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Bridging Academia and Industry: Experiential Learning Strategies in Construction Management Education

Dr. Esra Tepeli PhD, PMP, Purdue Polytechnic Institute, Purdue University – West Lafayette

Dr. Esra Tepeli is a Clinical Assistant Professor in the School of Construction Management Technology at Purdue University. She holds a Bachelor of Science degree in Civil Engineering, a Master's degree in Construction Management with a double major in project and risk management, and a Ph.D. in Construction Project Management and Risk Management. Her doctoral research focused on managing complex and strategic construction projects, including Public-Private Partnerships (PPP), design-build-maintenance, and large transportation projects. At Purdue, Dr. Tepeli teaches courses in contract administration and specifications, strength of materials, and quantity takeoff, with a strong emphasis on experiential and industry-integrated learning. Her teaching and research interests include project and risk management, Lean Construction, sustainable construction, and the integration of emerging technologies such as BIM, cloud-based project management tools, and AI into construction education. Dr. Tepeli is an active member of the Project Management Institute (PMI) and holds the Project Management Professional (PMP) credential. She has conducted professional trainings, contributed to outreach initiatives, and presented at global conferences hosted by PMI chapters. She is also preparing a Lean Construction Certificate in collaboration with the Lean Construction Institute (LCI). Her work actively bridges academia and industry to enhance student engagement, retention, and workforce readiness.

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Esra Tepeli, PhD, PMP, RMP

Purdue University, Construction Management

Abstract

Preparing construction management graduates for a rapidly evolving industry requires educational practices that extend beyond traditional classroom instruction. This paper presents the design, implementation, and outcomes of industry-integrated experiential learning strategies embedded across a construction management curriculum and aligned with professional competency expectations. The work contributes to ongoing discussions in the ASEE Construction Engineering Division on experiential pedagogy, student engagement and retention, and academia–industry collaboration. This study explores how construction-specific experiential modules—developed in close collaboration with industry—can enhance both technical learning and professional preparedness. Across three academic semesters, multiple experiential modules were embedded in core courses, including case study applications in project delivery and risk management, scenario-based bid proposal preparation and presentation, and the use of cloud-based project management platforms for project administration and contract management. Modules were co-designed with industry partners who contributed authentic project constraints, mentored student teams, and evaluated deliverables using common rubrics. The impact of these initiatives was assessed through a mixed-methods approach that combined rubric-scored artifacts, student pre/post self-efficacy and engagement measures, reflective writing, and partner interviews. Results indicate that industry-integrated experiential learning strengthens students' confidence in performing technical tasks (estimating, scheduling, contract administration), improves communication and teamwork behaviors, and supports professional identity development through repeated practice under realistic constraints. Industry partners reported mutual benefits, including early talent identification and opportunities to shape workforce readiness. Faculty observed that these industry-driven experiences not only enhanced academic performance but also contributed to student retention by making coursework directly relevant to professional career pathways. The paper contributes (a) a transferable design pattern for academia-industry experiential modules, (b) a curriculum integration roadmap that scaffolds experiences from early exposure to authentic performance, and (c) lessons learned on scaling partner engagement while maintaining equity and manageable faculty workload.

Keywords: experiential learning; construction management education; academia-industry collaboration; project-based learning; workforce readiness

1. Introduction

The construction industry is undergoing rapid transformation driven by technological innovation, increased project complexity, sustainability demands, and evolving delivery methods. As a result, construction management (CM) graduates are expected to enter the workforce with not only technical knowledge but also strong professional skills such as communication, teamwork, decision-making, and adaptability. Traditional lecture-based instruction alone is therefore insufficient to prepare students for these multifaceted expectations [1], [2].

In response, construction management education has increasingly emphasized experiential and project-based learning approaches that mirror real-world practice. Accrediting bodies such as ABET underscore student outcomes related to problem-solving, teamwork, communication, and professional responsibility, while industry employers consistently seek graduates who can quickly integrate into project teams and apply knowledge effectively in practical contexts [3], [4].

The value of experiential and project-based learning in engineering and construction education is well established [1], [5]. In construction education specifically, experiential modules can be particularly powerful because professional practice is both artifact-driven (e.g., schedules, estimates, RFIs, submittals) and decision-rich, requiring trade-offs among safety, cost, schedule, quality, and logistics. When designed in partnership with industry, these learning experiences can further align coursework with current tools, norms, and expectations, strengthening readiness for internships and entry-level roles [3].

