Using a scenario-based learning approach with instructional technology to teach conflict management to engineering students

Olivia Ryan, Virginia Tech Department of Engineering Education

Olivia Ryan is a Ph.D. student in Engineering Education at Virginia Tech. She holds a B.S. in engineering with a specialization in electrical engineering from Roger Williams University. Her research interests include developing professional skills for engineering students and understanding mathematics barriers that exist within engineering.

Marin Jayne Fisher, Department of Engineering Education at Virginia Tech

Marin is a doctoral student from Aurora, IL. She holds a B.S. in mechanical engineering from Brigham Young University. Her current research interests include teamwork in student teams and religious identity within engineering. When not working on research, she enjoys hikes, road biking, and coaching high school color guard.

Lisa Schibelius, Virginia Tech Department of Engineering Education

Lisa Schibelius (rhymes with rebellious) is a Doctoral Candidate in the Department of Engineering Education at Virginia Tech (VT). She holds both B.S. and M.S. degrees in mechanical engineering with an aerospace concentration from the University of South Alabama. Prior to beginning her studies at VT, she worked as an engineer for 4 years at Airbus in the retrofit of aircraft cabins with experience in project management, automation, airworthiness, and additive manufacturing. Her research interests leverage her experiences from industry and are centered on culture, team dynamics, and conflict management, as well as global engineering and art & creativity in engineering.

Dr. Mark Vincent Huerta, Virginia Polytechnic Institute and State University

Mark Huerta is an Assistant Professor in the Department of Engineering Education at Virginia Tech. He earned his PhD in Engineering Education Systems and Design at Arizona State University and has a BS/MS in Biomedical Engineering. Dr. Huerta's research interests include exploring approaches to cultivating positive, inclusive learning environments and the development of professional skills (e..g, teamwork, leadership) in engineering education contexts.

Dr. Susan Sajadi, Virginia Tech

Susan Sajadi is an assistant professor at Virginia Tech in the department of engineering education. She has a BS and MS in Biomedical Engineering and a Ph.D. in Engineering Education Systems and Design from Arizona State University. Prior, she worked as an engineer in the medical device industry.

Using a scenario-based learning approach and instructional technology to cultivate conflict management skills in engineering students

Abstract

This evidence-based practice paper shares the methodology and findings of a workshop on conflict management that was piloted in three interdisciplinary engineering design courses that include first through fourth-year students. The workshop was designed to collect real-time student reflection data through Mentimeter, an instructional technology designed to promote class engagement.

Background: Emerging literature from Industrial and Organizational (I/O) Psychology has highlighted the importance of effective conflict management on team performance. Teaching students how to effectively manage conflict and establish inclusive, psychologically safe team environments are essential skills for effectively working on teams in preparation for the workplace, as emphasized by ABET and professional engineering organizations. Despite this, literature suggests that many engineering instructors have limited training and confidence in facilitating learning experiences that help students develop teamwork skills, including conflict management skills. While conflict management is a large field of research, there has been minimal research on instructional strategies for teaching conflict management skills to engineering students. The purpose of this paper is to share the methodology and findings of a conflict management workshop that was delivered to engineering students in three different project-based learning courses involving year-long design projects: a first-year foundations of engineering course, an interdisciplinary design course for first through four-year students from multiple majors, and a senior interdisciplinary engineering capstone course. Students' primary conflict management strategies are understood using the Dual Concern Model, which aligns conflict along two dimensions of concern for self (assertiveness) and concern for others (cooperativeness) with five conflict management strategies: *Forcing, Problem Solving, Compromising, Avoiding,* and *Yielding.*

Methods: The workshop leveraged scenario-based learning and Mentimeter to foster engagement and collect real-time reflection data. Before each class, students took the Dutch Test for Conflict Handling, which identified the extent to which students use the five different conflict management approaches. At the beginning of the workshop, students were introduced to conflict management approaches and encouraged to reflect on how they typically handle conflict. Next, students were introduced to two scenarios involving task, relationship, and process conflict. The scenarios were developed and specifically related to an engineering context with real-world situations students may encounter as a design team. During each scenario, students assumed a randomly assigned role and then role-played the scenario in groups of four to five. Mentimeter was used to collect student reactions to each scenario, reflections about their experience in their

assigned role, solutions their team came up with, and key takeaways from the workshop, all in real-time.

