focused primarily on the development of units rather than their longitudinal impact on student learning, necessitating future evaluation through structured assessment, which is part of future agenda. Institutional and logistical challenges, such as faculty time availability, funding, and industry partner coordination, also highlight barriers that must be addressed to sustain and scale such programs.

Future phases of this initiative will include converting these units into course modules, pre- and post-assessments to measure their effectiveness on student learning outcomes, engagement, and readiness for professional practice. These assessments will generate evidence-based insights to guide ongoing improvement of module design and teaching strategies. Beyond individual course enhancement, the externship model offers a replicable framework for construction programs nationally to embed faculty learning into curriculum development and accreditation alignment.

Looking ahead, the externship model is envisioned to evolve into a sustained framework advancing workforce development, technological innovation, and research collaboration through applied fellowships, industry-integrated coursework, mentorship, emerging technology adoption, and joint initiatives that strengthen long-term academia–industry partnerships. Overall, this study presents a replicable learning framework that translates faculty externship experiences into ACCE-aligned instructional content, thereby strengthening the link between construction education and contemporary industry practice, with the long-term goal of fostering sustainable academia-industry partnerships that drive continuous curricular improvement, reinforce professional competencies, and ensure education evolves alongside technological innovation and workforce demands.

Acknowledgement

The authors gratefully acknowledge the support of Purdue University's Bowen School of Construction and its Industry Advisory Council for championing this externship initiative. Special thanks are extended to Gaylor Electric for serving as the host industry partner and providing faculty

with unparalleled access to real-world specialty contracting environments, project teams, and innovation facilities.

References

Anderson, A., Kanter, A., & Slane, C. (2003). Ethics in Externships: Confidentiality, Conflicts, and Competence Issues in the Field and in the classroom. Clinical L. Rev., 10, 473.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. Qualitative research in psychology, 3(2), 77-101.

Becker, T., Sanvido, V., Kufahl, G., Elston, A., & Woodard, N. (2014). Investigation into the relationship of construction engineering and management education with specialty trade contractors. Practice Periodical on Structural Design and Construction, 19(1), 20-29.

Clevenger, C. M. & Ozbek, M. E. (2013). Teaching sustainability through service-learning in construction education. International Journal of Construction Education and Research, 9(1), 3-18.

Cribbs, J., & Naganathan, H. (2023, June). Implementing Live Knowledge Transfer Based Pedagogy in CM Education through Faculty Externship. In 2023 ASEE Annual Conference & Exposition.

Cribbs, J., Naganathan, H., O'Neil, C., & D'Agostino, M. J. (2023, June). Leveraging Faculty Externship to Develop New Concentrations and Specializations in Construction Management Curricula. In 2023 ASEE Annual Conference & Exposition.

Grohs, J. R., Kirk, G. R., Soledad, M. M., & Knight, D. B.(2018). Assessing systems thinking: A tool to measure complex reasoning through ill-structured problems. Thinking Skills and Creativity, 28, 110-130.

Heydari, M. H., Shojaei, A., & Rokooei, S. (2024). Empowering the next generation: Transformative impact of faculty development programs in construction management and engineering. Proceedings of International Structural Engineering and Construction, 11(2), EPE-02. doi:10.14455/ISEC.2024.11(2).EPE-02.

Holliday, L. M., Reyes, M., & Robson, K. F. (2014, June). Faculty internship: Providing new skills for construction educators. In 2014 ASEE Annual Conference & Exposition (pp. 24-596).

Hora, M. T., & Lee, C. (2024). Does industry experience influence transferable skills instruction? Implications for faculty development and culture theory. Innovative Higher Education, 49, 799–820. doi:10.1007/s10755-023-09692-3.

Kinsella, C. J., & Waite, B. C. (2021). Faculty externships: Understanding and capitalizing on the latest trend in faculty development. The Journal of Faculty Development, 35(1), 19–26.

Lin, K. Y., Kim, Y. W., & Dossick, C. (2010). Repositioning the faculty internship experience in construction management. In Construction Research Congress 2010: Innovation for Reshaping Construction Practice (pp. 215-225).

Luft, V. D., & Vidoni, K. L. (2000). Educator externships: how classroom teachers can acquire business and industry experience. The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 74(2), 81-83.

Mani, N. (2022). Teacher externship program: An opportunity for educators to build a relationship with industries. In Proceedings of the 2022 Industry, Engineering & Management Systems Conference (Vol. 28, pp. 54-60).

Palomera-Arias, R., & Capano, C. D. (2014, June). Developing a Professional Internship for Faculty in Construction Higher Education Programs. In 2014 ASEE Annual Conference & Exposition

Rokooei, S., Shojaei, A., & Ly, R. (2025). Faculty development program to enhance teaching quality in construction. International Journal of Construction Management, 25(1), 89–98. doi:10.1080/15623599.2024.2304475.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Prentice Hall.

Perrenoud, A. J., Sullivan, K., & Lines, B. (2020). Enhancing construction management education through experiential and industry-integrated learning models. International Journal of Construction Education and Research, 16(1), 45–61.

Zheng, Y., Debs, L., Besiktepe, D., & Oh, H. J. (2025). Insights for Key Professional Competencies of US Entry-Level Construction Positions: A Structural Topic Modeling Approach. Journal of Construction Engineering and Management, 151(8), 04025103.