This paper presents an industry-integrated experiential learning approach embedded across core CM courses and evaluated across three academic semesters. The study addresses three questions: (1) how can industry-integrated experiential modules be embedded in core CM courses; (2) what impact do modules have on student technical competence, professional skills, and self-efficacy; and (3) how do such experiences influence engagement, belonging, and persistence in the major. The paper contributes a transferable curriculum integration pathway, reusable module design patterns, and an evaluation approach that balances rigor with feasibility for repeated offerings [6], [7].

By addressing these questions, this paper provides empirical evidence and practical guidance to ongoing discourse on experiential learning in construction and engineering education. The work extends prior discussions of experiential and project-based pedagogy by emphasizing (a) co-design with industry, (b) a scaffolded progression of experiences across courses, and (c) a feasible evaluation strategy suitable for repeated implementations.

2. Literature review and conceptual foundation

Experiential learning is commonly described as learning through experience that is intentionally designed, guided, and supported through reflection. Experiential learning theory frames learning as a cycle that moves through concrete experience, reflective observation, abstract conceptualization, and active experimentation. In practice, effective experiential learning requires structured opportunities for students to (a) notice and document observations, (b) interpret what occurred and why, (c) connect experience to concepts or models, and (d) apply improved strategies in a subsequent task [1], [5], [8].

Figure 1 maps Kolb's experiential learning cycle to the instructional logic used in this study: Students complete authentic proposal deliverables (concrete experience), engage in structured reflection and peer review (reflective observation), connect lessons learned to course concepts and professional tools (abstract conceptualization), and revise deliverables based on feedback and updated assumptions (active experimentation) [1], [6], [9].

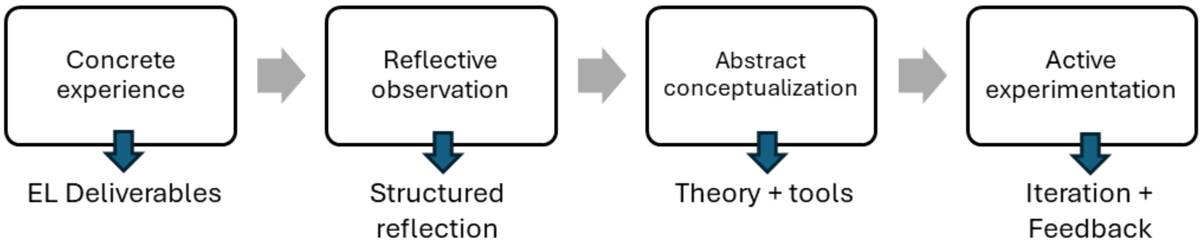

Figure 1. Kolb experiential learning cycle mapped to a case-study based module

Experiential learning intersects with active learning, project-based learning, problem-based learning, and related student-centered pedagogies. Across these approaches, the common mechanism is active cognitive engagement: students explain reasoning, make decisions under constraints, use evidence, and receive feedback rather than passively receiving information [10], [11], [12]. Research syntheses in STEM and engineering education show that active learning approaches improve student performance and reduce failure rates compared with lecture-only formats. Although experiential learning extends beyond in-class activity, the evidence base consistently supports structured practice, feedback, and reflection as core mechanisms for improving learning. Importantly, these benefits can occur across class sizes when activities are well aligned to outcomes, scaffolded appropriately, and assessed using transparent criteria [10], [11], [13].

At the same time, novelty alone does not ensure learning. Poorly aligned activities can become "busy work," while smaller experiences (e.g., brief observations or mini-cases) can produce meaningful learning when reflection is structured and when students must make and defend decisions [6],[9]. Scaling experiential learning from isolated course innovations to a coherent program strategy also introduces constraints that individual instructors may not face, such as partner availability, safety and liability considerations, scheduling conflicts across multi-section courses, variability in student preparation, and workload equity among faculty. Program-level design can mitigate these challenges by standardizing core routines (e.g., reflection prompts and rubric dimensions), curating reusable experiential learning assets (e.g., scenarios, videos, datasets), and concentrating external partner involvement on a small number of high-value touchpoints [7], [14].

Across engineering education research, stronger impacts are reported when experiential activities are intentionally designed rather than appended as isolated "hands-on" events. Key design features include (a) clear performance expectations, (b) opportunities for iteration, (c) structured reflection that links evidence to decisions, and (d) timely feedback that targets reasoning rather than only final answers [6], [13], [15]. These features are especially important in construction management, where professional performance depends on defensible assumptions, constraint awareness, and coordination across multiple stakeholders.

