2026 ASEE ANNUAL CONFERENCE June 21–24, 2026 | Charlotte Convention Center, NC
Host Sponsor UNC Charlotte
ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION
Paper ID #52378

NSF RFE: Faculty and Student Practices Shaping Teamwork Regulation, Psychological Safety, and Conflict Management in First-Year Engineering Project Teams

Mr. Kriz Thomas George, Rochester Institute of Technology
Dr. Mark Vincent Huerta, Virginia Polytechnic Institute and State University

Dr. Huerta is an Assistant Professor in the Department of Engineering Education at Virginia Tech. He earned his PhD in Engineering Education Systems & Design at Arizona State University and has a BS/MS in Biomedical Engineering. His research group explores approaches to building positive and inclusive learning environments that support the professional growth of students and faculty within engineering education contexts. His research interests include graduate student mentorship, faculty development, mental health and well-being, teamwork and group dynamics, and the design of project-based learning classes.

Dr. Ashish Agrawal, Rochester Institute of Technology (CET)

Ashish Agrawal is an Assistant Professor in the College of Engineering Technology at Rochester Institute of Technology. His research interests include exploring the intricacies of STEM curricula, studying the influence of curricular features on students' experiences, and designing equitable interventions and assessing their influence on student learning. He has taught several introductory engineering courses using student-centric approaches such as project-based learning and flipped classroom.

NSF RFE: Faculty and Student Practices Shaping Teamwork Regulation, Psychological Safety, and Conflict Management in First-Year Engineering Project Teams

1. Background

Teamwork is a skill considered essential for engineers to succeed in their workplace [1]. This has led to teamwork and teamwork-related interventions becoming prominent in engineering education [2], especially in the form of project-based learning (PBL) and senior capstone projects. However, despite the increased number of teamwork opportunities for engineering students, there remain issues and gaps in how these skills are taught and assessed [3], [4].

These issues include faculty tending to assess the output of teamwork (e.g., final reports, prototypes) over the process of teamwork [5], and assuming that students will develop teamwork skills through experience rather than through more structured teaching [6]. Prior work has highlighted that conflicts in first-year student teams are common and can erode team dynamics, leading to negative impacts on the team's performance and students' individual experience [7], [8]. These issues are particularly pronounced in the first-year PBL contexts where students have limited teamwork experience [9].

Recent work has started to explore the role of psychological safety, or the belief that team members can take risks without fear of negative consequences, in engineering student teams [9]. This project aims to advance knowledge on how student teams currently regulate their teamwork performance and identify specific approaches that students and instructors can take to foster team psychological safety and enhance students' ability to resolve conflicts within their teams.

2. Aims and Outcomes

This study aims to address critical gaps in how first-year students monitor and adapt their teamwork behaviors, as well as how faculty practices affect this adaptation. Specifically, the project's salient contribution lies in exploring teamwork practices from the lens of psychological safety, which is an understudied area in engineering education. In doing so, we aim to inform the development of pedagogical interventions that can support students' ability to cultivate psychological safety, manage conflict, and regulate their teamwork performance in engineering education PBL contexts. To address these aims, the following research questions guide the project:

1. How do engineering students foster psychological safety, manage conflict, and regulate their team performance (e.g., cooperation, intrateam coaching) in their first-year teams?
2. How do students' perceptions of psychological safety influence how they manage conflict and regulate their team performance while working on first-year teams?
3. How do faculty instructional and assessment practices influence engineering students' team psychological safety, conflict management, and regulation of team performance?

3. Theoretical Framework

To guide our project, we are using an adapted form of Rousseau's integrative framework of teamwork behaviors [10], as shown in Figure 1. This framework organizes teamwork

behaviors in a hierarchical conceptual structure under two basic functions: 1) the regulation of team performance and 2) the management of team maintenance. The regulation of team performance function is further divided into four categories: 1) preparation of work accomplishment, 2) task-related collaborative behaviors, 3) work assessment behaviors, and 4) team adjustment behaviors. The regulation of team performance function is based on action regulation theory [11], which proposes that individuals can attain a high-performance level if they sequentially apply regulation functions of task completion. It transposes the four key functions necessary for task completion (i.e., preparation, execution, evaluation, and adjustment) into teamwork behaviors.

The management of the team maintenance function of the framework is divided into two categories: 1) psychological support and 2) conflict management. These functions account for the team environment and how it impacts the team's ability to resolve conflicts and interpersonal issues that can prevent the team from working effectively. In our framework, we modify psychological support to focus on how students foster psychological safety, a concept that has been increasingly gaining attention from scholars in recent years [12], [13], [14]. Team psychological safety is a shared belief held by members of a team that it's okay to take risks, express their ideas and concerns, speak up with questions, and admit mistakes — all without fear of negative consequences [15]. Empirical research on psychological safety has identified strong links to performance, learning, creativity, and communication [13]. There is also considerable evidence demonstrating the relationship between psychological safety, conflict, and team performance, as depicted by The Team Conflict Dynamics Model [14].

