Industry-Partnered Simulation for Construction Engineering Education: Implementation and Evaluation of the ASPE 11th Hour Bid Day Exercise

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Andrew Kleimola is a construction industry veteran with over 35 years of experience in preconstruction, cost estimating, and construction management. He currently serves as Senior Vice President of Estimating at Accenture, where he has been since November 2024.

Throughout his career, Andrew has led estimating and operations for major capital projects across the United States, spanning aviation, higher education, manufacturing, public works, and hospitality. Before joining Accenture, he has held leadership roles at KMI International, R W Block Consulting, and PCL Construction.

Andrew holds a Bachelor of Science in Construction Engineering and Management from Purdue University. He is a Certified Estimating Professional (CEP) through AACE International.

He is deeply involved in the professional estimating community, serving as Past President of Orlando Chapter 50 and is currently East Regional Governor for the American Society of Professional Estimators (ASPE), and as an active member of ASPE Orlando Chapter 50. He is also a member of AACE International.

A passionate advocate for the estimating profession, Andrew regularly writes and speaks about topics ranging from the role of AI in estimating to the importance of understanding how buildings are actually constructed. He believes that every building gets built twice: first in the estimator's mind, then in the field.

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Raissa Seichi Marchiori is currently a Graduate Research Assistant (GRA) and a Ph.D. student in the Department of Civil, Construction, and Environmental Engineering at the University of Alabama. Raissa obtained her bachelor's degree and an MBA in Civil Engineering in Brazil. Her research topic is in the construction engineering area. Her research interests include implementing Building Information Modeling on construction sites, safety training, workforce development, and engineering education. Through these research topics, Raissa has been publishing papers for peer-reviewed journal and conference proceedings. Also, she is part of Dr. Siyuan Song's research lab, the Safety Automation and Visualization Environment (SAVE) Laboratory, which integrates technologies and education themes to improve building performance and safety engineering.

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Shalena Thomas brings over seven years of construction experience, with her primary experience focus on preconstruction services, cost estimating, scheduling, and construction management. Shalena holds the role of Estimator iI at Accenture. Since joining Accenture, she has worked on program and project

estimates for Orlando International Airport and Florida State University. In her previous role of Project Coordinator, Shalena was ultimately responsible for managing all operations, permitting, program budget management, labor allocation, SOVs, vendor outreach, subcontractor outreach, and value engineering. A great deal of her experience was in the government/public works, multifamily facilities, hospitality, retail, and education sectors. She has been apart of American Society of Professional Estimators (ASPE) for 4 years.

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I am a construction estimating professional with experience in aviation, public infrastructure, and educational facilities. I specialize in quantity take-offs, cost modeling, change order analysis, and supporting owners with budget planning from conceptual through construction documents. I am actively involved in professional development and knowledge sharing within the engineering and construction community.

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ABSTRACT

Undergraduate cost estimating education often relies on static, single-iteration takeoff exercises that do not reproduce bid-day realities such as evolving addenda, incomplete proposals, scope gaps, and compressed decision timelines. As a result, students receive limited supported practice with clarifying scope, normalizing subcontractor proposals, and assembling a defensible total within a fixed window, and students have few structured touchpoints with practicing estimators.

This work-in-progress paper describes the implementation and preliminary evaluation of an 11th Hour Bid Day simulation adapted from the American Society of Professional Estimators (ASPE) for undergraduate engineering education. The activity was delivered during Fall 2025 in an upper-division Project Planning and Regulation course at a public university in the southern United States, with direct participation of ASPE Orlando Chapter 50 professionals serving as facilitators and subcontractor representatives. The simulation engaged student teams in analyzing multiple rounds of subcontractor proposals under strict time limits while conducting live clarifying question-and-answer sessions with industry professionals.

Assessment of student performance among the 31 participating students revealed a bimodal distribution of outcomes, with two teams achieving accuracy within 2% of the target value while three teams exhibited systematic errors resulting in approximately 67% negative deviation due to incomplete scope capture and missing add-ons. One team submitted 236% above target due to cost aggregation errors, and one team was disqualified for late submission. Post-simulation survey data indicated high perceived realism (87% positive) and improved process understanding (90% positive), yet more diffuse confidence levels (67% positive), suggesting the simulation promoted metacognitive awareness of the complexity inherent in professional estimating practice. Student feedback consistently identified direct engagement with industry professionals for proposal clarification as the most valuable component, transforming their understanding from passive document review to active negotiation and scope verification. Time pressure emerged as a double-edged factor that promoted focus yet increased error risk. Students recommended clearer pre-briefings, additional facilitators to reduce question bottlenecks, modestly longer analysis windows, and explicit guidance on final price compilation.

The simulation successfully bridged academic instruction and industry practice through professional society partnership, exposing students to realistic bid-day conditions within a class period. Performance analysis revealed that foundational concepts in bid normalization and scope verification require additional instructional emphasis prior to future simulation exercises. This work-in-progress contributes a replicable model for integrating industry-validated simulations into construction engineering curricula and provides preliminary evidence of learning outcomes and implementation considerations for educators interested in adopting similar industry-partnered experiential learning approaches.