Findings: This paper shares the methodology for creating a scenario-based workshop and collecting data using Mentimeter. The quantitative results indicated that students aim to use a *Problem Solving* approach as their primary conflict management strategy. The qualitative responses from student reflections about the workshop showed that many students expressed a desire to move along the cooperative and assertive spectrum of the Dual Concern Model. Students discussed the importance of communication, indicating movement along the cooperation dimension. Additionally, students discussed movement along the assertive spectrum and were surprised that *Forcing* can be used as an effective conflict management strategy. Students also recognized the trade-offs involved when using different conflict management approaches and the importance of empathy when managing conflict. The implications of these findings are discussed in the paper, along with directions for future research.

Keywords: scenario-based learning, conflict management, pedagogy, teamwork, instructional technology, Menti, teaching and learning, Industrial and Organizational Psychology, interdisciplinary

Introduction

Teamwork is considered one of the key competencies engineering students should develop during their undergraduate educational experience. The ABET competency related to teamwork states that students should develop "an ability to function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives" [1]. Additionally, literature from Industrial and Organizational (I/O) Psychology has highlighted the relationship between effective conflict management and team performance [2], [3]. Helping students effectively manage conflict and establish inclusive team environments are important skills that are essential for their ability to work on teams in their future careers. However, the literature suggests that many engineering instructors have limited training and confidence to facilitate learning experiences that help students develop teamwork and conflict management skills [4], [5]. One way to help students develop and practice conflict management skills in the classroom is through scenario-based learning. Conflict scenarios have been used in prior studies to understand and develop conflict management skills, while role-playing serves as an opportunity for students to practice their skills in a low-stakes environment [6]–[8]. This evidence-based practice paper outlines a workshop that was developed for students to learn about conflict management and practice using conflict management strategies in real-world-inspired scenarios. This paper shares preliminary results highlighting students' key takeaways from participation in the workshop. The purpose of this paper is to introduce this method for a conflict management workshop using scenario-based learning and instructional technology and identify the impact of the workshop on students' perspectives about handling conflict.

In preparation for the workshop, students took the Dutch Test for Conflict Handling (DUTCH) survey instrument to determine their primary conflict management strategy. Students then participated in the workshop and shared their key takeaways that reflected the impact of the conflict management workshop to improve students' understanding and approaches to handling conflict. Thus, this study seeks to answer the following research questions:

RQ1: What are engineering students' primary conflict management strategies?
RQ2: What are engineering students' key takeaways from a conflict management workshop?

Theoretical Framework

Conflict management can be understood using Dual Concern Theory, which aligns conflict handling along two dimensions: concern for self and concern for others [9]–[11]. As seen in Figure 1, the Dual Concern Model describes five primary approaches to handling conflict, which fall along two axes: assertiveness and cooperativeness.