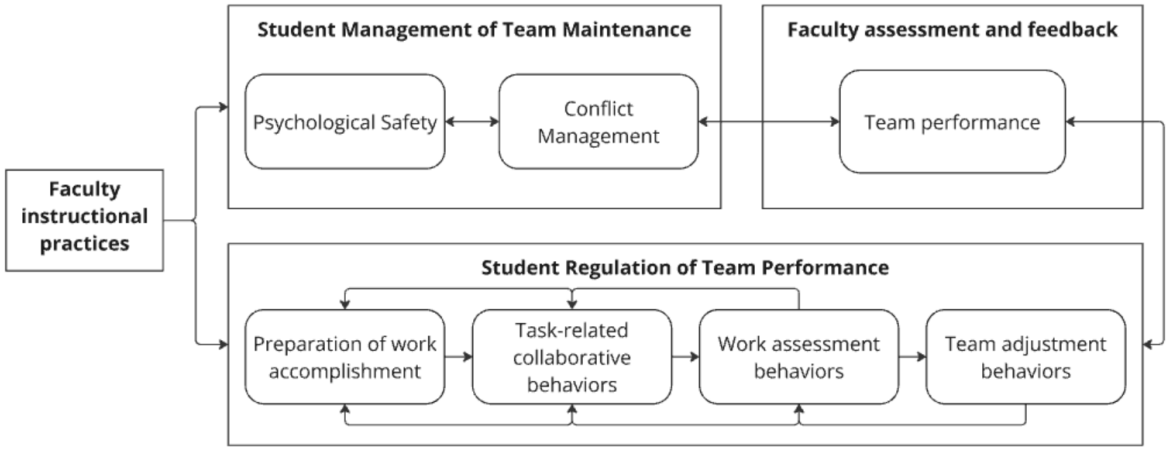

Figure 1. Rousseau's integrative framework of teamwork behaviors adapted to an engineering PBL classroom with the integration of the Team Conflicts Dynamics Model.

Figure 1 provides an overview of our adapted version of Rousseau's framework adapted to the context of an engineering PBL class that integrates faculty instructional and assessment practices. It also depicts the relationships between psychological safety, conflict, and performance in a feedback loop as seen in The Team Conflicts Dynamics Model. Faculty instructional practices refer to how faculty design and implement curricula around team projects and teamwork. It includes their practices around teaching teamwork, facilitations of aspects of teaming and the design process, and how they coach teams. Faculty assessment and feedback refers to how faculty assess team performance, such as team assignments, and provide feedback to teams on their deliverables as well as their teamwork process.

Our framework thus posits that in engineering classrooms faculty instructional and assessment practices impact student teamwork behaviors in a feedback loop, in that the faculty practices influence psychological safety, conflict management, and regulation of teamwork. Simultaneously, students' psychological safety, conflict management, and regulation of teamwork influence each other. We will utilize this framework as a lens to comprehensively understand how students regulate and maintain their teamwork behaviors, how faculty influence these behaviors and comprehensively classify opportunities to improve teamwork pedagogy in first-year PBL contexts.

4. Methods

To address these questions, the project uses a multiple-case study research design that involves two first-year engineering courses of contrasting natures: one at a public R1 university (referred to as site A) and another at a private R2 university (referred to as site B). Data are currently being collected from students and instructors in the form of focus groups, individual interviews, instructional materials, and artifacts generated by team members while working on the course project.

We facilitated focus groups in the mid-to-late semester to provide sufficient time for students to have teamwork experiences. Data collection began in Fall of 2025. In total, we facilitated three focus groups at site A and twelve focus groups at site B in Fall of 2025. The focus groups consisted of 3 to 5 participants, and we ensured no participants in the focus group shared groups.

Participants were also selected for follow-up interviews based on their discussion in the focus group. We made individual notes based on the transcripts of the focus groups, then met to discuss inclusion and exclusion criteria as well as which specific participants should be called back. Participants were selected for follow-up interviews if they provided concrete and unique experiences involving task, process, or relationship conflict, psychological safety, and teamwork regulation. We aimed to sample students who represented a diverse range of experiences including the spectrum of low to high levels of psychological safety and conflict, and different approaches students' used to regulate teamwork. Additionally, we also prioritized sampling participants who were in the same team as another participant to be able to triangulate experiences within teams. Participants were also selected to ensure representation from the different instructors of the course. The follow up interviews are currently ongoing.