INTRODUCTION

Construction cost estimating represents a critical competency area for construction engineering graduates entering preconstruction and project management roles. However, employers in the construction sector consistently identify estimating and preconstruction services as areas experiencing high workforce demand while simultaneously noting skill gaps among recent graduates [1]. Students transitioning from academic coursework to professional practice often report feeling unprepared for the pace, time pressure, and decision-making complexity characteristic of actual bid day environments [2]. Specific challenges include limited confidence in analyzing incomplete or ambiguous subcontractor proposals, engaging in real-time technical negotiations with trade contractors, managing coordination demands inherent in assembling competitive bids under compressed timelines, and applying judgment when proposal information conflicts or remains unclear [3]. Furthermore, undergraduate construction programs provide students with limited opportunities to interact directly with practicing estimators, reducing exposure to industry norms, professional standards, and the tacit knowledge that experienced practitioners employ during bid day decision-making [4], [5]. These skill gaps have tangible consequences for project outcomes, as inadequate estimating competency directly contributes to cost overruns, schedule delays, and increased risk exposure during construction delivery. Traditional classroom instruction in cost estimating, while effective for teaching quantity takeoff techniques and pricing fundamentals, often fails to replicate the authentic conditions that define professional estimating practice, particularly the integrated nature of technical analysis, interpersonal communication, risk assessment, and time-constrained decision-making that characterizes bid day operations.

This work-in-progress paper describes the implementation and preliminary evaluation of the 11th Hour Bid Day simulation within an undergraduate construction engineering course. The simulation, developed by the American Society of Professional Estimators (ASPE) and available for both professional development and higher education applications [6]. The simulation was implemented with direct involvement of industry professionals from [Regional ASPE Chapter, hidden for peer review] who facilitated the instructional workshop and served as subcontractor representatives during the simulation exercise. The present study examines how the combination of an industry-validated simulation structure with active participation by professional estimators as facilitators and role-players creates an authentic learning environment in academic settings. Through analysis of student survey responses, observation of simulation dynamics, and documentation of implementation processes, this research provides preliminary insights into student learning outcomes, perceived realism and educational value, coordination and time management challenges, and practical considerations for educators interested in adopting similar industry-partnered experiential learning approaches.

BACKGROUND

Experiential learning theory posits that effective learning occurs through iterative cycles involving concrete experience, reflective observation, abstract conceptualization, and active experimentation [7]. This theoretical framework has informed pedagogical approaches across professional education domains, with particular relevance for disciplines requiring integration of technical knowledge with complex interpersonal and decision-making skills [8]. Simulation-based learning represents a pedagogical approach within the broader experiential learning paradigm that creates structured environments approximating real-world conditions while maintaining instructional control and psychological safety for learners [9]. Effective simulations achieve learning objectives through several key mechanisms: compressing time to accelerate exposure to varied scenarios and decision points, heightening decision-making stakes to increase learner engagement and attention, introducing authentic constraints and uncertainties that mirror professional practice environments, and providing opportunities for immediate feedback and structured reflection on performance [10]. Research examining simulation effectiveness across multiple domains indicates that well-designed simulations can accelerate skill development, increase student motivation and engagement, enhance metacognitive awareness regarding competency levels, and bridge gaps between theoretical knowledge and applied practice [11]. The pedagogical value of simulation stems from its capacity to situate learning within authentic problem contexts that require learners to integrate multiple knowledge domains, apply judgment under uncertainty, and experience consequences of decisions in compressed timeframes.

Simulation exercises have been used in many areas of construction education. Al-Jibouri et al. [12] developed a simulation game for teaching construction planning and control, where students plan projects, monitor progress, and solve problems that cause delays. Safety simulations using virtual reality have been shown to improve students' abilities to identify hazards and assess risks. Research shows these methods work better than traditional lectures [13], [14]. Goedert and Rokooei [15] developed project-based simulations delivered in gaming environments for construction methods and equipment education, demonstrating both effectiveness and student engagement through pre- and post-assessment measures. Within cost estimating instruction specifically, experiential learning approaches incorporating hands-on exercises have been documented to promote course learning objectives and provide authentic construction experiences that transcend typical classroom activities [16]. Previous studies on estimating simulations have documented mock bidding exercises where students evaluate subcontractor bids and calculate final bid prices under time pressure. Studies consistently show that hands-on approaches increase student interest, help students remember technical concepts better, and make students feel more prepared for work compared to lectures alone [15], [16]. This body of research establishes simulation-based pedagogy as an accepted and effective approach for developing both technical competencies and professional judgment within construction education contexts.

Within the specific domain of bid day simulation for cost estimating education, two implementations have been documented in recent construction education literature. Korman [5] implemented a semester-long mock bid simulation where students analyzed approximately thirteen bids per student and assembled comprehensive bid packages over an entire academic term. In contrast, Ray et al. [4] implemented a time-compressed simulation requiring students to review subcontractor quotes and compile bid packages under strict time constraints that replicated actual bid day pressure. The semester-long approach emphasizes thorough analysis and reflection, while the compressed format prioritizes rapid decision-making under pressure. Both studies reported positive student perceptions and demonstrated that simulation-based approaches effectively address gaps in traditional estimating instruction by providing authentic contexts for developing technical analysis skills and professional judgment. However, these simulations were developed primarily by academic faculty members for specific institutional contexts, with faculty serving as simulation facilitators and role-playing as subcontractor representatives during the exercises. Additionally, neither implementation documented direct participation of industry professionals during the simulation exercise itself, potentially limiting the authenticity of the negotiation and clarification processes that characterize actual bid day interactions. Furthermore, while Ray et al. [4] employed formal mixed-methods assessment to evaluate learning outcomes, Korman's work focused primarily on exercise design with limited formal assessment of student learning gains [5].

A gap exists in understanding how established industry simulations developed and refined by professional societies translate to academic settings when implemented through partnership models involving direct participation of industry professionals. The ASPE 11th Hour Bid Day simulation represents a mature, industry-validated exercise that has been used for professional development contexts for multiple years, yet its application within undergraduate construction education and the learning outcomes associated with such implementation have not been systematically documented or evaluated in the academic literature. This study addresses this gap by documenting the implementation and providing preliminary evaluation of the ASPE simulation within an undergraduate course context, examining how professional society partnership can enhance authenticity while identifying practical considerations for adoption by construction educators.