Authentic learning further emphasizes participation in practices that resemble the target profession, including the artifacts, constraints, and communication patterns of the workplace [9]. For CM students, authenticity is not simply a "real project" label; it is operationalized through professional documents (drawings, specifications, addenda, RFIs, submittals), time-bound decision-making, and trade-offs among cost, schedule, safety, and quality. Authentic tasks also require explicit articulation of assumptions and uncertainty, which aligns with risk management and delivery-method decision-making.

Industry collaboration can be understood as a boundary-spanning mechanism that brings professional standards and current practices into the curriculum. When partners co-define deliverables and participate in evaluation, they provide an external benchmark that helps students calibrate performance and helps faculty avoid "academic-only" optimization. Collaboration must also respect partner constraints [3]. Accordingly, this paper emphasizes a sustainable model that concentrates partner time on high-leverage moments (kickoff expectations, midpoint critiques, juried review) while using reusable scenarios, standardized rubrics, and structured peer review to support routine feedback.

Beyond technical learning, experiential modules can influence professional identity development. Repeated exposure to authentic tasks and external feedback can strengthen students' sense of belonging in the discipline and confidence that they can succeed—factors associated with engagement, persistence, and student success [2], [7]. Consistent with this perspective, the present study treats industry-integrated experiential learning not only to improve task performance, but also as an approach to strengthen students' professional preparedness and persistence through sustained, scaffolded practice.

Finally, the CDIO framework emphasizes contextual learning through conceiving, designing, implementing, and operating systems and processes, which aligns naturally with CM workflows and delivery-method decisions [8],[11]. Building on this foundation, academia–industry collaboration can extend beyond guest lectures and internships to include co-design of learning activities, provision of authentic project information, mentoring, and participation in assessment [3]. Such collaboration improves relevance and calibrates student performance against professional benchmarks. It may also strengthen engagement and persistence by reinforcing professional identity and belonging [14], [16]. Within this literature, the present study is positioned as an implementation-oriented contribution. Prior work has established the value of active, project-based, and industry-connected learning; however, fewer papers describe how such experiences can be sequenced across multiple CM courses, assessed with common evidence streams, and sustained without overextending partners or faculty. The contribution of this paper is therefore not the claim that experiential learning is effective in general, but a construction-specific integration model that combines scaffolded learning progression, authentic professional artifacts, rubric-based assessment, and a sustainable partner-engagement structure.

3. Program context and curriculum integration approach

The study was conducted within an undergraduate construction management program at a large public university, with an explicit emphasis on workforce readiness. The program is accredited under ABET criteria and prepares students for professional practice across residential, commercial, industrial, and infrastructure construction.

Experiential modules were embedded in core courses addressing project delivery and risk, contract administration, and planning/control. These courses provide foundational knowledge and are well-suited for applied, industry-relevant learning activities. Rather than treating experiential learning as isolated events, the approach sequences experiences across a scaffolded pathway that supports gradual increases in complexity, repeated feedback, and accumulation of evidence over time [5], [8].

The curriculum integration approach was shaped by two practical constraints: (1) limited contact hours within required courses and (2) finite industry-partner availability. Instead of adding credit hours, the design replaces a subset of traditional assignments with performance tasks that simultaneously assess course outcomes and simulate professional practice. To reduce barriers for students with limited prior exposure, modules incorporate scaffolds such as templates, role cards, and exemplar artifacts. Checkpoints are embedded to prevent late-stage failure and to ensure equitable access to timely feedback. These supports are intentionally faded across the pathway so that students assume increasing autonomy by the signature experience.

Industry-partner engagement is organized around three touchpoints per module cycle: (a) a kickoff briefing to clarify expectations, roles, and constraints; (b) a midpoint critique to surface risks, check feasibility, and coach students on professional standards; and (c) a final review involving juried scoring and structured feedback. Between these touchpoints, faculty and teaching assistants support student progress using standardized materials and shared rubrics, minimizing repeated demands on partners [3].

To sustain partner participation over multiple offerings, a rotating roster approach is recommended in which different partners participate across cycles while a consistent rubric and feedback structure is maintained. This model distributes effort, reduces reliance on any single organization, and broadens student exposure to varied roles and organizational cultures across the industry ecosystem.

