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Making Collaboration Work: Fostering Positive Experiences and Attitudes around Psychological Safety, Diversity, and the Value of Teamwork

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Making Collaboration Work: Fostering Positive Experiences and Attitudes around Psychological Safety, Diversity, and the Value of Teamwork

Abstract

The ability to work well in a team is becoming increasingly important across disciplines and throughout the workplace, making it a valuable skill for students to develop. Evidence suggests that diverse perspectives can generate more innovative ideas and enhance critical thinking, but only if team members value diversity and share knowledge with one another. To foster students' abilities to work well in diverse teams, we must teach them why collaboration is important and how to bring about its benefits. We describe a new interdisciplinary course designed with these goals, along with an evaluation of the degree to which students who take this course show changes in attitudes and beliefs around teamwork. The course emphasizes psychological safety—a measure of how safe a team is for interpersonal risk-taking. Research shows that psychological safety is an important predictor of team success and a key mechanism for incorporating diverse perspectives. We surveyed students at the start of the course, the end of the course, and just after the following term. At the end of the course, students reported increased psychological safety in their teams, more positive attitudes towards teamwork, and stronger beliefs that diversity is beneficial. At the end of the following term, students reported higher levels of psychological safety in their teams than before the course, and their attitudes about psychological safety and teamwork still remained more positive. We discuss implications of these findings for researchers studying student teamwork and for instructors who wish to introduce or improve collaborative experiences in their courses.

La capacité à travailler en équipe est de plus en plus importante dans toutes les disciplines et sur le lieu de travail, ce qui en fait une compétence précieuse à développer pour les étudiants et les étudiantes. Il est prouvé que la diversité des points de vue peut générer des idées plus innovantes et renforcer la pensée critique, mais seulement si les membres de l'équipe valorisent la diversité et partagent leurs connaissances les uns avec les autres. Pour développer les capacités des étudiants et des étudiantes à bien travailler au sein d'équipes diverses, nous devons leur enseigner pourquoi la collaboration est importante et comment en tirer profit. Nous décrivons un nouveau cours interdisciplinaire conçu avec ces objectifs, ainsi qu'une évaluation de la mesure dans laquelle les étudiants et les étudiantes qui suivent ce cours montrent des changements d'attitudes et de croyances concernant le travail d'équipe. Le cours met l'accent sur la sécurité psychologique – une mesure de la sécurité d'une équipe face à la prise de risques interpersonnels. La recherche montre que la sécurité psychologique est un prédicteur important de la réussite d'une équipe et un mécanisme clé pour l'intégration de perspectives diverses. Nous avons interrogé les étudiants et les étudiantes au début du cours, à la fin du cours et juste après le trimestre suivant. À la fin du cours, les étudiants et les étudiantes ont fait état d'une plus grande sécurité psychologique au sein de leur équipe, d'attitudes plus positives à l'égard du travail d'équipe et d'une plus grande conviction que la diversité est bénéfique. À la fin du trimestre suivant, les étudiants et les étudiantes ont fait état de niveaux de sécurité psychologique dans leurs équipes plus élevés qu'avant le cours, et leurs attitudes à l'égard de la sécurité psychologique et du travail d'équipe sont restées plus positives. Nous discutons des implications de ces résultats pour les chercheurs et les chercheuses qui étudient le travail d'équipe des étudiants et des étudiantes et pour les enseignants et les enseignantes qui souhaitent introduire ou améliorer les expériences de collaboration dans leurs cours.

Keywords
collaboration, teamwork, group work, interdisciplinary, diversity, psychological safety; collaboration, travail d'équipe, travail de groupe, interdisciplinarité, diversité, sécurité psychologique

Cover Page Footnote
We are grateful to the students who took INTEG 210: Making Collaboration Work and participated in our study—obviously, this work would not have been possible without them. The lead author, Dr. Plaisance, would also like to thank the Knowledge Integration (KI) students who helped design this course: Georgia Lamarre, Akanksha Madan, and Shane Morganstein. Dr. Plaisance also owes a debt of gratitude to her colleagues in KI from whom she learned how to teach design thinking and collaborative problem-solving, with special thanks to Paul McKone who co-taught an iteration of this course and shaped its content from the outset. Lastly, we appreciate the financial support for this project, which came from a Learning Innovation and Teaching Enhancement (LITE) Seed Grant at the University of Waterloo, entitled "Closing the Collaborative Skills Gap: Assessing the Effectiveness of a University-Wide Course Designed to Teach Students How to Collaborate in Diverse Groups."

Collaborative skills are becoming increasingly important across a wide variety of disciplines and sought after throughout the workplace. Many of the complex problems we currently face as a society—such as climate change, global poverty, and racial inequities—can only be addressed when people from diverse backgrounds work together effectively. Even in workplaces that deal with more straightforward challenges, collaborative approaches are becoming more common and have been shown to increase productivity (Gaskell, 2017). In fact, a recent large-scale survey of employers indicates that the ability to work well in a team is one of the top attributes employers look for in recent graduates (Gray, 2022). A vast amount of research illustrates why collaboration is so powerful: it offers a broader knowledge base, a wider variety of skills, and more diverse perspectives than working individually, which in turn can lead to more creative and innovative ideas (Laughlin et al., 2008; Maciejovsky et al., 2013; Page, 2017; Phillips, 2014). In other words, having a diverse team is often what makes collaboration so powerful. Research also indicates, however, that these benefits may not be realized unless team members recognize the value of diversity (Hentschel et al., 2013; Leroy et al., 2022; Shemla et al., 2014; van Dick et al., 2008). Teams must have processes in place to ensure that diverse perspectives are heard and integrated into the group decision-making process. As educators, if we want students to be able to work well in a team, we need to teach them *why* collaboration is important and *how* to harness its potential benefits.