SIMULATION DESIGN AND IMPLEMENTATION

The 11th Hour Bid Day simulation was a two-session hands-on learning activity adapted from the American Society of Professional Estimators (ASPE) professional development program. The simulation was delivered during Fall 2025 in an upper-division Project Planning and Regulation course at a public university in the southern United States. The course had 23 Civil Engineering and 10 Environmental Engineering students, with 31 students actively participating (two were absent). Each class session lasted 2 hours and 15 minutes, providing enough time for instruction and hands-on practice. The first session was a training workshop that covered the basics of the competitive bidding process and bid analysis methods through guided instruction and a practice example. The second session was the actual simulation, where students experienced the time pressure and fast decision-making of real bid day conditions.

Session One: Introductory Workshop and Guided Practice

The first session established the foundational knowledge required for effective participation in the simulation. Two industry professionals from ASPE Orlando Chapter 50 delivered instruction on construction delivery methods, with particular emphasis on the design-bid-build approach and hard bid procurement (Figure 1). The presentation distinguished hard bid procurement from alternative delivery methods including design-build, construction manager at risk, and integrated project delivery, contextualizing the hard bid process within the broader landscape of project delivery options.

Figure 1. Industry professional from ASPE Orlando Chapter 50 delivering instruction on hard bid procurement methods.

Next, the session covered how to analyze subcontractor quotes. Students learned to create and interpret quote comparison sheets, commonly referred to as bid tabs in professional practice, which serve as the primary organizational tool for normalizing subcontractor proposals to a common scope baseline. The instruction covered common problems in subcontractor proposals, such as missing work items, material substitutions, incomplete quantity takeoffs, and missing taxes, permits, or bonds. Students were taught to identify these gaps and calculate appropriate add-on costs to achieve comparable totals across competing proposals.

To ensure students understood the analytical process before the time-constrained simulation, the instructional team conducted a guided walkthrough using Division 4 Masonry as a teaching example. Students received three competing masonry subcontractor proposals and worked through the analysis process step by step under instructor guidance. This exercise required students to identify scope inclusions and exclusions in each proposal, formulate clarifying questions to ask subcontractors, calculate required add-ons for taxes and missing scope items, determine comparable totals for each bidder, and select the most appropriate subcontractor based on price, scope completeness, and risk factors. After this practice session, teams received project drawings for a commercial warehouse building to review before the simulation.

Session Two: Bid Day Simulation

The second session was the active simulation where students used the analysis methods they learned under real bid day conditions. 31 students were split into eight teams. Seven teams had four students each, and one team had three students. Each team acted as a general contractor putting together a bid for a commercial building project. Teams chose a team captain who handled communication within the team, kept track of the master bid summary sheet, received bid documents from the instructors, and turned in the final sealed bid package. Other team members looked at specific trade divisions on their own, then shared their work with the full team.

During the simulation, teams analyzed six trade divisions that were not covered in the first session. These included Division 3 (Building Concrete), Division 5 (Structural Steel and Metal), Division 7 (Roofing), Division 9 (Painting), Division 32a (Landscaping), and Division 32c (Site Concrete). For most divisions, teams received three competing bids from different subcontractors. However, for Division 3 (Building Concrete) and Division 32c (Site Concrete), two subcontractors sent combined bids that covered both types of concrete work at once. This matches what happens in real construction, where concrete companies often bid on both building concrete and site concrete as one package. Because of these combined bids, teams looked at 16 separate bid documents during the simulation instead of 18. When combined with the three masonry bids from the first session, teams reviewed a total of 19 subcontractor bids across seven trade divisions to build their complete bid.

Teams received an initial packet containing proposals for selected divisions, with remaining divisions distributed at staggered intervals throughout the simulation period. This phased release replicated realistic bid day conditions where subcontractors submit proposals at varying times, frequently concentrating submissions in the final hours preceding the deadline. The distribution schedule remained consistent across all teams to maintain equity in available analysis time. Additionally, teams received a project addendum during the simulation that modified certain material specifications and clarified ambiguous contract language.

Each team received a packet at the beginning of the simulation (Figure 2). The packet included the invitation to bid issued by the project owner, the project addendum, bid tab templates for each trade division pre-populated with scope line items and budget quantities, a general contractor summary worksheet for consolidating trade totals into the final bid amount, and blank copies of required submission forms designated as Attachment A (Bid Form) and Attachment B (Subcontractor List).

The provision of pre-populated bid tabs with scope breakdowns and estimated quantities represented work typically completed during the weeks preceding bid day in actual practice. This design choice focused the simulation on quote analysis and decision-making activities rather than the more time-intensive quantity takeoff process. Each bid tab template enumerated major scope items for the respective trade, referenced relevant specification sections, included estimated quantities where applicable, and provided space to record each subcontractor's base bid, included and excluded items, required add-ons, and comparable total.

Figure 3 illustrates representative subcontractor proposals for Division 5 (Structural Steel and Metal) that students received during the simulation. As demonstrated in the Figure 3, proposals varied substantially in format, level of detail, and scope completeness, requiring students to perform active interpretation and normalization work rather than simple price comparison. The two proposals present notably different exclusions, with one explicitly addressing bond costs while the other omits this element, and each itemizes different scope limitations that required clarification through direct questioning of the subcontractor representative.