Overall, the approach treats experiential learning as a developmental pathway rather than a single capstone event. Experiences were designed to progress in complexity following a sequence of Exposure → Application → Integration → Authentic Performance. Industry involvement was concentrated on a small number of high-value touchpoints (mentoring and juried evaluation for the signature experience), while routine experiences relied on curated scenarios and reusable assets [5], [8]. The scaffolded pathway in **Table 1** serves as a design template: each stage specifies the experiential purpose, typical modalities, and evidence that can be collected using shared rubric dimensions.

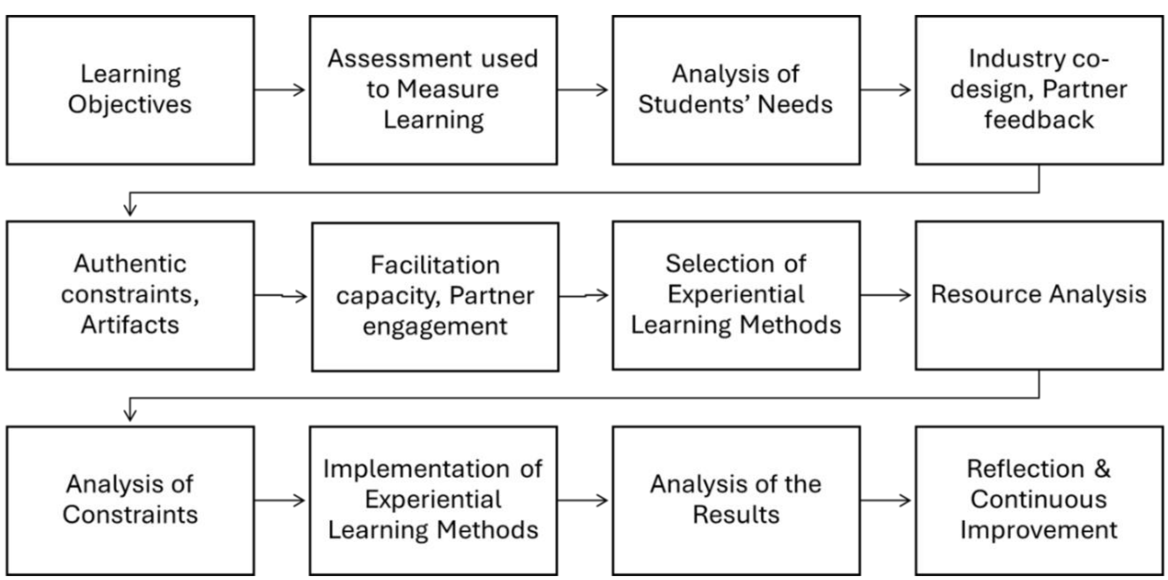

Figure 2. Conceptual model for industry-integrated experiential learning

Figure 2 summarizes the program's logic model for industry-integrated experiential learning, clarifying how inputs and design features translate into measurable outcomes. In this model, key inputs include authentic project scenarios and artifacts, standardized templates and rubrics, faculty/TA facilitation capacity, and targeted partner engagement. These inputs enable learning activities such as artifact-based performance tasks (e.g., bid deliverables and documentation workflows), structured checkpoints and iteration, and partner-informed feedback at high-leverage moments. The model highlights proximal outcomes expected within and across semesters—improved technical task confidence, stronger communication and teamwork behaviors, and higher-quality professional artifacts—as evidenced through rubrics, juried evaluations, and pre/post self-efficacy measures.

Finally, the model links these proximal gains to longer-term outcomes relevant to CM programs, including professional identity development, engagement and belonging, persistence in the major, and improved workforce readiness. By making this chain explicit, **Figure 2** also serves as an implementation guide: it reinforces why partner time is concentrated at specific touchpoints, why iteration and reflection are required (not optional), and why common rubrics and evidence collection are necessary to support program-level evaluation and continuous improvement.

Table 1. Scaffolded experiential learning pathway (illustrative)

Curriculum stage	Primary intent	Typical experiences	Evidence collected / assessment
Year 1 (Intro) Exposure	Exposure, orientation + sensemaking	Micro-experiences: guided demonstrations, short observations, brief reflections; Construction: plan-reading scavenger hunt and jobsite/virtual observation memo.	Reflection memo; short quiz; rubric on observation quality.
Year 2 (Core) Application	Application in bounded problems with templates	Structured cases and role-plays; construction: small-scope estimate, basic CPM schedule, change-order/RFI role-play.	Problem set with rubric; short presentation; peer feedback.
Year 3 (Systems) Integration	Integration across constraints, cross-constraint reasoning	Team mini-projects with trade-offs; construction: methods/logistics/safety plan; coordination decision simulation; BIM-enabled workflow.	Multi-part deliverables; portfolio artifact; teamwork rubric; instructor feedback and revision.
Year 4 (Capstone / Signature) Authentic performance	Authentic performance; professional-level performance	Industry-sponsored project, internship reflection, or competition; construction: simulated bid/competition with juried presentation and Q&A.	Deliverables; panel rubric; Presentation scores; after-action review; partner feedback; self/peer assessment.

