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Shaping Online Capstone Expectations from Student and Sponsor Experiences: A Pilot Study

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This paper reports preliminary results from an ongoing mixed-methods investigation of Oregon State University's Engineering Senior Capstone Design courses. This study seeks to identify best practices for fully remote capstone courses by interviewing teams in an in-person capstone who conducted most sponsor and intra-team collaboration remotely. Ten student and four industry-sponsor interviews have been analyzed; this is an ongoing study with interviews continuing in the coming years. Guided by insights from the systematic review of virtual capstone pedagogy reported in our ASEE 2025 paper, we translate these themes into provisional guidelines for instructors and sponsors. This paper extends the current state-of-research review by integrating preliminary survey data and pursues three research questions: (1) What benefits and challenges did students and sponsors encounter in the pilot's online setting, (2) Which collaboration practices and digital tools most effectively sustained project momentum and engagement, and (3) How did project modality influence the cohort's ability to demonstrate ABET design outcomes? Results converge on four findings: (1) a weekly meeting plus a single backchannel kept communication timely and courteous; (2) sponsors' unfamiliarity with academic artifacts generated avoidable friction; (3) team cohesion improved in the build phase, yet compressed timelines caused uneven workload and rising stress; and (4) despite tensions, students valued schedule flexibility and sponsors valued access to diverse talent, deeming the remote format professionally viable when expectations were explicit.

Keywords: remote learning, sponsors, project scope, interviews

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Introduction

Senior Capstone Design requirements throughout engineering programs have become synonymous with the Accreditation Board for Engineering and Technology (ABET) accreditation and workforce preparedness[1]. Traditionally, capstone courses are hands-on, team-based projects with physical outcomes. However, fully remote capstone courses have been gaining momentum in recent years, particularly after lessons learned during the COVID-19 pandemic[2-4]. Fully remote offerings may suffer from difficulties with communication, management of sponsors, and ABET standards[5-7]. Yet, even years beyond the pandemic, a percentage of students in the United States still complete their capstone experience online through a limited number of massive distance-education programs[8-12]. This speaks to the need for increased development of quality senior capstone design experiences that focus not only on ABET and institution requirements but also provide a worthwhile experience for students and sponsors alike.

The authors performed a systematic literature review of virtual capstone pedagogy, presented at the American Society of Engineering Education Conference[13]. Our review evaluated 57 potentially applicable articles and parsed it down to 23 relevant sources. This attrition of quality sources speaks to the limited empirical evidence that can help guide engineering capstone course designers. Based on the results of this literature review, a pilot study was designed and performed to capture the perspectives of sponsors and students on their lived experiences working in various formats of hybrid and fully remote collaboration.

This research pursues three research questions: (1) What benefits and challenges did students and sponsors encounter in the pilot's online setting, (2) Which collaboration practices and digital tools most effectively sustained project momentum and engagement, and (3) How did project modality influence the cohort's ability to demonstrate ABET design outcomes? This paper will outline the interview design and outcomes of the pilot study.

Pilot Study

This research seeks to identify best practices for online capstone courses by, as a first step, analyzing teams in an in-person capstone who conducted most sponsor and intra-team collaboration remotely. The programs evaluated were part of Oregon State University's Engineering Senior Capstone, a two-term, eight-credit, in-person sequence offered through both the School of

Mechanical, Industrial, and Manufacturing Engineering (MIME) and the college-wide Multidisciplinary Capstone Program (MCP). Student teams meet each week on campus for studio critiques and faculty mentoring, with access to makerspace (e.g., machine-shop) facilities for prototype work. Outside of that required in-person work by the students, many industry sponsors and students interact with their teams remotely or in a hybrid mode.

Under Institutional Review Board (IRB) approval, all students in the two-quarter, Winter–Spring 2025 MIME and ENGR capstone sections were invited to participate in this study. A single survey link circulated at the start of each team's first and second term explained the study, documented informed consent, and let volunteers choose a 30-minute Zoom slot. Eligibility hinged on having collaborated with their teammates and sponsors primarily through remote or hybrid channels across both quarters.

Students and industry sponsors who met those criteria then completed interviews. Because OSU's capstone program assigned projects before the study began, team composition (e.g., discipline mix, sponsor location) reflected the course's natural variation rather than researcher intervention.