In this article, we describe a new interdisciplinary course designed with exactly these goals in mind. This course teaches students collaborative theory and practice, enables them to apply what they are learning via small group projects, and prompts them to reflect on their experiences to improve their collaborative skills. Perhaps most important, the course emphasizes a key concept called *psychological safety*, a measure of how safe a team is for interpersonal risk-taking (Edmondson, 1999). Research in organizational behavior indicates that psychological safety is one of the most—if not *the* most—important predictors of team success (Duhigg, 2016; Edmondson and Lei, 2014; Newman et al., 2017). As we discuss below, it can also serve as a key mechanism for including diverse perspectives, which can in turn improve team outcomes.

The course has several key learning objectives. Among other things, it aims to improve students' experiences of psychological safety in their teams, enable them to recognize the value of diverse perspectives, and foster more positive attitudes towards teamwork. We assessed the degree to which these objectives were met by surveying students at three time points: the beginning of the course, the end of the course, and immediately after the following term (four months later). After presenting our findings below, we address some of the limitations of our study, suggest avenues for future research, and offer recommendations for instructors who wish to introduce or improve collaborative experiences.

Theoretical Background

We drew on a variety of theoretical frameworks and empirical studies to generate course learning objectives, design course activities, and create the survey questions. We focused on research that examines the role of psychological safety and diversity for fruitful collaboration, much of which stems from organizational psychology. We also examined research in the Scholarship of Teaching and Learning (SoTL) to see how concepts like psychological safety and diversity have been used in the context of student teams. In what follows, we provide an overview of key concepts and findings from these literatures.

The Power of Diverse Teams

Research across a variety of fields supports a key finding that has been gaining traction in the past few years: simply put, diverse groups tend to produce better outcomes (Mannix and Neale, 2005; Page, 2017; Phillips, 2014). One of the more well-known findings is that diverse teams are often more creative and innovative (Díaz-García et al., 2013; Leroy et al., 2022; Page, 2017; Stahl et al., 2010). As these studies show, this holds true whether diversity is construed in terms of cognitive differences (e.g., different areas of expertise) or social identity (e.g., demographic differences such as gender or race). It may seem obvious how diverse perspectives can lead to higher levels of creativity: interdisciplinary teams, for instance, can come up with new methods or insights that transcend disciplinary boundaries, and teams with high levels of demographic diversity can harness the variety of lived experiences to create a wider set of potential solutions. What is perhaps more surprising, however, is that diverse teams also display higher levels of *critical thinking*. One study compared judgements made by juries that were racially diverse to those composed of all white members. They found that mixed race juries deliberated more carefully, recalled information more accurately, and cited a wider range of evidence in support of their judgments than did the all-white juries (Phillips, 2014; Sommers, 2006). Given that critical thinking is essential for producing better solutions, giving students the opportunity to work in diverse teams may improve their outcomes as well.

While diverse teams have the *potential* to generate more innovative ideas and produce higher quality work, it is important to note that this potential is not always realized. Teams with high levels of diversity can also experience more challenges around communication and conflict (Mannix and Neale, 2005; Phillips, 2014). Researchers have begun to identify the factors that determine whether a diverse team will struggle or succeed. Key among these is whether the members of the team view diversity in a positive light (Hentschel et al., 2013; Leroy et al., 2022; Shemla et al., 2014; van Knippenberg & van Ginkel, 2022). Moreover, even if team members value diverse perspectives, they must have mechanisms in place to ensure that those perspectives are shared—and heard—so team members can learn from one another and generate new insights. As the lead author of this article has argued elsewhere, one of the best ways to ensure that diverse perspectives are taken up is to foster psychological safety (Plaisance, 2022). As we discuss below, psychological safety facilitates the ability of those with diverse perspectives to contribute and fosters learning behaviors among team members.

The Importance of Psychological Safety in Teams

Psychological safety captures the extent to which members of a team believe that the team is safe for interpersonal risk-taking (Edmondson, 1999). When team members have high levels of psychological safety, they feel as though they can bring up problems with their teammates, challenge others' ideas without fear of negative repercussions, and make mistakes without it being held against them. Importantly, psychologically safe teams do not avoid difficult conversations, but create conditions whereby team members can engage in such conversations in ways that demonstrate mutual respect and accountability.

Research in organizational psychology has shown psychological safety to be the strongest predictor of positive team outcomes (Duhigg, 2016; Edmondson, 1999; Frazier et al., 2017). Psychological safety is particularly important for tasks that require critical thinking and complex problem-solving. One meta-analysis showed that "psychological safety is more strongly

associated with learning and performance in studies conducted in knowledge-intensive task settings, that is, settings that involve complexity, creativity, and sensemaking" (Sanner and Bunderson, 2015, p. 224).

While most research on psychological safety has been done in the context of work teams, it is highly applicable to student learning and collaboration and thus should be of interest to those of us working in postsecondary education. Indeed, a careful examination of research on psychological safety demonstrates that one of the key mechanisms through which it exerts its positive effects is by enhancing the team learning process (Edmondson, 1999; You, 2021). As Edmondson herself notes, learning within a team is "an ongoing process of reflection and action, characterized by asking questions, seeking feedback, experimenting, reflecting on results, and discussing errors or unexpected outcomes and actions" (1999, p. 353). For this learning process to work, students must be able to take risks, suggest wild ideas, and challenge one another—precisely what the concept of psychological safety entails.