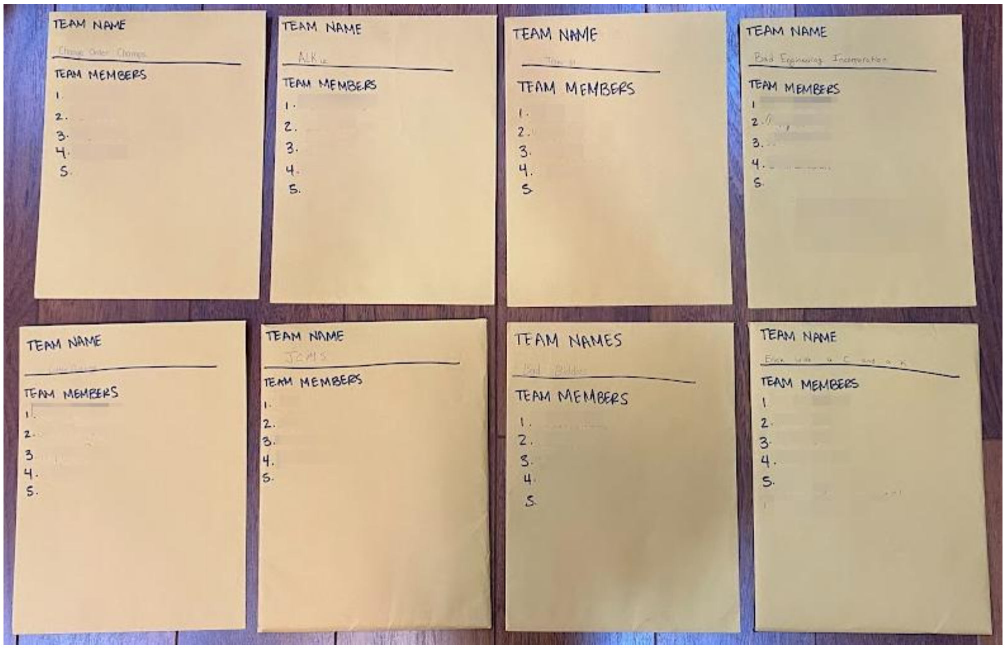
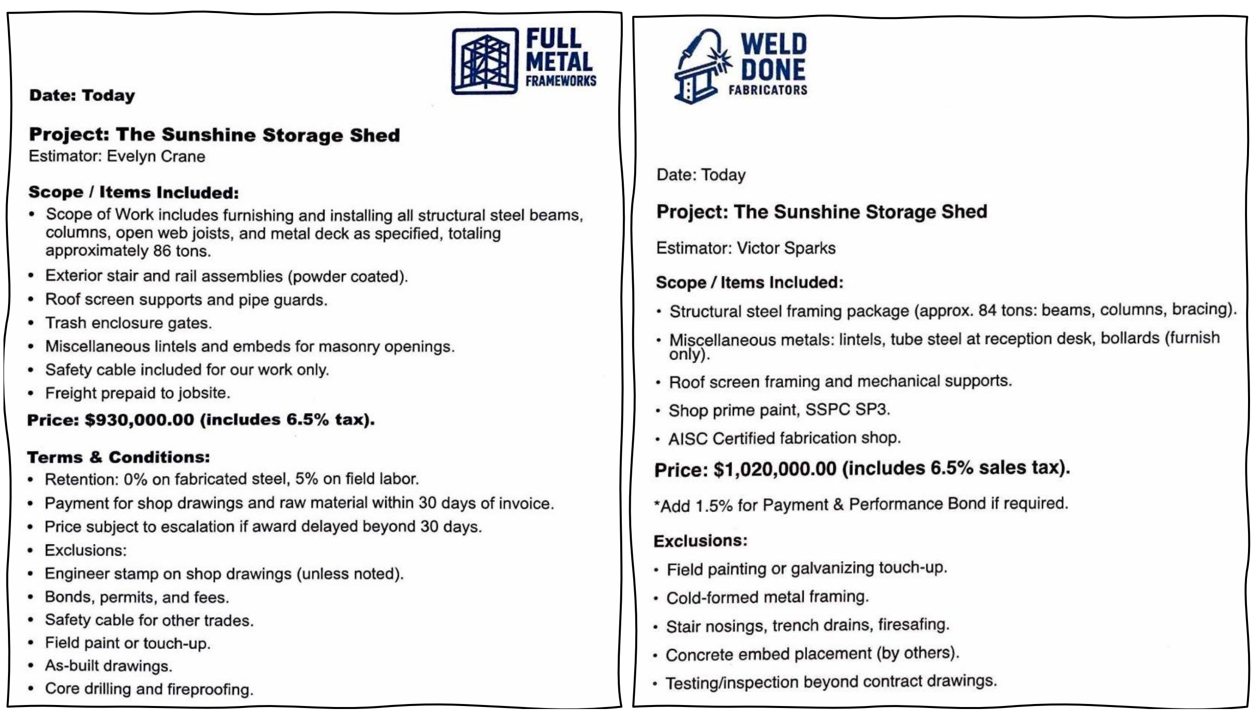


Figure 2. Simulation packets that each student received at the beginning of the simulation



FULL METAL FRAMEWORKS

Date: Today

Project: The Sunshine Storage Shed
Estimator: Evelyn Crane

Scope / Items Included:
- Scope of Work includes furnishing and installing all structural steel beams, columns, open web joists, and metal deck as specified, totaling approximately 86 tons.
- Exterior stair and rail assemblies (powder coated).
- Roof screen supports and pipe guards.
- Trash enclosure gates.
- Miscellaneous lintels and embeds for masonry openings.
- Safety cable included for our work only.
- Freight prepaid to jobsite.

Price: $930,000.00 (includes 6.5% tax).

