Towards a Distributed Model of Teaming: Instructor-driven Lessons from I-MATTER

Austin Morgan Kainoa Peters, Purdue University

Austin Morgan Kainoa Peters was born and raised in Wailuku, Hawaii where he attended Kamehameha Schools Maui (KSM). This private, Christian K-12 institution gives admission preference to children with Hawaiian ancestry and attempts to incorporate Hawaiian culture, history, and values into a Western-based curricula. Although KSM has many settler colonial influences, it taught Peters to see the benefits of his ethnicities, especially Native Hawaiian, within academia. Peters obtained his bachelor's degree at the University of San Diego (USD) in Integrated Engineering. Assimilating to the culture of this predominantly white institution left Peters questioning if he could be an engineer and multiracial. Fortunately, the liberal arts emphasis of the school combined with research work in Engineering Education helped him to see his worth as a multiracial engineer. Peters' current goal is to obtain a doctorate in Engineering Education at Purdue University to challenge the embedded settler colonialism of engineering and engineering education.

Dr. Alice L. Pawley, Purdue University

Alice Pawley (she/hers) is a Professor in the School of Engineering Education and an affiliate faculty member in Environmental and Ecological Engineering and the Women's Gender and Sexuality Studies Program at Purdue University. She is the winner of numerous awards, including best paper awards, leadership awards, and a PECASE in 2012. She is strongly involved in Purdue's chapter of the American Association of University Professors. Her research group's diverse projects and group members are described at pawleyresearch.org. Email: apawley@purdue.edu

Stephanie Masta, Purdue University

Member of the Sault Ste Marie Tribe of Chippewa Indians and educational researcher focused on issues of equity in Black and Brown education in the United States.

Dr. Darryl Dickerson, Florida International University

Dr. Darryl Athos Dickerson is currently an assistant professor in the Department of Mechanical and Materials Engineering at Florida International University. Dr. Dickersonâ€™s research agenda contains two interconnected strands: 1) systematic investigati

Dr. Matthew W. Ohland, Purdue University

Matthew W. Ohland is the Dale and Suzi Gallagher Professor and Associate Head of Engineering Education at Purdue University. He has degrees from Swarthmore College, Rensselaer Polytechnic Institute, and the University of Florida. His research on the longitudinal study of engineering students and forming and managing teams has been supported by the National Science Foundation and the Sloan Foundation and his team received for the best paper published in the Journal of Engineering Education in 2008, 2011, and 2019 and from the IEEE Transactions on Education in 2011 and 2015. Dr. Ohland is an ABET Program Evaluator for ASEE and represents ASEE on the Engineering Accreditation Commission. He was the 2002–2006 President of Tau Beta Pi and is a Fellow of the ASEE, IEEE, and AAAS. He was inducted into the ASEE Hall of Fame in 2023.

WIP Research: Towards a distributed model of teaming: instructor-driven lessons from I-MATTER

Abstract

This WIP research paper describes the development of a preliminary practical model to improve how instructors of large classes can address marginalization amongst teammates in small teams. We collected interviews with instructors of large first-year engineering classes at a large Midwestern, primarily white, research-intensive university, and analyzed them thematically drawing on Sue and colleagues' microaggression theory, Cortina and colleagues' articulation of selective incivility, and theory on coded language. Through iterative readings and coding, we offer an initial articulation of attributes demonstrated by instructors, and position those attributes in a preliminary contrasting model that prioritizes distributed responsibility over instructors being solely responsible for addressing marginalization.

Keywords

qualitative methods; instructors; teaming; diversity; microaggressions

Background

This WIP research paper describes the development of a preliminary practical model to improve how instructors of large classes can address marginalization amongst teaming. ABET criteria for undergraduate engineering program accreditation incorporates working effectively in a team as a skill students should learn to do better through both learning content about teaming and receiving feedback to improve. Teaching engineering undergraduate students how to work effectively in teams has become especially important in first year undergraduate courses [1]. However, engineering instructors rarely have sufficient necessary tools or expertise to promote teamwork among students and to identify and deal with conflicts, especially on issues of marginalization [2], [3], [4], [5].

One tool for helping students how to improve working in teams is CATME (catme.org), a web-based tool designed for team formation and peer evaluation. A large research base supports CATME's use [6]. However, identifying the ways that teammates engage in marginalizing and harassing behaviors is not explicitly pulled out, even though handling such damaging behavior would require more instructor or bystander engagement and intervention. Our prior work [7], [8] suggests that instructors are able to see early warning signs through CATME for teaming problems that may escalate over time, and suggest that it is worth addressing them early rather than waiting for them to get bigger (in case the team might somehow address them first).

In addition, other work on this project [9] has argued that racially minoritized students have learned to hold low expectations for what lengths they can expect engineering instructors to go to keep safe the learning environment for them, that racially minoritized students may publicly minimize the impact of classroom harassment on themselves (potentially as a safety strategy), and that they don't consider instructors a resource that can help them or make them feel welcome in the organization.

