An Investigation of Team Conflicts Among First-Year Engineering Students (Year Two of NSF PFE: RIEF)

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Background

Team-based design projects are widely used in introductory engineering courses to allow first-year engineering students to build both technical and collaboration skills. As novice collaborators, interpersonal conflict with teammates is a common challenge for students [1]. In our work, we use the term *engagement-related team conflict* to refer to problems that arise from a report that a team member is disengaged from the team (i.e., not contributing as expected) [2]. Responding to team conflict promptly is a logistical challenge when the student-to-instructor ratio is high, as is often the case with large-enrollment introductory engineering courses. For such a course at our institution, the first author and PI of this project has developed a co-instructional model with engineering undergraduates who have previously completed the course serving as near-peer mentors (NPMs), using a student-to-NPM ratio of 25:1 [3], [4]. Our NSF PFE: RIEF project's goal is to develop a coaching program for NPMs to help mitigate conflicts that arise during team-based design projects. This short paper provides an overview of the work that we have completed so far and some preliminary findings.

The study context is a required first-semester Introduction to Engineering course taken by approximately 700 students every fall semester at the University of Delaware (UD), a large public R1 university in the Mid-Atlantic USA. In this course, students work on a design project in teams of 4-5 and complete self- and peer-evaluations using Comprehensive Assessment of Team Member Effectiveness (CATME) peer evaluation surveys [5]. The lead instructor (PI of this project) uses ~30 NPMs to mentor student teams, grade assignments, and monitor CATME peer-evaluations. While the NPMs do not receive specific training on conflict resolution, the NPMs meet weekly with the course instructor to discuss updates and troubleshoot concerns. Given this background, this project aims to address three research questions:

RQ1. What are the root causes and common characteristics of engagement-related team conflicts in introductory engineering courses?
RQ2. Given a mixed-reality simulation of engagement-related team conflict, how do NPMs facilitate discussions that aim to diagnose and intervene in instances of team conflicts?
RQ3. What features of a coaching program are essential to improve the efficacy of NPMs in responding to reports of disengaged team members with strategies that promote persistence and development of professional habits for all team members?

Data Collection

The Institutional Research Board at UD approved our study protocol. Data collection efforts for all three RQs include both quantitative and qualitative data. So far, we have completed data collection for RQ1 and RQ2; RQ3 data collection is slated to the completed in 2026. To address RQ1 we collected CATME Peer Evaluation survey data across three cohorts of the course (Fall 2023-25), which capture student reflections on teamwork during the semester. We also collected confidential end-of-semester reflections on team conflict from both students and NPMs. These data were collected using two novel survey instruments, the Student Team Reflection (STR)

survey and the Peer Mentor Observation (PMO) survey. Both surveys contain a mixture of multiple-choice, Likert scale, and open-response questions.

In our previous paper in the NSF Grantees Session at the 2025 ASEE Annual Conference, we presented initial results from the STR and PMO surveys [6]. The top sources of team conflicts reported by both students and NPMs at the end of the Fall 2024 semester included: someone not contributing as much as they were capable of, someone losing interest in the course, and team struggling to find times/places to accommodate all teammates' needs [6]. Since then, we have further analyzed the end-of-semester STR and PMO, and within-semester CATME peer evaluation survey data. This revelated that while some teams ameliorated their conflict by the end of the semester, some others stagnate with respect to their conflict [7]. Additionally, while students report evaluating their peers using CATME, the scores or system-generated flags seem insufficient to individuate student performance or alert the NPM to team conflicts [7].

To address RQ2, we developed a simulation scenario to enable NPMs to facilitate discussions with a fictional team of five student avatars: Angela, Ciara, James, Jordan, and Stephanie. The scenario situated this fictional student design team mid semester in the course, included personal and team backstories, and presented scores and peer-to-peer comments from a CATME peer-evaluation survey that would be accessible to an NPM assigned to this team. The scenario details were crafted to indicate to the NPM that three student avatars were not contributing as expected by their teammates due to different primary reasons—logistical difficulties as a commuter, disinterest in the field, and marginalization. Participants engaged in the simulation using Mursion®, a mixed-reality simulation platform, where a trained human simulation specialist (co-PI of this project) voiced and controlled actions of avatars with whom study participants interacted via Zoom. We have elaborated on the development of this mixed-reality simulation scenario in a full paper at the 2026 ASEE Annual Conference [8].