These data will be deductively analyzed using Rousseau's integrative teamwork behavior framework to understand how faculty and student practices shape psychological safety, conflict management, and regulation of performance within teams. We have created a preliminary codebook identifying aspects of safety, types of conflict, and regulation of performance.

5. Preliminary Findings

Data collection is still ongoing; however, we have included our preliminary codebook in Table 1. We have also provided some example quotes that are representative of these codes.

Table 1. Preliminary codebook

Code	Definition
Task Conflict	Disagreements about project goals, ideas, or content of the work
Process Conflict	Disagreements about how work gets done e.g. team roles, responsibilities, logistics, workflows
Relationship Conflict	Interpersonal friction, emotional clashes, and personality differences that make people dislike one another
High Psychological Safety	High willingness to take interpersonal risks/share ideas/concerns/ask questions/admit mistakes without fear of negative consequences
Low Psychological Safety	Low willingness to take interpersonal risks/share ideas/concerns/ask questions/admit mistakes without fear of negative consequences
Adaption of Teamwork Behaviors	Team regulation of performance and adjustments made to teamwork behaviors based on teamwork experiences

Several aspects of teamwork as noted in the table above were evident in the focus group data we collected from the participants. Students identified different kinds of conflicts, varying levels of psychological safety while working in the team, and the strategies they adopted to regulate their teamwork.

In one example, Orrin describes how a process conflict due to a student procrastinating on a task and being held accountable by other team members for their lack of contribution. This process conflict, as well as ineffective communication, lead to a task conflict. The team lacked the time and communication to discuss or redo a poorly done assignment.

> *So there was a night before the first project was due... and there was an assignment we had to do... and one person was responsible for it. They hadn't been doing a lot with the project... and they had calculated that the initial launch velocity of the marshmallow was 5,000 inches per second... They're like, 'don't worry about it, it's just math.'... And then they just didn't really respond.... I called them responsible for this kind of poor work, but we were just like, we got to get this done at this point.*

In another example, Octavia experienced a process conflict with teammates failing to show up or communicate their reasons for doing so. This led to a relationship conflict where harsh words were exchanged over group text that led to the instructor being asked to intervene.

> *So the two other people in my group... weren't submitting the work on time or just weren't showing up to class... So we had someone who was out for a week with no response [on the group chat]... And then we're all kind of left in the dark... that's kind of what led to our conflict, especially in the group chat. There wasn't very respectful words from certain people, so I was like, okay, well maybe it's just time to have a professor mediate it and just scrap it out.*

In a positive example, Oisin kept the same group across both projects. In discussing the team dynamic, he found that high psychological safety led to task conflict. These disagreements were to the benefit of the ideation process and performance of the team.

> *During the first project... was a little more iffy, but it was like we are getting used to each other. And... going into group two... we respect each other to the point where...*

> *we feel comfortable with each other to just be like, 'Hey, this is what we got to do. How are we going to do this?' We take everyone's ideas and we're like, 'all right, what's the best one?' I think a lot of it's just respect for peers and just acknowledging that someone's idea may be better than yours, but it's not just acknowledging that, it's like 'why is it?'*

Ocea experienced the differences between low and high psychological safety across two teams. The responses of her team members to her shared ideas affected her psychological safety, i.e. her willingness to share.

> *For my first team, I wasn't as comfortable sharing my ideas more because they got questioned a lot. And then so once they kept getting questioned, I kind of just stopped sharing them. For my new team that I'm in now, I feel more comfortable sharing my ideas. They actually listen to what I say instead of right off the bat just not letting me finish and just questioning everything.*

Ojo experienced how team adaption could occur when process conflict occurred in a team with high psychological safety. A team member volunteered for a role they were unable to fulfill, only informing the team at a very late stage. The team discussed expectations and reassigned roles for the rest of the project.

> *In my first group, early stages we're like, okay, you can do X, Y, Z, you can do A, B, C, and then I'll do the other stuff. But then for the person who said, okay, I'm really good at this 3D modeling business, I can do it, don't worry. I call at 11:30 PM on the day of the submission for the 3D model itself, he says, 'Hey, I can't get this done.' And we're like, 'yeah. So it's really important to know what you can do,*

As can be seen from above, the different aspects of teamwork experiences are related in that one kind of conflict often leads to another. Similarly, students' experience of psychological safety affects how the team completes the tasks at hand.

6. Next Steps

At the current time, data collection has been completed at one research site and is ongoing at the second research site. Our next steps are to evaluate these data more comprehensively, including looking at faculty interviews to understand how they facilitated teamwork in class.