4. Experiential module design (industry-integrated)

Industry partners (e.g., contractors, specialty trades, and construction technology providers) were engaged through advisory board and alumni networks. Early alignment meetings were used to clarify shared goals, define deliverable expectations, coordinate schedules, and map module activities to targeted outcomes. Partner effort was intentionally concentrated at high-value touchpoints (mentoring and juried evaluation), while routine activities relied on reusable scenarios, standardized templates, and shared rubrics to support scalability and consistency.

Across modules, learning objectives are stated in observable performance terms (e.g., produce a milestone schedule with defensible logic rather than understand scheduling). Each module includes clearly defined deliverables, a rubric aligned to professional benchmarks, and an after-action review. This common structure strengthens student expectations, supports comparable evidence collection across semesters, and enables longitudinal evaluation. Modules were designed to complement existing course objectives rather than replace core theoretical content [6], [17].

4.1 Module A: Case-based delivery and risk management

Learning objectives are: Justify a delivery method recommendation using project constraints, create a phase-appropriate risk register with ownership and triggers, and communicate trade-offs to different stakeholders.

Activity flow: Students receive a scenario packet and work in teams to identify key constraints and unknowns, propose a delivery method and contracting strategy, generate a risk register with likelihood/impact rationale, and present mitigation strategies tied to measurable indicators. Industry mentors provide examples of how risks are framed, monitored, and communicated in practice.

Students analyze scenarios with incomplete or competing constraints and produce professional artifacts such as a delivery method rationale, risk register, and mitigation plan. Industry reviewers provide targeted feedback on risk framing, constructability assumptions, and clarity of communication, reinforcing professional norms.

4.2 Module B: Bid proposal signature experience (competition-style)

Learning objectives are: Synthesize project documents into an actionable bid strategy, communicate scope, assumptions, and value proposition in a professional proposal format, and perform under change by responding to addenda and stakeholder questions.

Deliverables are: Proposal narrative, estimate assumptions summary, milestone schedule, site logistics plan, safety and quality approach, risk and contingency rationale, and a final presentation deck. The rubric emphasizes defensibility of assumptions, coherence across deliverables, and stakeholder-aware communication.

Equity and accessibility factor: The module is designed so all core work can be completed within the scheduled class time using the provided documents and templates. Optional enhancement tasks (e.g., alternative means and methods) are available, but do not disadvantage students with work or family constraints.

The signature experience is a scenario-driven bid proposal aligned with a collegiate competition format. Teams receive a project package, develop a proposal under tight timelines, and present to an industry jury. The module is structured in two phases: (1) **prework phase**, in which students analyze drawings and documents; perform quantity takeoff; develop a milestone schedule; define an organizational breakdown structure; prepare site logistics; and propose safety management and risk strategies; and (2) **performance phase**, in which teams respond to addenda, update assumptions and deliverables, and deliver a formal presentation and Q&A demonstrating adaptability under pressure.

Example student experience: A student team begins by reviewing the project narrative, drawings, specifications, and addenda to identify scope boundaries and missing information. Team members then divide roles such as estimating lead, scheduling lead, logistics/safety lead, and proposal coordinator. During the midpoint critique, industry mentors question assumptions about access, sequencing, labor availability, and risk contingency. Students revise their estimate assumptions, schedule logic, site logistics plan, and risk rationale before delivering a final juried presentation. The experience concludes with an after-action review in which students identify one defensible decision, one weak assumption, and one improvement they would make in a future bid cycle.

4.3 Module C: Cloud-based project administration and contract management

Learning objectives are: Document project decisions using professional communication norms, maintain traceability across RFIs, submittals, and changes, and coordinate work using a shared information environment.

Activity flow: Students assume role-based responsibilities (e.g., GC project engineer, subcontractor coordinator) and complete a sequence of documentation tasks. Scenarios incorporate incomplete information and competing stakeholder priorities to simulate real coordination dynamics.