We recruited 15 former NPMs as study participants (12 [80%] served once and three [20%] served twice as NPMs for the course); they were provided details about the scenario and simulation sessions after consenting to the study. The participants came from nine different engineering majors and included different undergraduate statuses: six [40%] sophomores, five [33%] juniors, and four [27%] seniors. The participants represented a variety of racial/ethnic backgrounds, included ten [67%] women and five [33%] men, three [20%] members of the LGBTQ+ community, three [20%] first-generation college students, one [7%] international student, and two [13%] students who are/have been commuter students (demographics based on participant self-identification).

Each study participant engaged in two Mursion® simulation sessions. In their first simulation session, they facilitated one-on-one discussions with three student avatars with the goal of understanding each student's side of the story rather than giving advice or trying to solve the problem. About six weeks later, in their second simulation session, each participant facilitated a whole team discussion with all five student avatars, with the goal of helping the team generate possible remedies for their conflict. Participants were provided a simulation preparation document before each session that provided information about the student team and elucidated the goal for each session. Transcripts were generated from the video recordings of these simulated discussions. We will be employing qualitative analytical methods to characterize NPM "talk moves" within these discussions [9].

In addition to the two Mursion® simulation sessions, all 15 participants completed three surveys to provide information about their experience (1) prior to the simulation: Pre-simulation Survey, (2) of the simulated one-on-one discussion: Between-simulation Survey, and (3) of the simulated team discussion: Post-simulation Survey. Each participant was compensated $200 after completing all these steps. In the following sections, we present a subset of preliminary results from each of these surveys that characterizes the NPM study participant pool for RQ2 data collection and their viewpoints after engaging with the simulation sessions.

Pre-simulation Survey: Experience Before Simulation Sessions

All participants completed the Pre-simulation Survey before engaging in the first simulation session (one-on-one discussions with three student avatars). The survey included two open-response, two 0-10 rating scale, 13 Yes/No choice, and five Likert-scale questions to gather data on participant perspectives and experience with team conflict both as an undergraduate engineering student working on a team design project and as an NPM assigned to a design team.

Participants responded to several Yes/No choice questions related to their experiences with team conflict as a student and as an NPM. As seen in Figures 1 and 2, all participants report experience with engagement-related conflict as a student team member and/or as an NPM.

Reponses to a Likert-scale question on how comfortable and/or prepared they felt as an NPM intervening to resolve a team conflict showed a range of levels: one [7%] responded as “very comfortable”; eight [53%] “somewhat comfortable”; four [27%] “somewhat uncomfortable”; and two [13%] “very uncomfortable.” About half [eight/53%] of the participants reported receiving coaching aimed at helping them make decisions about when or how to intervene to help a design team resolve a team conflict. All participants responded either “somewhat important” [nine/60%] or “very important” [six/40%] when asked about their opinion about the importance of NPMs receiving such coaching.