Terms & Conditions:
- Retention: 0% on fabricated steel, 5% on field labor.
- Payment for shop drawings and raw material within 30 days of invoice.
- Price subject to escalation if award delayed beyond 30 days.
- Exclusions:
- Engineer stamp on shop drawings (unless noted).
- Bonds, permits, and fees.
- Safety cable for other trades.
- Field paint or touch-up.
- As-built drawings.
- Core drilling and fireproofing.

WELD DONE FABRICATORS

Date: Today

Project: The Sunshine Storage Shed

Estimator: Victor Sparks

Scope / Items Included:
- Structural steel framing package (approx. 84 tons: beams, columns, bracing).
- Miscellaneous metals: lintels, tube steel at reception desk, bollards (furnish only).
- Roof screen framing and mechanical supports.
- Shop prime paint, SSPC SP3.
- AISC Certified fabrication shop.

Price: $1,020,000.00 (includes 6.5% sales tax).

*Add 1.5% for Payment & Performance Bond if required.

Exclusions:
- Field painting or galvanizing touch-up.
- Cold-formed metal framing.
- Stair nosings, trench drains, firesafing.
- Concrete embed placement (by others).
- Testing/inspection beyond contract drawings.

Figure 3. Example subcontractor proposals for Division 5

Subcontractor Interaction Process

Industry professionals from ASPE acted as subcontractor representatives during the simulation. As shown in Figure 4, four ASPE professionals sat at two desks at the front of the classroom. Students could come to these desks to ask questions about the subcontractor bids. Each professional represented multiple subcontractors from different trades and answered questions based on the written proposals students received.

To make the simulation realistic, students had to wait in line and could only ask about one subcontractor bid at a time. If students wanted to ask more questions or ask about a different subcontractor, they had to go to the back of the line and wait again. This setup replicated the real bid day situation where estimators must make many phone calls to subcontractors in a short time. Students asked questions to clarify what work was included in each bid, check if materials met project requirements, get prices for missing work, confirm the subcontractor knew about the addendum, and discuss small changes to the scope.

This face-to-face interaction was very different from normal classroom exercises. It gave students real practice in negotiating scope, getting price clarifications, and having technical discussions. The ASPE professionals gave realistic answers. Sometimes they acknowledged missing items, sometimes they provided add-on prices for extra work, sometimes they clarified material types, and sometimes they were deliberately vague so students had to ask better follow-up questions. Students had to think carefully about what questions to ask based on their analysis of the written bids and the project requirements. The line system shown in Figure 4 added time pressure because students had to decide which questions were most important to ask within the limited time available.

Figure 4. ASPE professionals acting as subcontractors while students wait in line to ask questions about their bids

Bid Analysis and Documentation Process

Teams documented their analysis on the provided bid tab templates for each trade division. The analysis process required recording the face value of each subcontractor proposal, identifying and listing included and excluded scope items, calculating required add-ons for sales taxes, subcontractor bonds, or missing work, documenting verbal clarifications or price adjustments obtained from subcontractor representatives, determining a comparable total that reflected complete and compliant scope, and selecting the subcontractor to be used in the final bid based on comparable total, scope completeness, and perceived risk.

Figure 5 presents an example of a student team's completed bid tab analysis for Division 5 (Structural Steel). Teams were required to verify that all proposals incorporated specified materials and methods, acknowledged the project addendum, included applicable sales taxes calculated at 6.5% applied to the material portion of the work (assumed to be 50% of the subtotal if not separately identified), and provided subcontractor bond rates that would be carried forward into the general contractor's cost buildup. As shown in Figure 5, when subcontractors excluded required scope items or provided incomplete information, students documented verbal clarifications in handwriting on the form, calculated add-on costs for missing scope elements, and adjusted initial bid amounts to arrive at comparable totals that could be fairly evaluated across competing proposals.

PROJECT: THE SUNSHINE STORAGE SHED Bid Date: TODAY

5: STEEL Estimator:

Bidding Company Name:	Quantity	BUDGET	Full Metal Frameworks	Steel Deal Inc.	Weld Done Fabricators		
Bid Per Plans & Specifications?		YES		Yes	Yes		
Addenda Included?		1, YES		Yes	Yes		
Sales Tax (6.5%) Included?		YES	Yes	Yes	Yes		
Bond Rate:		YES		Yes	1.5%		
BASE BID:			$930,000	$990,000	$1020,000		
Structural Steel			Yes	Yes	Yes		
Wide-Flange Beams & Columns	84 tons	$ 808,080	Yes	Yes	Yes		
Joists and Deck	21,000 sf	$ 136,500	Yes	Yes	Yes		
Erect Steel	$500/ton	$ 109,200	Yes	Yes	Yes		
Supply Precast Embeds for Steel Connections	Plug	$ 6,500	Yes	$6,500	Yes		
AISC Certified Shop	Per Spec	YES	NO	Yes	Yes		
Miscellaneous Metals			Yes	Yes	Yes		
Supply Bollards (install by Concrete)	2 ea	$ 1,300		Yes	Yes		
Supply Window Lintels (install by Mason)	11 ea	$ 1,560		$1560	Yes		
Supply Countertop Supports (install by Casework)	2 sets	$ 910		$910	Yes		
Supply Tube Steel for Reception Desk Wall (install by Drywall)	3 pieces	$ 390		Yes	Yes		
Cooling Tower Frame	Allowance	$ 1,950		Yes	Yes		
Exterior Stairs & Railing	Allowance	$ 1,950	Yes	Yes	1950		
Unload/Stock supplied material to location	16 hours	$ 1,872		Yes	1872		
SUBTOTAL		$ 1,070,212	$ -	$992470	$1023800	$ -	$ -
Sub Bond	2.00%	Included	$ -	$1012319	$1039179	$ -	$ -
Sales Tax *	6.50%	Included	$ -	$Included	$Included	$ -	$ -
TOTAL		$ 1,070,212	$ -	$1012319	$1039179	$ -	$ -