Psychological Safety in Student Teams

Despite its key role in successful team outcomes, psychological safety has not yet been well-studied in student teams (Miller et al., 2019; You, 2021). The few studies that do exist, however, provide evidence that psychological safety is beneficial for student learning and enhances the creativity and quality of students' work. For example, a study of 20 multidisciplinary engineering teams at the University of Toronto demonstrated strong correlations between levels of psychological safety and team innovation (Balouchestani-Asli et al., 2016), while a study of high school engineering teams found that psychological safety is correlated with stronger learning outcomes (McEneaney & Nieswandt, 2017). Researchers in the U.S. found that while psychological safety was not correlated with the quantity of ideas generated by engineering design teams, it was positively associated with higher quality ideas (Cole et al., 2022). Another study of 93 science teams at a Korean university looked at the relationship between team efficacy (a team's perceptions of their ability to perform certain tasks), team interaction (which included exchange of information), and psychological safety, focusing on how these factors interact to enhance levels of team creativity (You, 2021). The study demonstrated a strong correlation between psychological safety and creativity; moreover, results showed that higher levels of psychological safety led to higher levels of team interaction, regardless of the level of team efficacy. This suggests a key mechanism of action whereby psychological safety increases important team learning behaviors, which in turn enable students to generate more creative ideas. Lastly, a study of 12 engineering teams at a U.S. university looked at changes in psychological safety over time, tracking each teams' levels of psychological safety at various points throughout their four-week design project. The authors found that psychological safety tended to stabilize after students had interacted with one another multiple times, shortly after idea generation had begun (Miller et al., 2019).

These studies provide good evidence that psychological safety is important for student teams, especially for complex tasks or projects that require creative thinking. However, the SoTL research in this area is currently limited in two key respects. First, these studies are observational and do not include attempts to *teach* students about psychological safety, nor how to cultivate it in their teams. Miller et al. (2019) highlight this limitation themselves, noting that "The question of *when* to intervene, as well as *how* to intervene, remain key questions" (p. 9). Second, these studies focus exclusively on science and engineering teams. Indeed, much of the literature on

student collaboration and teamwork focuses on science and engineering, overlooking collaboration in non-STEM disciplines or in interdisciplinary contexts, which we focus on here.

Advancing the SoTL Literature

Our course design and evaluation advances the SoTL literature by addressing the limitations discussed above. The course documented in this article explicitly teaches students about the role of psychological safety, especially when it comes to leveraging diversity, and how to cultivate psychological safety in teams. Second, the course offers students an opportunity to work in *broadly interdisciplinary* teams.[1] This interdisciplinary aspect is important given that such teams may naturally experience lower levels of psychological safety due to their diversity, as Balouchestani-Asli et al. (2016) point out. Thus, if we can increase psychological safety in highly interdisciplinary teams, it will likely be possible to do so in less diverse teams as well. Lastly, this work contributes to the SoTL literature by offering actionable suggestions for instructors. These suggestions are informed not only by our findings from evaluating course outcomes, but by the theoretical frameworks and empirical research discussed above as well.

In the next section, we describe how we applied insights from the literature on diversity and psychological safety to design a new course on collaboration and teamwork (after which we present our evaluation of students' attitudes and experiences before and after taking the course).

Course Setting and Design

Course Setting

The course described in this article—INTEG 210: Making Collaboration Work—was developed in the Knowledge Integration program at the University of Waterloo in Canada. Many undergraduate students in Canada take most of their courses within their own program or faculty and lack opportunities to collaborate with students from other disciplines.[2] Thus, we designed INTEG 210 with students from across the university in mind and opened it to anyone in their 2nd year or above.

INTEG 210 was offered and evaluated in Fall 2018 and Fall 2019. Students from both cohorts participated in this study, with 33 students in the 2018 cohort and 25 students in the 2019 cohort. In both offerings, we had students from every faculty on campus, so we were able to place students in broadly interdisciplinary teams, each of which included both STEM and non-STEM disciplines (see the Method section for more details on participant demographics, as well as team

[1] Julie Thompson Klein, one of the key scholars who developed the field of Interdisciplinary Studies, distinguishes between *broad interdisciplinarity* and *narrow interdisciplinarity* (2010). Narrow interdisciplinary teams are those that include members of disciplines that are relatively "close" to one another (e.g., students from different engineering programs within a Faculty of Engineering), while broad interdisciplinary teams include members from "distant" disciplines (e.g., students from different Faculties, such as Engineering and Arts). See also Kelly (1996) who first introduced this distinction.

[2] While there are some opportunities for students to work in multidisciplinary teams within their own faculty (e.g., through engineering capstone courses that bring together students from different engineering programs), it is much less common for students to work together *across* faculties (e.g., Engineering and Arts). In other words, what many students at Canadian institutions lack is the opportunity to work in *broad* interdisciplinary teams (Klein, 2010).

formation and composition; as we note, we were able to design teams that were demographically diverse as well).

Course Design and Assessment

The course was originally co-designed by the lead author in collaboration with three undergraduate students from Knowledge Integration.[3] These students had taken several courses to study the research on collaboration, teamwork, and interdisciplinarity, as well as related topics like diversity and conflict (some of these courses were taught by the lead author). The resulting course design involved a combination of collaborative theories and practices, along with experiential learning opportunities where students could immediately apply what they were learning in class.