The project has broader implications for instructors, students, and the engineering profession. We anticipate the results of this project will provide faculty with insights into student practices and challenges in regulating their teamwork behaviors, establishing psychological safety, and conflict management in PBL contexts. The results will highlight specific strategies instructors can use in their pedagogy to support teamwork processes. This will also contribute to broader efforts to create curricula that explicitly addresses teamwork dynamics.

Acknowledgements

This material is based upon work supported by the National Science Foundation under Award No. 2155547/2515548. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

References

[1] H. J. Passow, "Which ABET Competencies Do Engineering Graduates Find Most Important in their Work?," Journal of Engineering Education, vol. 101, no. 1, pp. 95–118, Jan. 2012, doi: 10.1002/j.2168-9830.2012.tb00043.x.

[2] "Criteria for Accrediting Engineering Programs, 2022 – 2023 | ABET." Accessed: Jan. 23, 2023. [Online]. Available: https://www.abet.org/accreditation/accreditation-criteria/criteria-for-accrediting- engineering-programs-2022-2023/

[3] R. Martin, B. Maytham, J. Case, and D. Fraser, "Engineering graduates' perceptions of how well they were prepared for work in industry," European Journal of Engineering Education, vol. 30, no. 2, pp. 167–180, May 2005, doi: 10.1080/03043790500087571.

[4] Committee on Understanding the Engineering Education-Workforce Continuum and National Academy of Engineering, Understanding the Educational and Career Pathways of Engineers. Washington, D.C.: National Academies Press, 2018, p. 25284. doi: 10.17226/25284.

[5] C. Picard, C. Hardebolle, R. Tormey, and J. Schiffmann, "Which professional skills do students learn in engineering team-based projects?," European Journal of Engineering Education, vol. 47, no. 2, pp. 314–332, Mar. 2022, doi: 10.1080/03043797.2021.1920890.

[6] H. Matusovich, M. Paretti, K. J. Cross, and A. Motto, "Teaching teamwork and communication in engineering: Strategies and Opportunities," in 2012 IEEE International Professional Communication Conference, Orlando, FL, USA: IEEE, Oct. 2012, pp. 1–4. doi: 10.1109/IPCC.2012.6408646.

[7] M. Borrego, J. Karlin, L. D. McNair, and K. Beddoes, "Team Effectiveness Theory from Industrial and Organizational Psychology Applied to Engineering Student Project Teams: A Research Review," Journal of Engineering Education, vol. 102, no. 4, pp. 472–512, Oct. 2013, doi: 10.1002/jee.20023.

[8] C. L. Colbeck, S. E. Campbell, and S. A. Bjorklund, "Grouping in the Dark: What College Students Learn from Group Projects," The Journal of Higher Education, vol. 71, no. 1, pp. 60–83, Jan. 2000, doi: 10.1080/00221546.2000.11780816.

[9] M. V. Huerta, S. Sajadi, L. Schibelius, O. J. Ryan, and M. Fisher, "An exploration of psychological safety and conflict in first-year engineering student teams," Journal of Engineering Education, vol. 113, no. 3, pp. 635–666, Jul. 2024, doi: 10.1002/jee.20608.

[10] V. Rousseau, C. Aubé, and A. Savoie, "Teamwork Behaviors: A Review and an Integration of Frameworks," Small Group Research, vol. 37, no. 5, pp. 540–570, Oct. 2006, doi: 10.1177/1046496406293125.

[11] M. Frese and D. Zapf, "Action as the core of work psychology: A German approach," Handbook of Industrial and Organizational Psychology, vol. 4, pp. 271–340, 1994. As cited by [10]

[12] B. Bergmann and J. Schaeppi, "A Data-Driven Approach to Group Creativity.," Harvard Business Review Digital Articles, pp. 2–5, Jul. 2016.

[13] A. C. Edmondson and D. P. Bransby, “Psychological Safety Comes of Age: Observed Themes in an Established Literature,” Annual Review of Organizational Psychology and Organizational Behavior, vol. 10, no. Volume 10, 2023, pp. 55–78, Jan. 2023, doi: 10.1146/annurev-orgpsych-120920-055217.

[14] T. A. O’Neill and M. J. W. McLarnon, “Optimizing team conflict dynamics for high performance teamwork,” Human Resource Management Review, vol. 28, no. 4, pp. 378–394, Dec. 2018, doi: 10.1016/j.hrmr.2017.06.002.

[15] A. Edmondson, “Psychological safety and learning behavior in work teams,” Administrative Science Quarterly, vol. 44, no. 2, pp. 350–383, Jun. 1999.