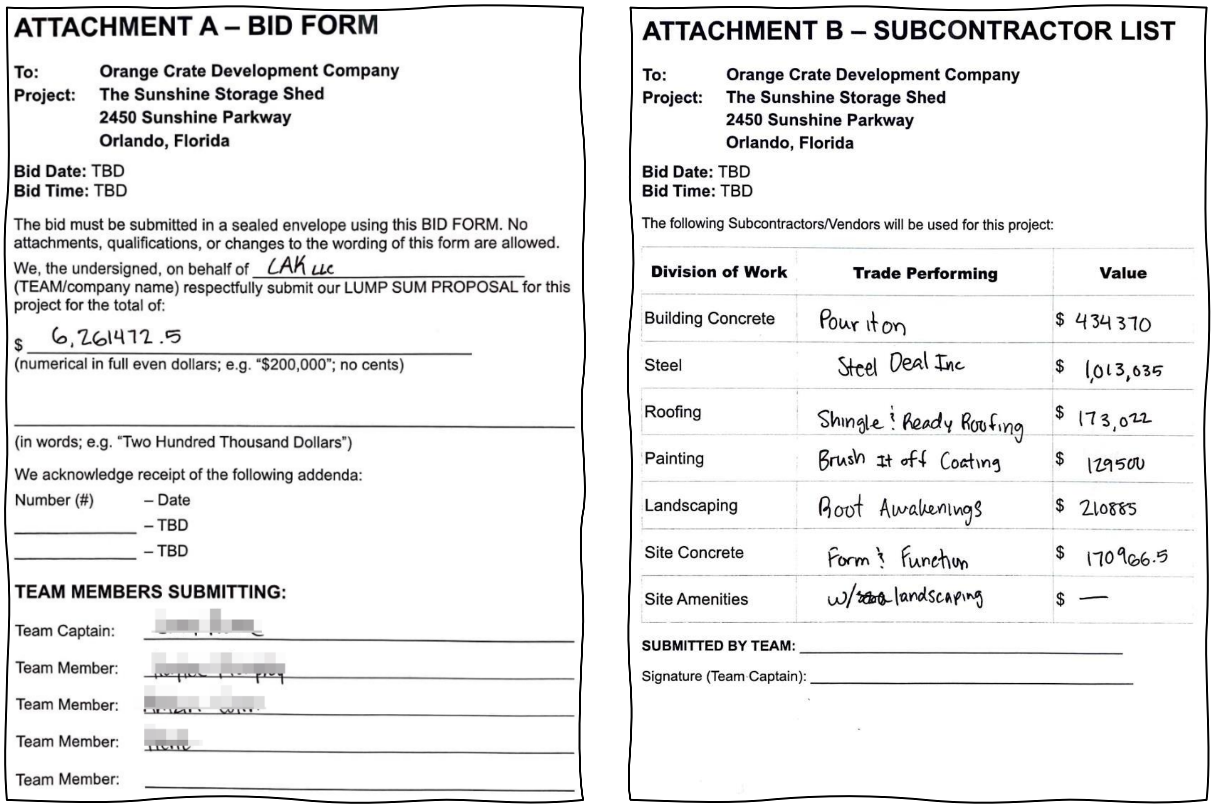
*Tax on Materials Only. If not broken out, use 50% of Subtotal Value for Material Portion.

Figure 5. Example of student team's bid tab analysis for Division 5 (Structural Steel) with handwritten clarifications and comparable total calculations

Final Bid Assembly and Submission Requirements

Teams had to complete two forms to submit their bid. Figure 6 shows these required submission documents. Attachment A (Bid Form) asked for the team name, all team member names, and the total bid amount. Attachment B (Subcontractor List) required teams to write which subcontractor they picked for each trade and how much that subcontractor's price was.

Both forms had to be filled out by hand and put in a sealed envelope before the deadline. The simulation enforced a strict time limit with no exceptions. Teams that submitted even one minute late were disqualified. This strict deadline rule was intentional. In typical classroom settings, instructors may offer some flexibility with deadlines. However, in real construction bidding, there is no flexibility at all. Late bids are rejected immediately, regardless of the reason. The simulation reproduced this reality to show students the critical importance of time management in competitive bidding.



ATTACHMENT A – BID FORM

To: Orange Crate Development Company
Project: The Sunshine Storage Shed
2450 Sunshine Parkway
Orlando, Florida

Bid Date: TBD
Bid Time: TBD

The bid must be submitted in a sealed envelope using this BID FORM. No attachments, qualifications, or changes to the wording of this form are allowed.

We, the undersigned, on behalf of CAK LLC (TEAM/company name) respectfully submit our LUMP SUM PROPOSAL for this project for the total of:

$ 6,261472.5
(numerical in full even dollars; e.g. "$200,000"; no cents)

(in words; e.g. "Two Hundred Thousand Dollars")

We acknowledge receipt of the following addenda:
Number (#) – Date
– TBD
– TBD

TEAM MEMBERS SUBMITTING:

Team Captain:
Team Member:
Team Member:
Team Member:
Team Member:

ATTACHMENT B – SUBCONTRACTOR LIST

To: Orange Crate Development Company
Project: The Sunshine Storage Shed
2450 Sunshine Parkway
Orlando, Florida

Bid Date: TBD
Bid Time: TBD

The following Subcontractors/Vendors will be used for this project:

Division of Work	Trade Performing	Value
Building Concrete	Pour it on	$ 434370
Steel	Steel Deal Inc	$ 1,013,035
Roofing	Shingle & Ready Roofing	$ 173,022
Painting	Brush It off Coating	$ 129500
Landscaping	Root Awakenings	$ 210885
Site Concrete	Form & Function	$ 170966.5
Site Amenities	w/ ~~site~~ landscaping	$ —

SUBMITTED BY TEAM:
Signature (Team Captain):

Figure 6. Required submission forms: Attachment A (Bid Form) and Attachment B (Subcontractor List)

After the simulation ended, ASPE professionals reviewed all submitted bids. They checked that the listed subcontractors could perform the required work according to the plans and specifications. They then compared each team's final bid amount to a target value that ASPE had prepared in advance. The team whose bid was closest to this target was declared the winner. This approach simulated the real process where owners award contracts to the lowest qualified bidder. Due to time constraints in the simulation, ASPE could not evaluate every step of each team's analysis process in detail. Instead, they focused on checking the final submission documents and comparing the final values. While not a perfect evaluation of all the work teams did during the simulation, this method allowed for practical assessment within the available time.

STUDENTS PERFORMANCE

Table 1 shows significant variation in student team performance that provides insight into distinct categories of estimating competencies required under time-constrained conditions. Two teams (CAK LLC and Bad Engineering Incorporation) achieved notable accuracy within 2% of the target value, demonstrating successful integration of scope analysis, subcontractor evaluation, and price adjustments. In contrast, three teams (Team 67, Chang Order Champs, and JCMS) exhibited remarkably similar negative deviations of approximately 67%, suggesting a systematic error pattern related to incomplete scope capture, failure to incorporate required add-ons, or misinterpretation of cost buildup structure. The Badd Bidders team presents an opposing case with a 236% positive deviation, indicating potential double-counting of costs or incorrect markup application, revealing a different category of conceptual error related to cost aggregation logic. Team 8's disqualification due to late submission underscores that successful estimating performance requires integration of technical skills with time management capabilities under pressure. The bimodal distribution of outcomes, with teams clustering either near the target value or at severe deviations, indicates that foundational concepts in bid normalization and scope verification require additional instructional emphasis prior to future simulation exercises to reduce the incidence of systematic errors.

Table 1. Student Team Final Bid Submissions and Deviation from Target Value

Student Team	Estimated Cost ($)	% of Accuracy
Team 67	$2,105,252.48	-67%
CAK LLC	$6,261,472.5	-1%
Bad Engineering Incorporation	$6,201,839	-2%
Chang Order Champs	$2,078,620	-67%
Badd Bidders	$21,221,219.9	236%
Little Duckling	$5,954,235	-6%
JCMS	$2,136,540	-66%
Team 8	Late submission (disqualified)	NA

The wide variation in final bid amounts suggests an opportunity to incorporate order-of-magnitude validation training in future implementations. Teaching students to compare their compiled totals against typical cost-per-square-foot benchmarks for commercial warehouse construction could provide a useful self-check mechanism. Teams submitting $2 million or $21 million for a project valued near $6 million might benefit from having conceptual estimating frameworks to flag potential compilation errors before the deadline, similar to practices used by professional estimators in construction and engineering firms. It should be noted that final bid deviation alone is insufficient to distinguish which specific competencies contributed to or detracted from team performance, and a more structured scoring rubric will be developed for future implementations.

POST CLASS STUDENT FEEDBACK

A post-class survey was created in the learning management system (LMS) consisting of three multiple-choice questions and seven open-ended questions to collect student data. The survey was administered as a required graded assignment to ensure participation, with responses collected anonymously to encourage candid feedback. All 31 participating students completed the survey. One of the questions asked students, "*What parts of the process did you find most valuable?*" Analysis of student reflections revealed several interconnected dimensions of perceived value in the simulation experience. As shown in Figure 7, the word cloud visualization derived from open-ended responses highlighted the centrality of "*questions*," "*subcontractors*," "*valuable*," and "*bid*" as dominant themes, reflecting the interactive and interrogative nature of the exercise. Qualitative feedback consistently emphasized the opportunity to engage directly with subcontractors through clarifying questions as the most valuable component of the simulation.

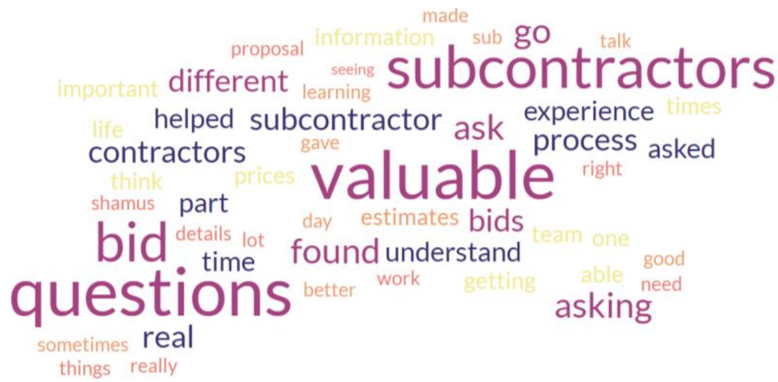


Figure 7. Word cloud of student feedback to the part they found most valuable.