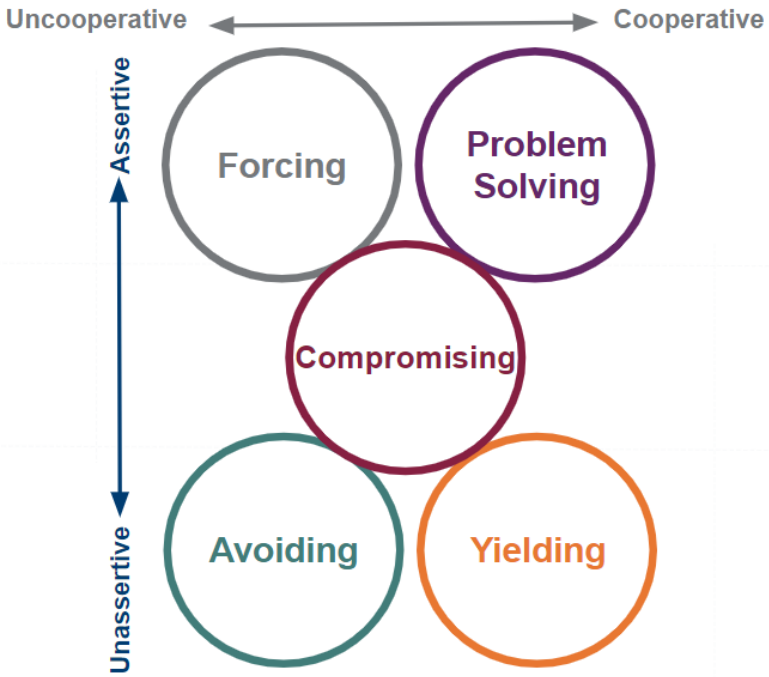

Figure 1. *Dual Concern Model* [9].

The Dutch Test for Conflict Handling is a validated instrument designed to measure an individual's approach to handling conflict [12]. The DUTCH has been validated for use in the workplace and similar studies across the United States [9]. The DUTCH is grounded in Dual Concern Theory to identify the extent to which individuals use the five conflict management strategies: *Yielding, Compromising, Forcing, Problem Solving,* and *Avoiding*. The DUTCH survey asks the participant to respond to the prompt "*When I have conflict at work or school, I do the following:"* for 20 total items using a 5-point Likert scale that ranges from "not at all" to

“almost always.” Each item corresponds to a specific conflict management style, and each conflict management style has four questions associated with the style. The student results are calculated by adding up their rating of the items that correspond to each specific conflict management style. Table 1 provides example survey items for each conflict management approach in the DUTCH.

Table 1
Overview of Conflict Management Approaches

Conflict Approach	**Example survey item in DUTCH [12]**
Yielding	“I try to accommodate the other party.”
Compromising	“I insist we both give in a little.”
Forcing	“I push my own point of view.”
Problem solving	“I examine ideas from both sides to find a mutually optimal solution.”
Avoiding	“I try to avoid a confrontation with the other.”

Methods

A conflict management workshop was designed and facilitated for three different project-based learning courses involving year-long design projects: a first-year foundations of engineering course, an interdisciplinary design course for first through fourth-year students from multiple majors, and a senior interdisciplinary engineering capstone course. The workshop utilized Mentimeter (Menti) to promote engagement and support data collection. Menti is an instructional technology that enables instructors to collect responses to specific prompts from students in real-time. The workshop also leveraged scenario-based role-playing activities to allow students to practice conflict management approaches with their peers in a low-stakes setting. Using Menti, data was collected and insights were gained about what students learned from the workshop and how groups of students may handle different types of conflict in realistic scenarios. This section also includes details on research participants, the design of the workshop, data collection, and data analysis.

Participants

In total, there were 210 participants across the three courses. The demographic distribution is shown in Table 2. Individuals were able to select multiple races or ethnicities.

Table 2
Participant Demographics

Gender	Number of Students
Male	166
Female	42
Non-binary	1
Prefer not to say	1
Race or Ethnicity	
Asian	69
Black or African American	12
Hispanic, Latino, or Spanish Origin	21
Middle Eastern or North African	10
Native Hawaiian or other Pacific Islander	3
White	118
Other or Prefer not to Answer	6

Conflict Management Workshop Overview

After ensuring that all participants were connected to Menti, the workshop was organized into four primary phases: 1) a reflection on the pre-survey, 2) a lecture that provided an overview of conflict management strategies and types of conflict, 3) scenario-based role-playing activities, and 4) a post-activity reflection. An overview of the workshop is also described in Figure 2.