The collaborative theories covered in INTEG 210 included: the stages of group formation (Tuckman, 1965), common barriers to effective teamwork (Lencioni, 2002), the role of trust in collaboration, psychological safety in teams, productive vs. destructive conflict, and the benefits of diversity (e.g., diversity of expertise and diversity of social identity). Students learned about each of these topics through readings, class lectures, and in-class discussions. When it came to psychological safety, for example, readings and lectures addressed what psychological safety is, what the research says in terms of its importance for successful team outcomes, and what kinds of practices can be used to cultivate it. Students also had the opportunity to *apply* collaborative concepts and theories through key practices, such as: creating team charters, engaging in brainstorming activities, assessing and managing conflict, giving and receiving constructive feedback, and evaluating peer contributions.[4]

Students engaged in experiential learning by working in two successive group projects, each five weeks in length. Both projects centered around a design challenge that required students to address a complex, real-world problem, thus making psychological safety more important than might be the case for less creative or complex tasks (Sanner & Bunderson, 2015). Student teams were formed by the instructor with the goal of maximizing several types of diversity. Each team had four or five students representing anywhere from three to five different faculties, and students from the same program were never placed on the same team. Teams were also diverse in terms of gender, ethnicity, and year of study. We avoided token membership by making sure that no team had only one woman nor only one racialized student (Bear & Woolley, 2011). Because of these teams' highly diverse composition, there was simultaneously potential for both greater conflict and higher quality work.

Students learned about psychological safety at a key point during their first collaborative design project: just before they began brainstorming potential solutions. The intention behind the timing of this aspect of the intervention was to encourage students to engage in highly divergent thinking to generate a broad set of ideas. As it turns out, Miller et al. (2019) found that psychological safety tended to stabilize shortly after idea generation had begun. Thus, this was a sensible point at which to teach students what psychological safety is and how to cultivate it. To

[3] Knowledge Integration (KI) is an interdisciplinary undergraduate program at the University of Waterloo that emphasizes highly transferable skills such as critical thinking, communication, creativity, and collaboration. Notably, INTEG 210 was designed for students *outside* KI who do not have the same opportunities to learn collaborative theory nor work in interdisciplinary teams.

[4] For a full list of topics, see https://uwaterloo.ca/knowledge-integration/current-undergraduates/course-offerings/ki-elective-courses/integ-210

reinforce this learning, we prompted students at the start of the second group project to consider how they would foster an environment of psychological safety in their teams and encouraged them to document that in their team charter. As discussed below, they also had an opportunity to reflect on this practice through individual reflection papers.

Assessments included group project portfolios for each of the two design projects, individual reflection papers, and course engagement. For the group projects, each team was required to submit a project portfolio, with preliminary deliverables along the way. The weekly deliverables included a team charter, problem statement, brainstorming map, team health check-in, responses to peer feedback, and a final project report. Asking for regular deliverables enabled us to assess and provide feedback on each groups' collaborative process in addition to the final project itself (many students remarked that this was the first time the *process* of group work had been explicitly taught and assessed, despite having experience with group work in other courses). Students also wrote individual reflections at three time points: the start of the course (based on past collaborative experiences), just after the first group project, and just after the second group project. In the last two reflections, students were asked to connect their experiences to course concepts (e.g., explaining what psychological safety is and the extent to which they perceived it to be present in their team). This enabled us to assess students' understanding of the course material and their ability to apply these concepts to their experiences. Lastly, each student was graded on course engagement, which involved in-class check-in questions (where students applied lessons from the readings about collaborative theory), in-class and online discussion, and peer evaluations. Students were given detailed instructions for conducting the peer evaluations and were graded on the evaluations their group members wrote about them, as well as the quality of the evaluations they wrote for their peers. These evaluations were anonymized and shared with each student so they could use the peer feedback to improve their collaborative skills in future projects.

Method

We evaluated changes in students' attitudes, beliefs, and values related to collaboration and teamwork by administering a survey to students at three time points: the start of the course (pre-course), the end of the course (post-course), and just after the end of the subsequent term approximately four-months later (follow-up). The follow-up survey asked students about their team experiences in courses they took during the subsequent term, as well as their beliefs and intentions regarding future collaborations. This pretest-posttest design was the best method available to us to assess change—we could not randomly assign students to this course or a different course because students selected their own courses. Moreover, due to the highly interdisciplinary nature of this course, there was no class on campus with a similar sample of students against which we could compare this class's changes in survey responses.

The survey included a combination of validated measures and original questions that we designed, primarily using Likert-scale items to allow us to test for statistically significant changes. The key measures we examined were psychological safety, attitudes towards teamwork, and beliefs about the value of diversity when it comes to team outcomes (see Measures section for

details).[5] The survey also included open-ended questions so that we could include illustrative quotes of students' descriptions of their experiences to provide context for the quantitative results.[6]

Ethics Clearance

This study received ethics clearance from our institution before the course began (ORE #32065). All standard research ethics protocols were followed (e.g., informed consent, the ability to skip any question for any reason, and an option to stop participating at any time without loss of credit or remuneration). Students gave their consent to participate in the study before completing the pre-course survey. We decided to ask for students' consent to use their data at the end of the post-course survey and follow-up measure to ensure that their consent was fully informed (namely, after they had responded to all the questions). Participation was kept confidential until the course was completed (i.e., the course instructor did not see who had completed the survey until after course grades were submitted to the institution's Registrar), and students' survey responses were kept permanently confidential by ensuring their names were not associated with their survey data at any point during data collection, analysis, and ultimate data storage.

Survey Participants

All students taking INTEG 210 in Fall 2018 (n = 33) and Fall 2019 (n = 25) were invited to participate in the surveys. A total of 53 of the 58 students who completed the course gave us permission to use at least some of their survey data (91.4%). Of those 53, 47 took the pre-course survey (88.7%), 50 took the post-course survey (94.3%) and 31 took the next-term follow-up survey four months later (58.5%).[7]

Table 1 displays the demographic characteristics of the starting sample. As Table 1 illustrates, students came from a wide range of academic disciplines and social identities, making them an optimal group with which to implement and assess an intervention designed to improve collaboration in diverse teams.

[5] We also included questions that we thought would be useful to the instructor (e.g., why students chose to take the course) or which could serve as pilot measures for possible future research (e.g., mindset items and personality traits).