Students practice documentation workflows (RFIs, submittals, change management, meeting communication, and closeout documentation) using cloud-based collaboration tools. Instruction emphasizes timeliness, traceability, and stakeholder clarity. Industry examples are used to calibrate expectations for document quality and professional communication.

4.4 Alignment to outcomes and shared assessment

Each module is mapped to program outcomes and ABET-aligned competencies, including problem solving, teamwork, communication, and professional responsibility. Rubrics were co-developed with industry to reflect professional benchmarks and to create consistent scoring criteria across courses. Reflection prompts and brief after-action reviews were used to convert experience into transferable lessons using a simple structure (claim–evidence–next step) [4], [5], [18].

To make assessment expectations more transparent, the bid proposal signature experiential module uses a scoring rubric organized around five dimensions: (1) technical accuracy and defensibility of assumptions; (2) schedule logic, sequencing, and milestone clarity; (3) integration of safety, logistics, quality, and risk considerations; (4) professional communication in written proposal and oral presentation; and (5) teamwork, role clarity, and responsiveness to feedback. Performance descriptors distinguish emerging, developing, proficient, and advanced work. For example, an advanced response not only lists risks, but connects each risk to ownership, trigger conditions, schedule/cost implications, and a feasible mitigation action. This rubric example was selected because it illustrates how professional judgment, not only final numerical accuracy, was evaluated.

Scaling industry-integrated experiences introduces predictable constraints, including partner capacity, safety and logistics, variability in student preparation, and grading load. To mitigate these constraints, implementation emphasized reusable scenarios, standardized rubrics, peer review structures, and selective partner involvement at high-leverage touchpoints. Equity considerations are central: travel-based opportunities can widen access gaps if alternatives are not provided. Virtual site assets, in-class simulations, and transparent selection processes help maintain access, while role rotation and structured team norms support inclusive participation [3], [6], [13], [15].

Table 2 summarizes the core design elements used to make industry-integrated experiential modules scalable and repeatable, linking each element to a guiding question and concrete implementation guidance. The checklist is intended as a practical design aid for instructors and programs seeking to replicate the approach while maintaining alignment, authenticity, equity, and manageable workload.

Table 2. Checklist for designing scalable industry-integrated experiential modules

Design element	Guiding question	Implementation guidance
Alignment	Which outcomes does the activity assess?	Select 2–4 outcomes; publish rubric; define deliverables.
Authenticity	What makes the task resemble practice?	Include constraints (time, incomplete data, stakeholder roles).
Scaffolding	What support do novices need?	Provide templates, worked examples, checkpoints, and role guidance.
Reflection	How will students make learning explicit?	Use structured prompts and after-action reviews: claim-evidence-next step.
Feedback	Where do students receive corrective input?	Include midpoint review, peer-critique, and final juried evaluation.
Equity	Is access fair and feasible for all students?	Ensure in-class time; provide virtual alternatives; transparent team roles
Sustainability	Can this run every year without burnout?	Reuse scenarios; rotate partners; use TA's support and peer review
Evaluation readiness	How to gather input consistently and analyze data?	Collect artifacts and survey data consistently across semesters

5. Evaluation Methods and Data Collection

A mixed-methods design was used to evaluate the module impacts across three consecutive semesters, allowing iterative refinement while maintaining consistent measurement across offerings. Data sources included rubric-scored student artifacts, pre/post-surveys of self-efficacy and engagement, student reflections, and partner/faculty feedback [7], [18].

Participants included undergraduate CM students enrolled in the target courses and industry partners serving as mentors and evaluators. Cohorts spanned three semesters, with approximately 60+ student participants overall.

Quantitative data were collected using pre- and post-surveys assessing student confidence and self-efficacy in technical and professional skill areas. Likert-scale items measured perceived competence in domains such as project administration, contract management, communication, and teamwork. Qualitative data consisted of student reflective journals, open-ended survey responses, and semi-structured interviews with industry partners and faculty.

Quantitative survey data were analyzed using paired-sample statistical tests to identify significant changes from pre to post. Qualitative data were coded thematically to identify recurring patterns related to learning, engagement, and professional identity development.

Student surveys were administered at the module start (pre) and immediately following module completion (post) to capture short-cycle shifts in self-efficacy and engagement. Rubric scoring occurred at key milestones during the deliverable submission and juried review.

Reflection prompts were completed within one week of the performance event and used to triangulate survey findings. Reliability and internal consistency of survey constructs are examined using Cronbach's alpha. For rubric scoring, two raters score a subset of artifacts to estimate interrater agreement and refine rubric descriptors as needed.