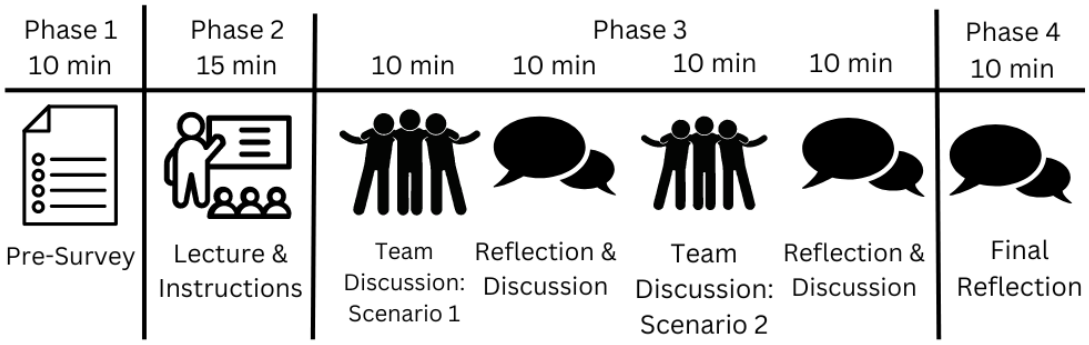

Figure 2. *Workshop Session Procedure*

Phase 1: Pre-Survey Activity (Quantitative Data Collection): The pre-survey was sent to students to complete before the workshop using QuestionPro, an online survey platform, approved by the sponsoring institution. The survey included items to collect demographic information and conflict management strategies using the DUTCH. The survey was designed to provide a summary upon completion. The total scores for each conflict management approach were totaled so that students were aware of the extent to which they use the different conflict

management approaches. Students were instructed to record and/or take a screenshot of their results to ensure the results were accessible for the workshop as shown in Figure 3.

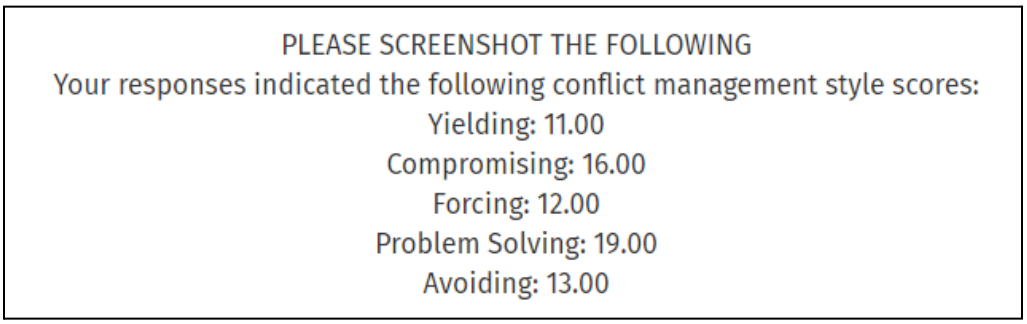

Figure 3. *Sample of Results Screenshot from DUTCH survey*

At the beginning of class, students were instructed not to sit with their class project team for the workshop. Before beginning the workshop, the instructors provided an overview of the research study, and students were asked to log into Menti through their computer or phone. Menti was set up so students could answer questions anonymously during the class session; this allowed for both digital and in-person discussions. The first several questions on Menti were designed to have students reflect on their DUTCH results. The class averages for the five conflict management approaches were shared on the projector screen so students could see the breakdown of their classmates' primary conflict management approaches. A quick discussion was facilitated on whether individuals were surprised by their results or the class results. Additionally, participants were asked when their primary conflict management strategy may not be appropriate to use.

Phase 2: Conflict Management Workshop Lecture & Instructions: In phase 2, an overview was provided about the three primary types of conflict: task, process, and relationship. Task conflict is the variation in ideas and viewpoints concerning how a task should be accomplished. Process conflict refers to disagreements over the procedures or methods a team should use to complete a task, such as logistics of meetings or the delegation of tasks. Finally, relationship conflict involves a dispute between people and creates interpersonal tensions [13]. Some conflict, like task conflict, can be beneficial and lead to improvements in problem-solving, creativity, and innovation. However, process and relationship can impede group progress and lead to greater emotional distress if left unresolved.

Next, students were introduced to the five primary conflict management strategies based on the Dual Concern Model. Each strategy was discussed within the context of the Dual Concern Model, and relevant examples were offered, including when they may or may not be appropriate for specific contexts. A major aspect of this lesson was explaining that all five strategies have pros and cons. An individual must examine the situation to determine which strategy is best.