[6] While a full qualitative analysis of these responses is beyond the scope of this article, these illustrative quotations offer helpful context regarding students' attitudes and experiences. In choosing which quotes to include, we read through all the open-ended responses, noted which ones were particularly relevant to our research questions, and selected one for each of the three key measures that demonstrated a student's shift in thinking with respect to that measure.

[7] Degrees of freedom in the analyses vary because not all students completed all surveys: 45 students filled out both the pre- and post-course measures (84.9%) and 27 filled out all three measures (50.9%). Some students skipped some items.

Table 1
Participant Demographics

Gender	*n*	%		**Faculty**	*n*	%
Men	23	43.4%		Arts	13	24.5%
Women	24	45.3%		Engineering	16	30.2%
Non-binary students	1	1.9%		Environment	8	15.1%
Not provided[8]	5	9.4%		Health	4	7.5%
				Mathematics	6	11.3%
Ethnicity (select all that apply)				Science	6	11.3%
Black or African	3	5.9%				
Chinese (including Hong Kong Chinese & Taiwanese)	11	21.6%		**Year in Program**		
East Indian	7	13.7%		2nd	28	52.8%
Hispanic or Latino/a	2	3.9%		3rd	8	15.1%
Korean	2	3.9%		4th	15	28.3%
Middle Eastern	3	5.9%		*Data unavailable*	2	3.8%
White or European	10	19.6%				
Other Asian ethnicities	13	25.5%				
Not provided	5	9.4%				

Measures

Psychological Safety

Psychological safety was assessed with five items in the pre-course survey, the post-course survey, and the next-term follow-up survey. Three of the items were adapted from Edmondson (1999): (1) "If I made a mistake, it would be held against me" (reverse-coded); (2) "Team members were able to bring up problems and tough issues without negative repercussions"; (3) "I felt it was safe to challenge another group member's ideas" (*1-Strongly Disagree to 6-Strongly Agree*). We also added two exploratory items to see if students endorsed stronger beliefs around team members' responsibilities to cultivate a psychologically safe environment. These were: (4) "Each group member has the responsibility to ensure others are heard, the responsibility doesn't just fall on a member themselves"; and (5) "I specifically made an effort to ensure that other members feel heard."

Wording in the pre-course survey focused on students' previous team experiences. For example, the item "If I made a mistake, it would be held against me" was phrased in the pre-course survey as "In most of my group work experiences, I got the sense that if I made a mistake, it would

[8] Five participants did not complete the pretest where we collected demographic data.

be held against me." Wording in the post-course survey focused on their experiences in the course, such as: "In the groups I was part of in this course, I got the sense that if I made a mistake, it would be held against me." In the next-term follow-up survey, we had two versions of this scale. One focused on their experiences working in teams during the subsequent term (e.g., "In the groups or teams I was part of this term, I got the sense that if I made a mistake, it would be held against me"). The other focused on their ongoing attitudes about psychological safety in teams (e.g., "I think if a member of the team makes a minor mistake, it should not be held against them").

Internal consistency across the three items from Edmondson was generally higher than reliability across all five items of the scale (see Table 2 for Cronbach's alphas). This is likely because they differ conceptually, where the first three items measure personal experiences during group work, while item 4 taps into beliefs that psychological safety is a group effort and item 5 is about personal initiative to make groups psychologically safe. The exception was the next-term follow-up version that focused on ongoing attitudes—Cronbach's alpha was low (α = .410) for Edmondson's three items but adequate for all five items (α = .630). Thus, we analyzed the measure two ways and reported the results of both: first, with items 1-3 averaged together and then with all five items averaged together.

Positive Attitudes Towards Teamwork

This variable was assessed with five items: (1) "I think that group projects offer valuable experience"; (2) "I believe that working on projects in a group improves the overall quality of my work"; (3) "I believe that I learn more about the subject matter when working in a group than by myself"; (4) "I am comfortable working collaboratively in groups"; and (5) "Regardless of comfort level, I feel that I have sufficient knowledge and tools I need to be a successful group member in my university courses" (1-*Strongly Disagree* to 6-*Strongly Agree*).

Wording in the pre-course survey and the post-course survey focused on students' current attitudes, as in the items above. In the next-term follow-up survey, we asked two types of questions, one that focused on their experiences working in teams during the subsequent term (e.g., "I think that group or team projects I had this term offered valuable experience") and one that focused on their ongoing beliefs about teams (e.g., "I think that future group or team projects will offer valuable experience").

Cronbach's alphas were acceptable (αs > .721, see Table 2), so all five items were averaged together for each version of the scale.

Belief that Diversity Leads to Successful Outcomes

Students' beliefs about the importance of diversity were assessed in the pre-course and post-course surveys only. Four items captured different types of diversity: (1) "To what extent do you think social diversity (diversity of race and gender) matters in the context of a team?"; (2) "To what extent do you think cognitive diversity (diversity of personality and thinking styles) matters in the context of a team?"; (3) "To what extent do you think experiential diversity (diversity of expertise and training) matters in the context of a team?"; (4) "To what extent do you think values diversity (diversity of goals and personal values) matters in the context of a team?"

The first cohort answered these items on a three-point scale, (1- *Leads to worse outcomes* to 3-*Leads to better outcomes*). Initial analyses suggested that scale was too narrow to capture variability. Therefore, for the second cohort, the scale was expanded to five points, using the same labels for the endpoints. To combine the two cohorts' data for analysis, we transposed Cohort 1's

scores to map onto the midpoint of Cohort 2's five-point scale without changing Cohort 1's scale interval. As such, scores of 1, 2, and 3 became scores of 2, 3, and 4, respectively. The same pattern of statistically significant results emerges if the interval of Cohort 1's scale is converted to match the labels of Cohort 2's scale (i.e., scores of 1, 2, and 3 become scores of 1, 3, and 5, respectively) or if we analyze only Cohort 2. Thus, we report the combined 5-point scale for both cohorts.