Using purposive sampling, we identified student teams and sponsors whose collaborations featured substantial off-site communication[13]. All invited participants provided informed consent under IRB-approved protocol. The presented data set comprises semi-structured interviews with students and sponsors. As this is an ongoing study, this paper analyzes a partial corpus that currently consists of ten student and four sponsor interviews.

Interviews were conducted in two rounds that bracketed each team's two-term capstone experience. Round 1 occurred during Weeks 8-10 of the first quarter; Round 2 was scheduled during Weeks 6-8 of the second quarter before prototype demonstrations. All sessions were held over Zoom, were audio-recorded with consent, and subsequently transcribed verbatim using WhisperX. The graduate student investigator then post-processed the transcriptions, correcting obvious speech-to-text errors, trimming filler words that obscured meaning, and redacting personal or institutional names.

Thematic (i.e., qualitative) analysis proceeds as a living, iterative process[15-16]. A provisional codebook derived from the study's research questions and major domains in the interview protocol guided the first sweep of coding, with initial categories focusing on communication cadence and collaboration practices, change across terms, and participants' accounts of deliverables and skill development. As fresh concepts surfaced, such as sponsors' requests for concise "decoder briefs" to bridge course-based artifact literacy gaps, they were folded into the codebook and earlier transcripts were revisited to ensure consistency. The themes and guidelines reported in this paper should therefore be read as provisional and will be revisited once the full data set is incorporated.

Pilot Study Results

Ten student and four industry sponsor interviews have been analyzed for this pilot study.

Thematic analysis of the interviews triangulated with course artifacts (sprint logs, peer-evaluation scores, mentor feedback), yielding four interlocking themes that illuminate the day-to-day realities of a fully remote capstone experience. These themes move from the mechanics of communication to the broader questions of workload equity and perceived program value. First, we trace how the frequency of contact shapes project momentum. Second, we document an artifact literacy gap that emerges when course-mandated assignments are not explicitly linked to design decisions. Third, we follow teams' evolving dynamics, showing how rising cohesion can mask late-term workload drift. Finally, we present participants' judgements of the overall viability and professional relevance of a fully remote model. Together, these themes provide insight into the three research questions by revealing the practices that sustain remote collaboration, the pain points that hinder it, and the conditions under which students and sponsors judge the experience successful.

Across the ten student and four sponsor interviews, the predictability of contact, not the specific tool, emerged as the single strongest driver of momentum. Teams that locked in a weekly stand-up or meeting described steady progress and minimal confusion; one student noted meeting their sponsor "two to three times a week over Teams … our standing meeting usually runs between 30 minutes to an hour" and judged communication "very open" and the project "going really well."

When that rhythm slipped to bi-weekly or ad-hoc touchpoints, delays multiplied. A team spent "two weeks" chasing an answer that surfaced only after an accidental face-to-face encounter, while another, relying solely on milestone emails, waited "within a couple of days" for replies that felt "not super frequent." Students traced several late-term redesigns to sponsor response times exceeding a week and called for an explicit 72-hour reply expectation in the statement-of-work.

If frequency of communication kept projects moving, shared understanding of design artifacts determined the quality of that movement. Every sponsor interviewed was familiar with ISO drawings, BOMs, and Gantt charts, yet only one had previously seen a House-of-Quality (HoQ) or Failure-Mode-and-Effects Analysis (FMEA) matrix, tools learned during the OSU Engineering curriculum. Students therefore spent substantial meeting time "walking through what the colored boxes even mean" instead of discussing risk controls or customer priorities. One sponsor quipped that the HoQ slide "looked like a heat-map of Mars," while a student recalled "re-explaining the axes three times before we could talk about the numbers." Although the teams struggled with this, it provides a key opportunity to practice explaining specific engineering tools to customers, considering that they may go into an industry that requires this skill.

Many interviewees agreed that workload drift became most visible during the build phase. One student project manager noted that "attendance to team meetings dropped off by about half the team … it was difficult to motivate them to actually do their work," and the result was unfinished design areas by showcase time. Another student described "unsaid strife within the group" as deadlines tightened: "I'm putting in work—you guys need to be putting in work," while classmates juggled other courses.