Qualitative analyses use an iterative codebook with periodic peer debriefing to reduce interpretive drift and strengthen credibility. Overall, quantitative analyses focus on changes over time in self-efficacy/engagement and patterns in rubric-scored performance, while qualitative analyses use thematic coding of reflections and interviews to identify mechanisms supporting learning transfer and persistence.

Table 3 summarizes the evaluation plan and shows how each data source maps to the constructs of interest, when each measure was collected, and the corresponding analysis approach. The table also clarifies how quantitative (pre/post survey, rubric and jury scores) and qualitative (reflections and interviews) evidence were combined to triangulate findings related to technical competence, professional skills, engagement, and professional identity development. The design emphasizes repeated measurement at consistent points in the module cycle (start, midpoint milestones, and post-module) to enable cross-cohort comparison while maintaining feasibility for routine implementation.

Table 3. Evaluation plan with construct measured (quantifying impact)

Data source	Construct measured	Timing	Analysis approach
Pre/post core student survey (12 items; 1-5 Likert)	Self-efficacy for CM tasks and professional skills (12 survey items*)	Start/end of module (and end-of-semester roll-up)	Paired tests; effect sizes; reliability checks
Rubric-scored artifacts	Technical performance and communication quality	During module milestones	Descriptive stats; trend comparison across cohorts
Presentation/jury scores	Professional performance under constraints	Competition-day / final presentation	Inter-rater agreement; benchmark comparison
Student reflections	Learning transfer, identity, belonging, perceived relevance	Post-module	Thematic coding; frequency of themes
Partner/faculty interviews	Workforce readiness signals and feasibility	Post-semester	Thematic synthesis; design improvement actions

**Note:* Construct measured for pre/post core student survey (12 elements):

1. I can interpret a project's scope and constraints using drawings/specifications and other bid documents.
2. I can produce a defensible quantity takeoff and clearly state key assumptions.
3. I can develop a milestone schedule and justify sequencing and durations.

4. I can create a basic site logistics plan that accounts for access, staging, and safety constraints.
5. I can identify key project risks and propose appropriate mitigation strategies.
6. I can manage RFIs, submittals, and change documentation using a cloud-based project platform.
7. I can communicate issues and decisions in professional written formats (e.g., RFI narrative, submittal comments).
8. I can defend my team's proposal choices during Q&A using evidence and assumptions.
9. I contribute effectively to team coordination (role clarity, deadlines, conflict management).
10. The learning activities reflected realistic construction constraints and professional expectations.
11. I feel better prepared to perform CM tasks in an internship or entry-level role.
12. These experiences increased my motivation to continue in the major.

6. Results

Across semesters, pre/post measures indicate increases in student confidence for core CM tasks (project administration, contract documentation, estimating/scheduling decisions) as well as professional skills (communication, teamwork, negotiation). Rubric-scored deliverables show improvements in the clarity of assumptions, organization and coherence of proposals, and justification of key trade-offs. Student reflections consistently highlight the perceived authenticity of the activities, the value of industry feedback, and a deeper understanding of stakeholder dynamics.

(a) Quantitative outcomes: Across cohorts, pre/post self-efficacy items showed positive shifts across the 12-item instrument. The strongest gains were most often associated with interpreting bid documents, producing a milestone schedule with defensible logic, creating site logistics and risk responses, documenting decisions in a cloud-based environment, and defending proposal choices during Q&A. Rubric-scored artifacts provided complementary performance evidence, particularly in assumption clarity, schedule coherence, proposal organization, and explanation of trade-offs.

(b) Qualitative themes from student reflections: Thematic analysis indicated three recurring themes: (1) increased awareness of trade-offs and uncertainty, (2) improved communication confidence developed through formal presentation and Q&A practice, and (3) stronger professional identity and belonging supported by mentor interactions **(Table 4)**.

Students frequently described industry feedback as a turning point because it made the assignment feel closer to professional practice and helped them understand why documentation, assumptions, and communication quality matter beyond the classroom.

Industry reviewers consistently emphasized the defensibility of assumptions and the clarity of communication. Faculty observations aligned with partner feedback: students who iterated after midpoint critiques showed the largest improvements in proposal coherence, and teams developed more realistic logistics and risk mitigations across repeated offerings.