Reliability was adequate (αs > .633, see Table 2), so we averaged the four items together.

Table 2
Cronbach's Alphas for Each Scale

	Pre-Course Survey	Post-Course Survey	Follow-up Survey: Experiences That Term	Follow-up Survey: Ongoing Attitudes
Psychological Safety: Three-Items	.663	.801	.659	.410
Psychological Safety: Five-Items	.516	.666	.605	.630
Positive Attitudes Towards Teamwork	.722	.722	.770	.880
Belief That Diversity Leads to Successful Outcomes	.634	.641	N/A	N/A

Statistical Analysis

Our primary goal was to evaluate whether students' attitudes changed between the beginning of the course and the end of the course. Our secondary goal was to evaluate, among the subset of students who completed the pre-course survey and the next-term follow-up, whether their experiences carried over into their new contexts in the subsequent term and whether their change in attitudes from the beginning of the course towards teams still held at the end of the subsequent term. Using SPSS (v.29), we conducted paired-samples t-tests to compare the pre-course survey to the other measures. We specifically used two-tailed significance tests to allow for the possibility that students' attitudes and experiences related to teams could worsen after the course. Following recommendations for statistical analysis in psychology (García-Pérez, 2023), we did not correct for multiple comparisons, because we are making statistical claims for each individual test and do not have an omnibus null hypothesis.

Results

Psychological Safety

Students' reports of psychological safety in teams using Edmondson's three items increased from a mean of 3.70 (SD = .92) before the course to a mean of 4.65 (SD = .89) after the course, $t(44) = -5.79$, $p < .001$, $d = .86$. The same pattern occurred when we included our two new items to make a five-item scale ($M_{pre} = 4.20$, $SD = .67$; $M_{post} = 4.87$, $SD = .63$), $t(44) = -5.28$, $p < .001$, $d = .79$. Thus, for both sets of items, we saw a moderate-to-large increase in terms of

students' perceptions of psychological safety in their teams when comparing this course to their previous group work experiences.

This effect persisted for students who had group work experiences in the following term. Comparing the pre-course survey and the next-term follow-up, students' perceptions of psychological safety in their teams increased for Edmondson's three items (M_{pre} = 3.76, SD = .93; $M_{followup}$ = 4.39, SD = 1.04), $t(23) = -2.84$, $p = .009$, $d = .58$. However, when our two new items were included, the change was not statistically significant (M_{pre} = 4.29, SD = .59; $M_{followup}$ = 4.42, SD = .78), $t(23) = .80$, $p = .431$, $d = .16$, suggesting that these exploratory items may not have captured changes in students' experiences as well as did the three items from Edmondson's scale. Notably, the means for these two items were higher to begin with than for the three-item scale.

Regarding students' ongoing attitudes about psychological safety in future teams, we also saw an increase compared to what students reported before taking the course. This occurred both for Edmondson's three items (M_{pre} 3.79, SD = .91; $M_{followup}$ = 4.96, SD = .68), $t(24) = -5.19$, $p < .001$, $d = 1.04$, and when we added our two items (M_{pre} = 4.30, SD = .58; $M_{followup}$ = 5.34, SD = .54), $t(24) = -7.05$, $p < .001$, $d = 1.41$.

One student described how the course affected their experience of psychological safety in teams: "INTEG 210 equipped me with important and vital knowledge and tools to be successful in all of my present and future collaborative work. I'm socially anxious. Situations where I have to interact with other people make me physically sick but INTEG 210 provided a safe space for me to improve my skills to work well in a small group. [...] And so, during the [following] term, I was comfortable seeking out group work, even with strangers."

Positive Attitudes Towards Teamwork

Students' reports of positive attitudes towards teams increased from 4.45 (SD = .70) before the course to 4.70 (SD = .71) after the term, $t(44) = -2.19$, $p = .034$, $d = .33$. While the effect size for this measure was not as large as what we saw for psychological safety, students' incoming attitudes were already relatively positive, on average, so it is notable that we still observed an increase.

When we surveyed students about their subsequent collaborative experiences at the end of the following term, however, participants' attitudes about those experiences were *not* significantly different from their attitudes before taking the course (M_{pre}= 4.59, SD = .63; $M_{followup}$ = 4.77, SD = .85), $t(23) = -.92$, $p = .368$, $d = .19$.

Interestingly, participants' attitudes about their *future* collaborative experiences were more positive than in the pre-course survey (M_{pre}= 4.58, SD = .62; $M_{followup}$ = 4.92, SD = .80), $t(24) = -2.21$, $p = .037$, $d = .44$, suggesting that they were optimistic that teamwork would be valuable for them in the future.

One student noted, "I used to think I worked better alone and tried to avoid group work, but now I realize that my ideas are better when I brainstorm with others."

Beliefs that Diversity Leads to Successful Outcomes

Students' beliefs about the value of different types of diversity (including social, cognitive, experiential, and values diversity) increased from 3.63 (SD = .66) before taking the course to 3.91 (SD = .62) after the course on a five-point scale, $t(44) = -3.06$, $p = .004$, $d = .61$. It is notable that

we saw such an effect size given that students' beliefs about the value of diversity already tended to be positive on the pre-course survey.

In an open-ended response, one student explained: "I believe that this course provided me with the skills to better work in groups. But, I wasn't expecting the effectiveness of diverse groups. I always assumed that like minded people made the best groups because they have the same mind set, avoiding conflict, but I found that diverse members enriched the quality of the work produced."