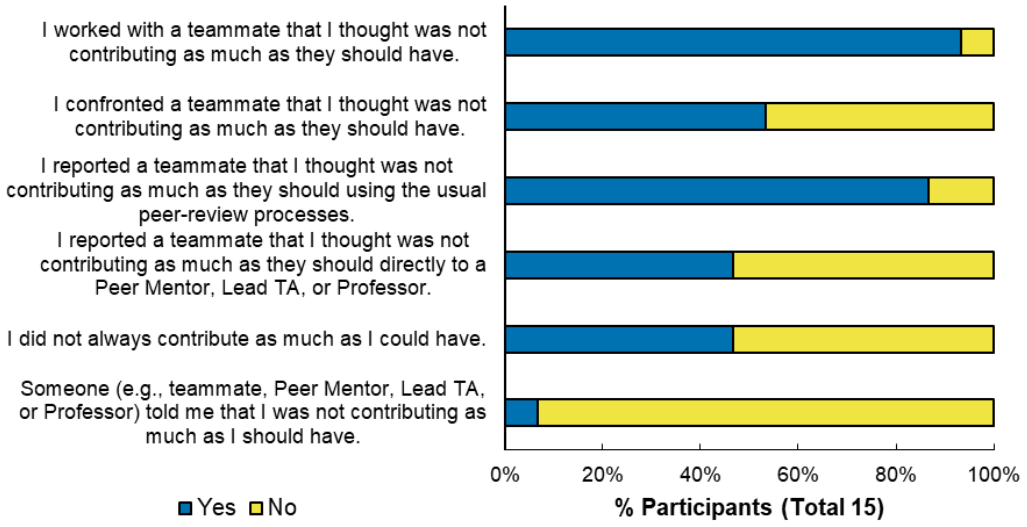

Figure 1. Team conflict experience as a student on a design team reported by study participants in the pre-simulation survey.

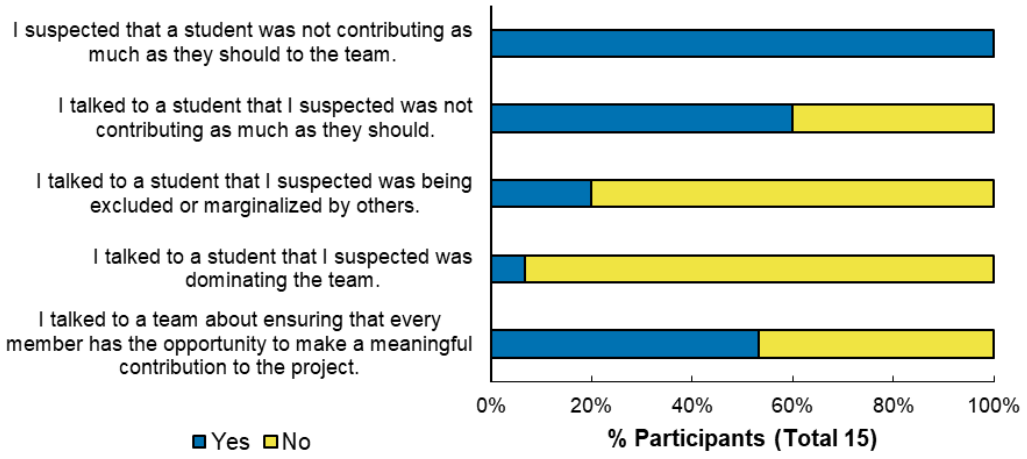

Figure 2. Team conflict experience as an NPM assigned to a design team reported by study participants in the pre-simulation survey.

Between- and Post-simulation Surveys: Experience After Simulation Sessions

All participants completed the Between-simulation Survey between the first (one-on-one discussions with three student avatars: Angela, Ciara, and Stephanie) and second (team discussion with all five student avatars) simulation sessions, and the Post-simulation Survey after completing the second simulation session. Both surveys included questions that collected data on participant perspectives on what they thought were the sources and severity of team conflict according to each of the five student avatars; these results are beyond the scope of this paper. Both surveys also collected data on the helpfulness of the simulation preparation documents and the realism of various aspects of the simulation experience for both sessions. In general, survey results indicate that participants found the simulation preparation documents to be helpful in preparing for and facilitating both the simulation sessions.

The Between-simulation survey included eight multiple-choice, one Yes/No choice, and 16 Likert-scale questions. Figure 3 summarizes participant responses to questions related to realism from the Between-simulation survey. In general, most study participants found the student avatar responses and behaviors to be very/somewhat realistic during the one-on-one discussions.

The Post-simulation survey included one open-response, 15 multiple-choice, ten 0-10 rating-scale, ten Likert-scale questions, and two Yes/No choice questions. Figure 4 shows survey results for questions on realism related to the second simulation session. To ensure that all study participants were starting from the same baseline knowledge about the student team, the simulation preparation document for the second session included notes on all five student avatars written from the perspective of an NPM who had one-on-one discussions with Angela, Ciara, and Stephanie. Most participants found these notes to be “very realistic” or “somewhat realistic”. Results also show that the participants generally found the verbal responses and interactions of the student avatars more realistic than nonverbal.