Table 4. Summary of evidence used to interpret module outcomes

Outcome area	Concrete evidence reviewed	Observed pattern across offerings
Technical task confidence	Pre/post survey items on bid documents, takeoff assumptions, milestone scheduling, site logistics, risks, and cloud-based documentation	Positive shifts across offerings, with the most visible gains in tasks students practiced repeatedly and received feedback on.
Artifact quality	Rubric-scored proposals, schedules, logistics/risk sections, documentation workflows, and juried presentation materials	Improved assumption clarity, stronger sequencing logic, more coherent proposal narratives, and more explicit connection between risks and mitigation actions.
Professional skills	Presentation/jury scores, peer/teamwork evidence, Q&A performance, and written communication artifacts	Students became more confident explaining decisions, defending assumptions, and coordinating roles under time and information constraints.
Engagement and persistence indicators	Reflection prompts, open-ended survey responses, faculty observations, and partner feedback	Students reported higher perceived relevance of coursework, stronger professional identity, and clearer motivation to persist in the CM major.

7. Discussion and implications

The findings indicate that industry-integrated experiential learning can enhance both technical and professional learning outcomes in construction management education. Alignment with ABET outcomes and industry expectations was central to the success of the modules. Importantly, the results suggest that experiential learning can also support engagement, belonging, persistence, and ultimately retention by making coursework explicitly relevant to professional practice—consistent with prior research linking authentic learning experiences to motivation and student success [4], [7], [10].

Overall, the approach appears to operate through four reinforcing mechanisms: (1) authentic constraints that mirror practice; (2) artifact-based performance that requires students to externalize reasoning through professional deliverables; (3) external feedback from industry mentors and juried reviewers; and (4) structured reflection that converts experience into transferable heuristics. The signature bid module is particularly influential because it integrates multiple CM domains and requires professional performance under time pressure and changes [15], [19], [20].

Implementation also faced practical challenges, including coordinating schedules with industry partners, managing additional workload for students and faculty, and maintaining consistency across teams. Lessons learned highlight the importance of clear expectations, structured deliverables, and proactive communication with partners to ensure feasibility and alignment.

Programs seeking to replicate this approach can begin with a single signature experience (e.g., bid proposal and juried review) and then build backward by embedding smaller preparatory activities earlier in the curriculum. A minimal viable implementation includes a scenario packet, a rubric shared with students on day one, two structured checkpoints, and an external review panel. Once this core cycle is stable, additional modules can be added to form a coherent pathway [12], [16], [19].

For programs focused on workforce readiness, the results suggest three practical steps. First, define a signature experiential experience (competition, capstone, client project) and work backward to scaffold preparatory micro-experiences earlier in the curriculum. Second, standardize reflection prompts and a small set of rubric dimensions across courses to reduce student confusion and enable program-level evidence collection. Third, formalize partner engagement through explicit expectations (time commitment, confidentiality, feedback format) and a rotating roster to distribute effort while sustaining consistency.

Based on the study findings, a transferable framework for sustaining academia–industry experiential learning is proposed: (1) early and sustained industry engagement; (2) clear alignment with learning outcomes and accreditation criteria; (3) authentic data and professional evaluation; (4) structured reflection and feedback; and (5) continuous assessment and improvement.

This study is limited by its focus on a single institution and reliance on self-reported measures of learning. Future research should include longitudinal tracking of graduates to examine workforce performance, career progression, and leadership development. Comparative studies across institutions and disciplines would further strengthen the evidence base.

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8. Conclusion

Industry-integrated experiential learning embedded across core CM courses can strengthen students' ability to perform authentic tasks, justify decisions, and communicate trade-offs in professional contexts. This paper provides a reusable curriculum pathway and an accompanying evaluation approach to support sustainable academia–industry collaboration.

The paper presented an industry-integrated experiential learning strategy for construction management education, including a scaffolded curriculum pathway and three transferable module patterns. Evidence drawn from student artifacts, reflections, and partner perspectives indicates that repeated practice under authentic constraints—paired with structured reflection and external feedback—supports students' technical competence, professional communication, and professional identity development. The approach offers a practical roadmap for programs seeking to bridge academia and industry while sustaining partnerships on a scale.

Overall, the results demonstrate that industry-integrated experiential learning can effectively narrow the gap between academic instruction and professional practice in construction management education. By engaging students in authentic, industry-driven experiences, programs can enhance technical competence, professional skills, and persistence in the major.

These findings provide empirical support for experiential pedagogy and offer a practical framework for sustaining academia–industry collaboration. As the construction industry continues to evolve, collaborative and experiential approaches such as those described here will remain essential for preparing resilient, adaptable, and workforce-ready graduates.

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