Discussion

Teamwork is essential for solving complex problems and tends to enhance individual performance, often leading to better outcomes (Gaskell, 2017; Laughlin et al., 2008; Maciejovsky et al., 2013). As educators, we should provide opportunities for students to develop their collaborative skills and teach them how to foster more positive and productive collaborations. A review of the literature on the characteristics of successful teams shows that cultivating psychological safety is especially important (Edmondson, 1999; Frazier et al., 2017; Newman et al., 2017) and that recognizing the value of diversity is a prerequisite for leveraging the potential benefits of diverse perspectives (Shemla et al., 2014; van Dick et al., 2008).

We designed and assessed an interdisciplinary course aimed at improving students' collaborative experiences with precisely this literature in mind. Students learned what psychological safety is and how to foster it, incorporated these lessons as they worked in teams, and reflected on their experiences and how they can improve their collaborations in the future. To examine how students' attitudes and experiences around teamwork changed after taking the course, we surveyed two cohorts of students at the start and end of the course; we also administered a follow-up survey at the end of the next term to see if these changes persisted over time and in new contexts.

Comparing students' responses at the beginning and end of the course, participants reported higher levels of psychological safety in teams, more positive attitudes about teamwork, and stronger endorsements of the view that diversity leads to successful outcomes after taking the course. The largest effect was seen in students' perceptions of psychological safety in the collaborative experiences they had during the course, compared to prior team experiences.

When we surveyed students at the end of the subsequent term, we again saw moderately higher levels of psychological safety in their new team contexts based on the three-item scale adapted from Edmondson (1999). The two additional exploratory items did not show a statistically significant increase, suggesting that these items may not be capturing meaningful changes in students' experiences. With respect to positive attitudes towards teamwork, while students' attitudes differed between the beginning and end of the course, we did not see differences between their pre-course responses and next-term follow-up, possibly indicating that they had difficulty replicating the positive experiences they had in the course when working in new contexts. Interestingly, however, students reported more positive attitudes when thinking about future teams than they did before taking the course, which suggests a sense of optimism.

Overall, our results demonstrate that students' attitudes, beliefs, and experiences of teams improved after taking INTEG 210: Making Collaboration Work, and that some of these changes persisted in new contexts and students' expectations for the future. As we discuss in the Limitations section, below, the design of the evaluation does not let us draw direct conclusions

about the mechanisms for these changes; however, we suggest that the course may have contributed to these changes in several ways.

First, having the opportunity to learn about psychological safety, and how to foster it, may have enabled students to cultivate more psychologically safe teams. The fact that we saw such a significant increase in students' perceptions of psychological safety between the beginning and end of the course could be a result of being on teams where *every* member learned about psychological safety and was prompted to discuss how they might cultivate it when creating their team charter. Yet, even when students worked on teams outside this course during the subsequent term, they reported higher levels of psychological safety compared to their pre-course experiences, suggesting that they may have been able to foster psychological safety to at least some extent in new contexts.

Second, with respect to improving students' attitudes about teamwork, the course may have strengthened students' beliefs that working in teams can lead to higher quality work either because they were exposed to the research on the benefits of collaboration or because they had a positive team experience in the course (or a combination of the two). It is notable that students' attitudes about teamwork were more positive at the end of the course *and* when thinking about future collaborations during the follow-up survey given how common it is for instructors to hear students bemoan group work (e.g., Murray, 2007). This shift in attitude may have been particularly important for students who had previously been skeptical of the value of group work. Thus, improving students' attitudes towards collaboration and teamwork could make them more likely to notice when things are going well and even increase their contributions to the team, which in turn could lead to better outcomes. Indeed, research on mindset indicates that one's attitude can have a significant effect on outcomes, partly owing to how it affects one's own behavior (Dweck, 2017; Murphy 2024).

Third, the course may have increased how much students valued various types of diversity because it exposed them to research on the benefits of diversity while giving them constructive experiences in teams that were deliberately designed to be diverse in several respects (gender, ethnicity, discipline, and year of study). As we discussed above, diversity in teams is only likely to lead to better outcomes when members of the team view diversity in a positive light. A key aspect of recognizing the value of diverse perspectives involves seeing how perspectives outside one's own are important in the first place.

Limitations

The design of this evaluation was limited by the reality of course offerings. Students could not be randomly assigned to this course or a control, so we cannot definitively conclude that the course *caused* the changes in students' survey responses. Additionally, there was no course on campus with a sufficiently similar sample of students that could serve as a matched control, so we cannot rule out the possibility that the changes in survey responses were due to something other than taking the course. However, given that students in this study were from a wide variety of programs, and included cohorts from two different time points, it seems unlikely that common experiences would influence their beliefs about collaboration specifically. Similarly, it is unlikely that changes were due to some common maturation process, given that students took the course at different stages in their university career.

We were originally hoping to examine differences between subgroups (e.g., gender, race, or program of study), but caps on course sizes meant that, even with two cohorts, the sample size

limited the opportunity to do so. We believe it would be beneficial for future SoTL research to assess interventions with larger sample sizes and similarly diverse groups of students.

Lastly, because our intervention consisted of an entire course, we cannot say for certain *which* aspects of the course were most impactful when it came to influencing students' experiences of psychological safety in their teams, their beliefs about the benefits of collaboration, or their views about the value of diversity in teams. Our intervention included readings and discussion of research on these topics as well as experiential learning and reflection activities. We strongly suspect that the opportunity for students to apply and reflect on the lessons about working in teams is critical to the success of such a course. We would love to see SoTL researchers continue to investigate psychological safety in student teams in ways that address these limitations and further advance our understanding of how we can improve student teamwork and help students hone their collaborative skills.