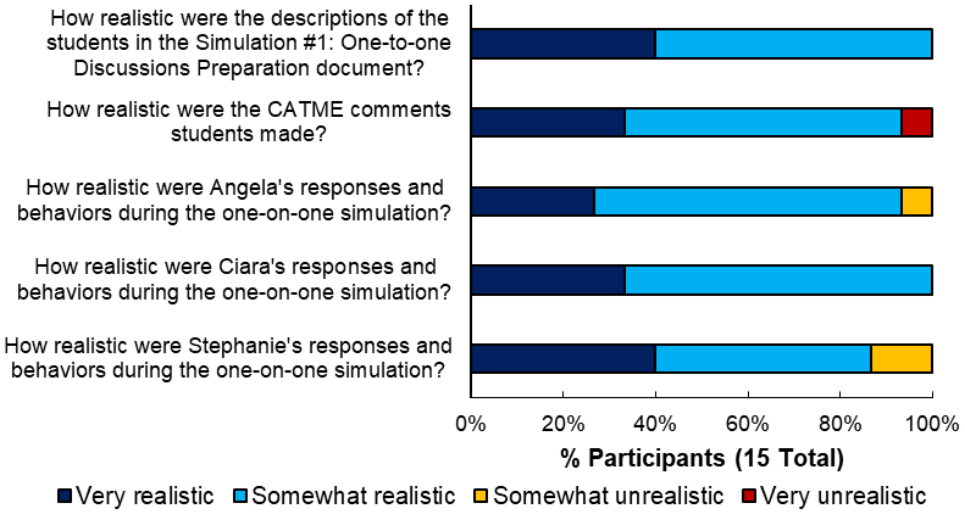

Figure 3. Participant perceptions of the realism of various aspects of Simulation #1: one-on-one discussions with student avatars Angela, Ciara, and Stephanie

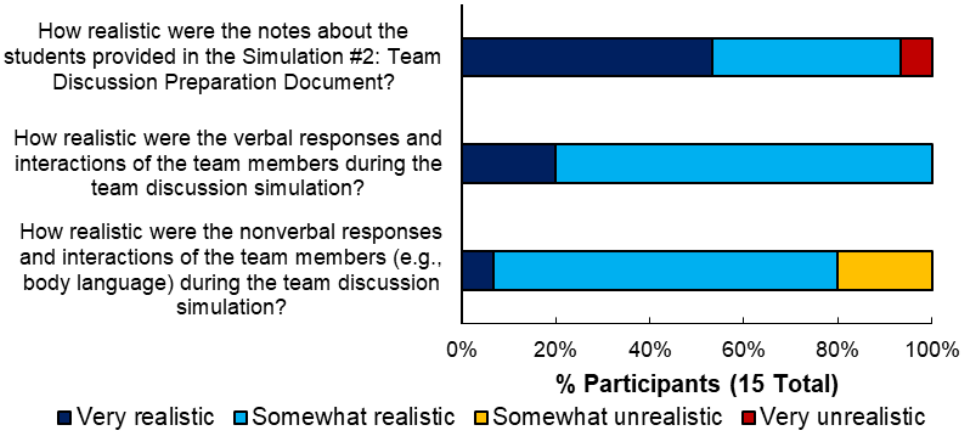

Figure 4. Participant perceptions on the realism of various aspects of Simulation #2: team discussion with the entire team of five student avatars.

Future Work

The study's NPM participants report real-world experience with engagement-related team conflict and recognize the importance of receiving coaching to help mitigate such conflicts. Our data collection efforts for RQ1 are expected to yield rich descriptions of engagement-related team conflicts seen in a large-enrollment introductory engineering class. By using a consistent mixed-reality simulation scenario for data collection in RQ2, we are able to investigate how NPMs currently facilitate conversations with individual students and with a whole team to diagnose and mitigate conflicts. For RQ3, we will be conducting a group-level assessment with former NPMs to determine the baseline knowledge they have about sources of conflict, strategies they use to mitigate them, and their specific coaching needs. With these, we plan to create a logic model for a evidence-informed logic model of a coaching program that promotes self-efficacy among NPMs tasked with responding to teams experiencing engagement-related conflict.

Acknowledgements

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