Students described this interaction as essential for understanding incomplete or ambiguous proposals, with many noting that subcontractors provided responses that mirrored real-world practices, including deliberate vagueness that required precise follow-up questions. Multiple respondents indicated that the experience shifted their understanding of the estimating process from a passive document review to an active negotiation and scope verification activity. One student captured this transformation by explaining, "*Originally, I thought that estimates came with all the costs prepared so asking the contractor to clarify was rare but this helped to give me the knowledge that it isn't as simple as I thought.*" Another participant described the pedagogical impact more directly, stating, "*As soon as the task was assigned, it all clicked into place and the estimating process made sense to me,*" suggesting that hands-on engagement succeeded where prior lecture-based instruction had not fully penetrated. Beyond individual skill development in questioning and proposal analysis, students frequently identified team collaboration as a critical value dimension, with several responses describing how team members divided responsibilities, cross-checked one another's analyses, and collectively managed the cognitive load under time pressure. Students also valued exposure to the variability in subcontractor proposal formats and the need to normalize bids across different presentation styles, with one noting that "*having it being fully hands on with receiving some bids at different times and having to go up and ask them questions was very valuable to the process.*" The staged release of proposals at different times was recognized as adding realism and requiring adaptive decision-making. Overall, the feedback suggested that the simulation's primary contribution lay in transforming abstract estimating concepts into tangible, embodied practice through direct engagement with industry professionals and authentic decision scenarios.

Figure 8 presents the distribution of student responses across three Likert-scale items assessing perceived realism, process understanding, and analytical confidence, measured using a five-point Likert scale. The results reveal a noteworthy progression from perceived realism to actual confidence that reflects the complexity of developing estimating competence. The high ratings for realism (87% positive) and process understanding (90% positive) suggest the simulation successfully bridged the gap between theoretical instruction and authentic practice, creating what students recognized as a credible approximation of professional bid-day conditions. However, the more diffuse distribution of confidence scores, with only 67% reporting positive confidence and 20% remaining neutral, indicates that exposure to realistic conditions does not automatically translate into self-assurance in performing the task independently. This confidence gap likely reflects students' heightened awareness of the complexity and risk inherent in bid analysis following direct engagement with ambiguous proposals and time-constrained decision-making. The simulation appears to have achieved dual pedagogical outcomes: it validated the authenticity of the learning experience while simultaneously revealing to students the depth of expertise required for competent practice. The fact that students could recognize the simulation's realism and articulate improved understanding yet remain appropriately cautious about their own skill levels suggests the exercise promoted metacognitive awareness rather than false confidence. This pattern may be pedagogically desirable, as it positions students to approach future learning and early professional experiences with realistic expectations about the ongoing skill development required in preconstruction roles.

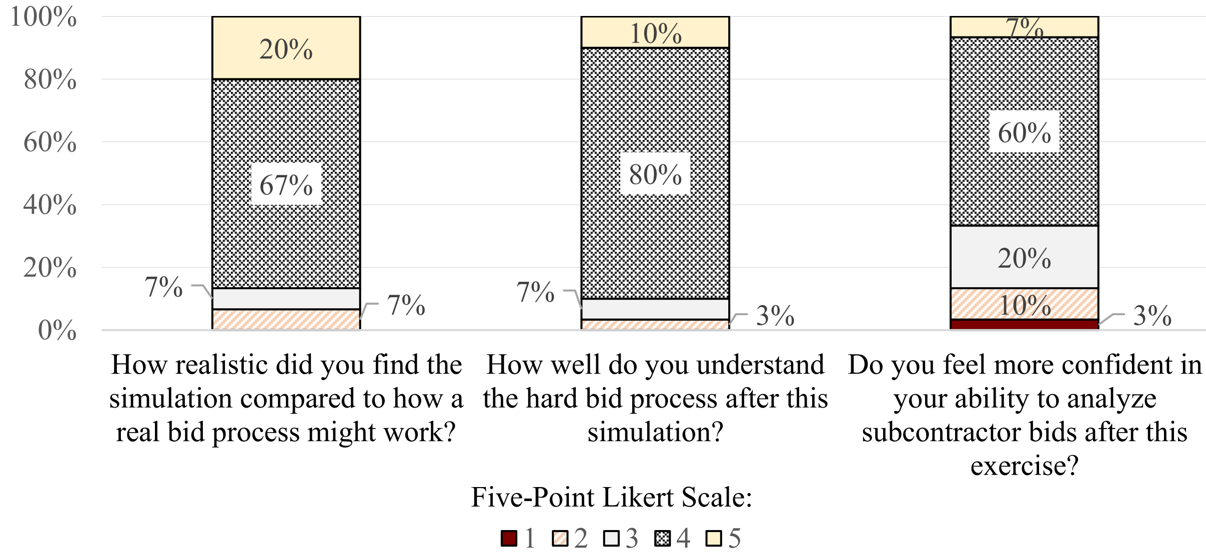


Figure 8. Student perceptions of simulation realism, process understanding, and confidence by course section

CONCLUSIONS

This work-in-progress paper documented the implementation and preliminary evaluation of the ASPE 11th Hour Bid Day simulation in an undergraduate construction engineering course, demonstrating how partnership with professional societies can create authentic learning experiences that bridge academic instruction and industry practice. The simulation successfully exposed students to realistic bid day conditions, including time-constrained decision-making and direct negotiation with industry professionals. Student feedback identified direct engagement with subcontractors as the most valuable component, while assessment revealed high perceived realism and improved process understanding. Analysis of team performance showed significant variation in accuracy, with systematic errors suggesting gaps in scope normalization and cost aggregation that require additional instructional emphasis. Future implementations can be strengthened by incorporating order-of-magnitude validation techniques, developing a structured scoring rubric that evaluates individual bid tab analyses across multiple dimensions including scope identification, add-on calculations, and proposal normalization accuracy, and introducing pre- and post-simulation assessments to more directly measure skill development. Future research should expand implementation across multiple institutions and ASPE chapters to examine generalizability of findings across different institutional contexts and levels of industry facilitation and collect longitudinal data on student preparedness for preconstruction and engineering careers.

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