Phase 3: Scenarios, In-Class Reflections, and Discussion: In phase 3, the students were introduced to two different scenarios to allow them to practice applying conflict management strategies in groups. Each scenario had randomly assigned roles with prompts for each student to role-play. One of the scenarios involved a team needing to design a pizza-delivery robot. The scenario was designed to include specific constraints to create task conflict between different team members and thus forced the team to try and resolve the engineering-focused problem. The roles included an electrical engineer, a designer, a project manager, a treasurer, and a coder. The teams were given 10 minutes to discuss what they would do to complete the project on time and fulfill everyone's best interests.

The second scenario focused on relationship and process conflict. It specifically involved several members of the team who were social loafing, which is when someone in a team does not contribute their fair share in a group project. Social loafing is a top concern and source of conflict in high school and undergraduate courses, so students were likely familiar with this problem [14], [15]. However, in this situation, several of the 'social loafers' were missing team meetings because of personal circumstances such as health problems, family commitments, etc. This scenario required students to communicate to understand the problem further and attempt to develop a solution that could improve how the group collaborates.

After each scenario, students were asked to share their thoughts and primary takeaways with their groups and then with the class through Menti. Answers were displayed on the screen, and responses that emphasized key takeaways or were unique were selected and elaborated on, which led to additional discussion.

Phase 4: Final Reflection: At the end of the workshop, students were asked to think about conflict management on their current design teams and key takeaways they had from the workshop. Students reflected on how their team handles conflict and identified individual goals to improve their conflict management strategies. The data from this part of the workshop is analyzed in this paper. The results are shown in the following sections.

Data Analysis

The survey responses were analyzed by calculating the mean scores for each conflict approach and also tallying the most frequently used conflict management approach for each student.

The in-class workshop yielded many qualitative responses. The initial coding pass involved two authors analyzing students' responses about the scenarios. Students were asked to share their thoughts about how they would handle the conflict and how their group came to a solution. The authors recorded themes they found and compared them in a meeting to create a preliminary codebook. The preliminary codebook allowed the research team to grasp the data and how the students responded to the scenarios.

A larger coding session focused specifically on students' key takeaways from the workshop. Since the student responses were short, holistic coding was used to categorize students' takeaways from the workshop [16]. The five research team members split up all responses and recorded codes on post-it notes. If a code was mentioned multiple times, tallies were added for each additional mention. The research team analyzed the data with a theoretical lens, considering specific conflict management styles, as well as an open lens, considering any other themes that emerged. A thematic analysis was conducted to analyze the codes developed and turn the codes into themes [17]. The team worked together to group the post-it notes, and larger, high-level themes were determined. The grouping of themes led to a discussion where the main, high-level themes were identified, which are discussed in the results section.

To ensure the reliability of the results, the research team participated in many validation processes, as described by Walther et al. [18]. Procedural validation was achieved by grounding the interpretations in the data and the theory. The interpretations of students' key takeaways were compared to the Dual Concern Model and what was taught in the workshop. All findings aligned with the information from the workshop and the theory it was based on. Process reliability was achieved by presenting the same workshop with the same presenters in multiple class settings. There were generally similar themes across the three different classes that participated in the workshop.

Results

The following sections share the preliminary results from the conflict management workshop. These include the quantitative survey results, themes from students' key takeaways, and student benefits from the workshop. The themes focus on shifts in approaches to managing conflict along the spectrum of cooperativeness and assertiveness within the Dual Concern Model, the importance of empathy, and the tradeoffs between different conflict management strategies.

Survey Results

To address research question 1, the results from the survey were analyzed. The survey provided students with average scores for each conflict management strategy. The maximum score for each strategy (showing that they very frequently use that strategy) is 20. Some students had similar averages across multiple strategies indicating they may use them equally. Other students had a clear primary conflict management strategy emerge, indicating they have a primary approach they use more than others. The frequency of each conflict management strategy scoring the highest among students and the average score of each strategy is shown in Table 3. For students that had a tie for their primary conflict management strategy, both were counted in the frequency. When students had multiple primary conflict management strategies, it was often a combination of *Problem Solving, Forcing,* and *Compromising*. This result shows how students

may vary on the cooperation spectrum with respect to their most common conflict management approach.

Table 3

Breakdown of frequency and score of conflict management strategies.