Future Directions for SoTL Research

As we noted above, psychological safety has been surprisingly understudied in the context of student teams and has only recently started to gain traction in the SoTL literature. The studies that have been published indicate that psychological safety plays a key role in student teamwork, especially when it comes to enhancing creativity and innovation (e.g., Balouchestani-Asli et al., 2016; Miller et al., 2019; You, 2021; Cole et al., 2022). This is important, as it indicates that key findings in the extensive research on psychological safety in work teams apply to student teams as well. However, these SoTL studies are primarily observational, stopping short of teaching students *how* to build psychological safety and examining changes in their experiences as a result. These studies are also limited to a particular context, as the majority focus on engineering teams, making it difficult to draw conclusions about other disciplinary contexts.

Our study advances SoTL research by describing and evaluating a course that explicitly teaches students why psychological safety, diversity, and collaboration are important, and how students can apply these lessons to their own collaborative experiences. The course also transcends specific disciplinary contexts by including students from a wide range of disciplines and offering them an opportunity to work in broadly interdisciplinary teams.

Yet, future research is needed to determine which aspects of such a course are the key drivers for cultivating psychological safety—and for whom. What theories, lessons, and practices make the most difference, and in which contexts? To what extent does teaching collaborative skills, like the course discussed in this article, have beneficial effects for students who are shy, neurodivergent, or from structurally disadvantaged groups? How might students on the same team differ in how they perceive the level of psychological safety on that team?[9] We encourage SoTL researchers to extend these findings using sample sizes that have the statistical power to examine various moderators and explore individual differences in perceptions of psychological safety.

Suggestions for Instructors

Until further research is done that can give us a more nuanced and context-dependent understanding of psychological safety in student teams, there are some general practices we can

[9] This is a particularly interesting question as the vast majority of research on psychological safety examines the construct solely at the team level, overlooking potential differences among individuals, as the lead author has pointed out elsewhere (Plaisance, 2022).

suggest to instructors based on our course design and study outcomes, the theoretical background provided above, and our own observations from teaching this course. Since our study was done with interdisciplinary teams, we believe these suggestions can be used in almost any discipline.

1. **Teach students about psychological safety and its importance as a predictor of team success**. Many students in our course noted that just being *aware* of the concept of psychological safety made it much easier for them to recognize psychological safety—or a lack thereof—and take steps to improve it.
2. **Discuss the research on the potential benefits of diversity, and how psychological safety can harness diverse perspectives.** As we noted above, the benefits of diversity need to be understood for students to listen to, take up, and even seek out different views. High levels of psychological safety can make it easier for *all* team members to share their perspectives and for team members to feel comfortable disagreeing with one another, both of which are essential for critical thinking and creativity.
3. **Give students time in class to get to know each other**. Recall that a psychologically safe team is one in which students feel that they can share wild ideas, take risks, and disagree with one another without fear of negative repercussions. This requires building trust, which in turn requires that students get to know one another. During one of our in-class discussions, students noted that having time during class to learn about their teammates enabled them to feel more comfortable sharing their ideas. Instructors can explore some of the resources online for cultivating psychological safety and share them with students; however, it might be just as effective—if not more so—to ask students to brainstorm ways to build psychological safety in their teams. This exercise requires students to think critically by reflecting on previous collaborative experiences that were high or low in psychological safety and trying to determine how they differed. It can also lead to more buy-in from students than would just giving them a set of practices to follow.
4. **Design group projects and collaborative experiences that require students to address complex problems and/or think creatively.** According to Sanner and Bunderson (2015), these are the types of collaborative projects that require diverse perspectives and necessitate psychological safety—and, thus, ones for which it will be especially worth putting effort into creating a positive team dynamic. Often, when students are assigned a group project, they take a divide-and-conquer approach, divvying up the work rather than truly working *together*. Conversations with students in the course indicated that students often default to a divide-and-conquer approach because they don't see the value of working in a more integrative fashion. Thus, it is important for instructors to be explicit about *why* students should take a more collaborative approach.
5. **Emphasize and assess the collaborative *process* in addition to the products of group work.** By following the suggestions above—namely, teaching students about the benefits of diverse teams and giving them time to get to know one another—instructors can help students recognize the value of working collaboratively. We also recommend signaling the value of attending to collaborative *process*. This can be achieved by having students create deliverables focused on group norms, dynamics, and processes, in addition to any products they are required to submit. For example, we asked students to develop team charters, which included (among other things): roles and responsibilities, expectations for communication, decision-making procedures, and mechanisms for providing constructive

feedback. Students were prompted to revisit their team charter part-way through the project, and were asked to submit both versions with their other project deliverables.

6. **Ask students to reflect on what did and did not work in their group, and what they can do next time to improve.** Reflection is particularly useful for deep learning and metacognition (Tanner, 2012). It can be done informally, through team debriefs and in-class discussion, and/or through writing, prompting students to analyze their collaborative experiences in depth and consider how they could improve in the future (Kaplan et al., 2013). This "learn, do, reflect" model was an intentional part of our course design, and one we recommend using.

Broader Implications for Educators & Administrators

This article has pedagogical implications beyond group projects. Instructors without group work in their courses can still focus on developing psychological safety in their classrooms. For example, instructors can draw on this concept to develop class norms and activities that make students feel safe sharing wild ideas, articulating dissenting views, and taking risks with their learning. For students in large classes, speaking up and asking questions can be intimidating, and an instructors' explicit attention to psychological safety might help them feel safe doing so.

Lastly, we believe that this study provokes important questions for administrators: Imagine if every university student took a course like this one early in their degree—how might that transform the campus culture? What benefits might students (and their instructors) experience in subsequent courses, especially those that use collaborative learning? How might this prepare students for graduate school and the ever-changing workplace? Given the need for more collaborative approaches to problem-solving, and the increasing demand for collaborative skills in the workplace, it is essential that institutions of higher education teach students why collaboration is important and how they can make collaboration work.

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