Interviewees, both students and sponsors, framed the remote or hybrid element not as a compromise but as authentic rehearsal for modern, distributed engineering work. One student said the project "emulated a job more than most classes … it felt like a co-worker situation with a boss and a client," adding that the two-term span forced them to manage changing requirements "just like in industry". Another participant credited the flexible mix of in-person prototype manufacturing sessions and online coordination for the team's success: "We are succeeding as a team because of the collaboration and us communicating the way we are … it's gone extremely well".

Despite participating inside an in-person capstone course with external sponsors, participants converged on a two-channel workflow that sustained remote or hybrid collaboration: synchronous video for complex decisions and scope pivots, complemented by an always-open chat or email thread for clarifications and file exchange. Hybrid teams stressed that the weekly virtual checkpoints remained the "backbone of coordination," regardless of whether the students could meet on campus.

Both participant groups independently proposed the same remedy for identified challenges: a concise "brief" delivered at project kick-off. Sponsors asked for "just a cheat-sheet" while students wanted a single reference they could point to rather than re-teaching during every call. Two teams that drafted an ad-hoc primer mid-term reported smoother meetings thereafter: discussions shifted from syntax to substance, and review cycles shortened from a week to, in one case, 48 hours.

Overall, remote and hybrid work makes any artifact-literacy gap more noticeable because teams cannot rely on quick, in-person explanations. A short decoder brief given at project kick-off can prevent most of these issues: meetings stay focused, design cycles move faster, and faculty still get the clear documentation needed for accreditation.

Across multiple interview transcripts, students linked the imbalance to remote or hybrid arrangements that mask real-time effort. One participant recalled that meeting online meant "people who weren't able to make it … that's where the breakdown in communication happened," leaving leads isolated in their "own thought bubble" and ordering parts that did not fit the shared specification. Another team member, who expected the second term to be lighter, said it instead "catches up to you at the end" and that "finishing details are a lot", underscoring how late-stage work accumulated when team planning slipped.

Student teams that tracked tasks publicly within the team reported fewer last-minute scrambles. Seeing a Kanban board (a visual project management tool) "fill up red" triggered a spontaneous re-allocation of responsibilities, whereas chat-only coordination "just snowballed and then two of us were up until 3a.m before demo day". Student participants therefore recommended a mid-term checkpoint focused on time-on-task and role distribution to surface imbalances early, echoing their call for transparent workload norms throughout the project lifecycle.

Future Work

Ongoing work will address several of the constraints identified in the pilot study. Specifically, interviews will be conducted with additional sponsors and students now that the fully remote capstone course for Mechanical Engineering has been launched at Oregon State University. A second coder will re-analyze the full corpus to establish reliability once data collection is complete, and the cohort-wide survey will add quantitative context to themes such as workload equity and perceived professional value. A planned multi-institution replication will test whether the weekly-cadence scaffold and artefact-primer intervention can transfer to programs with different schedules, tooling ecosystems, or accreditation regimes.

Conclusion

Results converged on four findings. (1) A weekly meeting plus a single backchannel kept communication timely and courteous. (2) Sponsors' unfamiliarity with academic artifacts generated avoidable friction. (3) Team cohesion improved in the build phase, yet compressed timelines caused uneven workload and rising stress. (4) Despite tensions, students valued schedule flexibility and sponsors valued access to diverse talent, deeming the remote format professionally viable when expectations were explicit.

This capstone program evaluates all student outcome criteria for ABET for on campus, hybrid, and online students. Regardless of modality, students must demonstrate ABET student outcomes 1-7. For online and hybrid students, developing strong abilities in Outcome 3 (ability to communicate effectively with a range of audiences) and Outcome 5 (ability to function effectively on a team) comes into particular focus, as honing those skills in an online or hybrid environment readies them for a globalized workforce. The challenges uncovered by the pilot study are not unfamiliar to in-person capstone programs. On campus students struggle with frequency of meetings and communication (with each other and with their industry sponsor), communicating complex engineering outputs, and team dynamics and workload balance. Insights uncovered in this pilot study and new interventions developed as a result can also contribute to improvements in on-campus capstone programs and student and sponsor experiences.

As more universities transition to offering new or expanded online degree programs, the need for remote senior design capstone experiences will likely continue to grow. Even for programs with solely on-campus students, working with sponsors at a distance can increase the pool of available sponsors and offer up new styles of projects. The insights into online capstone programs, provided by this pilot and subsequent studies, will help inform the continued development of remote and hybrid opportunities that can scale up while maintaining program quality and providing a positive and productive experience for the students and sponsors.

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