	Frequency of Conflict Management Strategy Scoring Highest	**Average Score of Each Conflict Management Strategy**
Problem Solving	127	16.05
Compromising	56	14.71
Forcing	33	12.60
Avoiding	28	12.41
Yielding	13	13.25

Major Themes

To address research question 2, the key takeaways from the workshop were analyzed. The major themes discussed in this section are from the students' responses about their key takeaways from the workshop and how they would like to incorporate different conflict management strategies in their design teams.

Cooperation Spectrum: Students consistently mentioned their desire to solve problems by communicating more. The majority of communication responses fall under two categories: 'communicate to change' and 'communicate to understand.' This theme aligned with the cooperation spectrum from the Dual Concern Model. Students who wanted to be more cooperative would communicate to understand problems occurring in their team members' lives. As one student shared, "Keep in mind the external problems that may be affecting your teammates. Communication is important in solving issues within the team." Students who demonstrated being less cooperative and more assertive would communicate to tell their team members that they were doing something wrong and needed to change.

Assertive Spectrum: The other axis of the Dual Concern Model is assertiveness. Many students indicated that they wanted to use forcing when necessary or wanted to utilize forcing more. Although *Forcing* is one of the Dual Concern Model conflict management strategies, it was interpreted that the desire to force was another way of saying they would like to be more assertive. For example, one student explained this feeling, "Honestly, I'd like to be a bit more forcing. I tend to start out forcing but as the argument continues I tend to give way. Maybe it's just continued assertiveness that I'd like to learn." During the scenarios, possible solutions

showed someone assertively making a decision and the decision working out. Students interpreted this use of assertiveness as *Forcing* and saw the positives to this part of the conflict management spectrum. In the class discussion and Mentimeter responses, students were surprised that *Forcing* could be a valid conflict management strategy.

Empathy: The scenarios included situations where team members had personal issues affecting their schoolwork; this showed students the importance of understanding what others are going through. Many students said it is important to understand that everyone has something going on in their life, whether they know it or not. This showed students the importance of empathy when working on a team, especially with others you may not know well. Empathy is about understanding each other, and one student shared the importance of having empathy while working on a team, "I think communication and empathy are very important in a team. It is already important to create a safe space where you can express yourself, and it's also very important to feel comfortable expressing things that you may have no control over."

Tradeoffs: The final theme that emerged from the data was the students' understanding of tradeoffs with respect to different conflict management strategies. Students identified that each strategy has pros and cons. One student explained their understanding of the tradeoffs "There are advantages and disadvantages to these strategies. Usually, a combination of two or more is necessary to find the most efficient and beneficial solution." They also identified how context is important to consider when managing conflict. One student shared how there isn't a one-size fits all solution to managing conflict "Don't make assumptions, different strategies work for different situations, one strategy does not fit all." Many students highlighted their desire to utilize different conflict management styles, such as *Compromising* and *Problem Solving*. Students identified that ideally, they would love to always problem-solve, but *Problem Solving* is a time-consuming process, so it may not be the most practical option for every situation. This idea was summed up by one student's response, "problem solving is great as long as it isn't too time consuming."

Student Perceptions from the Workshop: In the Menti reflections, students responded positively to the workshop. Students said that role-playing was a way to practice a conflict management strategy they would not typically use. In addition to role-playing different conflict management styles, students shared how they would like to work on their teamwork skills moving forward. One student addressed the benefits of the workshop by considering how they can use these skills moving forward, "As an engineering student, we will encounter lots of different people with their respective schedules. Being flexible and working with others to preserve peace requires different conflict managements."

Discussion

This paper aimed to understand engineering students' primary conflict management strategies and identify the impact of a scenario-based conflict management workshop for students. This

study found that students self-report using all five primary conflict management strategies to an extent with *Problem Solving* emerging as the most frequently used strategy. Additionally, themes from the student's key takeaways of the workshop centered on the desire to move along the assertive and cooperative spectrum of the Dual Concern Model, as well as identifying the importance of empathy and tradeoffs in conflict management.

The first research question focused on understanding students' preferred conflict management styles. Our results found that *Problem Solving* was the most common strategy among students. However, since students self-reported their conflict management tendencies through the DUTCH test, there is the potential for social desirability or halo error in their responses - meaning students may have the desire to make themself look better or give a general response based on their perception of the topic [19]. In everyday examples of conflict management, *Problem Solving* is considered the best approach to solving conflict [20], [21], so it is possible that students wanted to choose the options on the DUTCH test that aligned with their perception of the 'best' approach to managing conflict.

The second research question focused on students' key takeaways from the workshop, one of the main takeaways was students expressing a desire to move along the cooperative and assertive spectrum of the Dual Concern Model. The importance of communication heavily influenced students' desire to move along the cooperation spectrum. A study in a business education setting found that teams who improved their quality of communication or cooperation had more success in their final project [22]. This finding aligns with the students' perceptions of cooperation and communication. A surprise for students was the effectiveness of *Forcing* as a conflict management strategy; several students indicated a desire to be more assertive in their teams moving forward. *Forcing* and *Problem Solving* are two conflict management strategies that are on the assertive end of the spectrum [23]. Although these conflict management styles are valid approaches for handling conflict, a study found that they may serve as triggers for workplace bullying [24]. This is important to consider: *Forcing* and *Problem Solving* can be effective, positive conflict management approaches, but if executed without tact and consideration for others, they can have detrimental effects on teams.

One scenario in the workshop included multiple students who were undergoing personal challenges, which made it difficult for them to contribute to the team. Students recognized the situation in the scenario and stated the importance of having empathy and open communication when working on a team in their key takeaways. A study about adolescent friendships found that adolescents who had more dispositional empathy were associated with more successful conflict management [25]. Similarly, empathy and compassion have been associated with higher readiness for reconciliation in intergroup conflict [26]. This paper contributes to the literature by showing that students can recognize the importance of empathy when managing conflict.

One of the key takeaways from students was their acknowledgment that each conflict management style has tradeoffs. They also acknowledged that different situations require different approaches to managing conflict. A student's predisposition to a particular conflict management strategy can inhibit their effectiveness on a team [27], so understanding the tradeoffs of each strategy and being flexible in their approach can allow students to work more effectively on a team. Additionally, teams can be more effective by using and understanding multiple conflict management styles [28].

The workshop utilized scenario-based role-playing to provide a low-stakes environment for students to practice different conflict management strategies. This approach has been successfully used in a business setting to help promote positive changes in conflict management approaches [6]. Role-playing has been considered a valid pedagogical approach because it balances theory and practice to help students develop skills [29]. Role-playing also encourages students to work in a collaborative learning environment, which has shown to be beneficial in helping students develop teamwork skills [30]. Additionally, role-playing can engage students more effectively than traditional teaching approaches [31]. This paper contributes to the literature by showing the effectiveness of using a scenario-based role-playing approach to teach conflict management strategies to engineering students.

Conclusion and Future Work

This work aims to better understand and develop conflict management skills in engineering student teams. Our preliminary findings provide insight into students' primary conflict management strategies and their primary takeaways from the workshop. Understanding which conflict management strategy is most common among students can influence future iterations of the workshop. While the quantitative results were shared in this paper, future work will triangulate these findings with qualitative responses related to students' reflections on their quantitative results. The qualitative reflections related to how students approached and resolved the conflicts in the two scenarios will also be analyzed. Additionally, gender and other demographic characteristics were not considered in this analysis because it was beyond the scope of this paper, but it is a valuable direction for future work. Considering gender, demographics, and other identities alongside conflict management is important because differences have been found; one study found that women in a construction management setting, which has parallels with engineering, are more likely to use a collaborative approach, like yielding, to manage conflict [32].

The hope is to better understand why students prefer certain conflict management approaches over others depending on the context and to what extent they recognize the limitations of their preferred approaches. Understanding students’ preferred conflict management styles and perceptions of the workshop will help us orient our future work. The Menti reflection prompts for each scenario will be analyzed to learn more about the different ways student groups resolved

the conflicts and what they may have learned from their participation in the scenario-based role-playing activities. Subsequent work will also include analysis of written reflections and focus groups of students related to their experiences on teams throughout the semester. This work will help understand the types of conflict student teams face, how students manage conflict, and evaluate if students used the conflict management skills from the workshop on their student teams.

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