We have operationalized our understanding of marginalizing and harassing behaviors through three conceptual frameworks. The first is Sue and colleagues' theory of microaggressions [10], a set of interpersonal behaviors that they subdivide into microinsults, microinvalidations, and microassaults. While Sue and colleagues' work was originally based on articulations of interpersonal racialized harm, the concept of microaggressions also speaks to communities who are marginalized along lines of gender, sexuality, dis/ability, citizenship, age, as well as the ways in which people experience marginalization along multiple dimensions at once. Sue and colleagues have more recently [11] also offered a framework describing what they term as "microinterventions," organized into four different types of response to microaggressions: (a) make the invisible visible, (b) disarm the microaggression, (c) educate the perpetrator, and (d) seek external reinforcement or support.

The second framework we draw on is that of selective incivilities [12], [13], [14]. Cortina and colleagues have articulated a class of workplace behaviors recognized as "uncivil" but which are selectively applied to and experienced by marginalized workers in those workplaces. In this work, we extend this framing to classrooms, identifying the ways in which teammates engage in uncivil behavior selectively against marginalized teammates.

The third framework is that of coded language [15], [16] . While people still enact explicitly racist, sexist, homophobic and transphobic, ageist, xenophobic etc. harassment and violence on others, much harassment is more implicit and relates to an awareness of terms, values, behaviors and such which have been made relevant to race, gender, sexuality, age, and so on, and which are recognized by an audience as relating to a marginalized group, but with plausible deniability on the part of a perpetrator. So, for example, a person that describes a specific Black person as "articulate" is drawing on a long history in the US of white people denying Black people access to education, denigrating Black English dialects, and mocking the intellectual capacities of Black people as a group, thereby serving as code that disparages the abilities of Black people collectively. Our prior work [7], [8] described some ways that engineering undergraduate students have used coded language in their CATME evaluations to falsely accuse minoritized members of inadequate or otherwise unacceptable team participation.

Our past work [17], [18] describes how this individualistic model of teaming maintains microaggressions and selective incivilities on marginalized students, which contributes to marginalized students lowering their expectations of what they have a right to experience in their courses, and particularly some students giving up on their instructors' abilities or interest to address their harassment. We apply this work to our analysis of interviews with instructors of two large undergraduate engineering courses at one university. The interviews are based on how engineering instructors handle teaming problems as identified through CATME. This work-in-progress paper explores the research question: What are the ways in which instructors consider microaggressions and harassment in teaming as part of their teaching?

Methods

Participant recruitment and context: As part of the external evaluation plan for the project, we invited instructors of two associated large-scale (>2000 students per semester) required first-year engineering courses to talk with us at two different points in the academic year (mid-year, and end-of-year) about their experiences of overseeing and improving student teaming in the courses.

At this university, where engineering features prominently in the university's identity and international reputation, students admitted to be undergraduates are not required to choose an undergraduate major as part of their application. Instead, they indicate interest in being admitted to the engineering college, and are administratively labeled as "first year engineering" until they have successfully completed general chemistry, physics, math, and communications, and first year engineering courses. Most students take a specific two-course sequence of introductory engineering courses; the participants in this study teach one or both courses.

Because of the size of the engineering college and of first-year admissions, the required engineering courses are usually taken by more than 2000 students per semester, and taught by a collection of instructors including tenure-track and non-tenure track faculty, lecturers, and senior graduate students in the department's engineering education PhD program. Each section comprises around 120 undergraduate students, a graduate TA (who oversees two sections as part of a graduate appointment), 4 undergraduate peer teachers, and an undergraduate grader. The GTA and peer teachers attend each class period, which meets twice a week for 110 minutes. The group of instructors are substantially supported by full-time instructional support professionals.

Data collection: For this study, we spoke with 20 instructors, who varied greatly in their years of experience teaching generally and of this course specifically. We got the list of instructors from a departmental administrator, and invited them to participate via email. Interested instructors contacted our project's external evaluator, who designed the 30-minute interviews to assess the effectiveness of the project's research goals, and which served double-duty to inform this current work. The external evaluator conducted and transcribed the interviews, and pseudonymized them for name, role/rank, and years of teaching the course. This means that the authors of this paper do not know the participants' identities, nor their demographics beyond the pseudonymization.

Analysis: In this current work, with a new research assistant, we took a fresh look at the interviews. We read or re-read the transcripts before some initial conversations and consideration of our past work. One of the author team started an exploratory first-cycle coding of the transcripts looking for exemplary and more problematic teaching practices that aligned with our thinking about the different models of teaming. After this first pass, we reprocessed the transcripts through a second coding cycle that focused on what we are calling "dimensions" of a teaming model that aligns with our previous work [17], [18].

After this fine-grained coding, we created a two-dimensional data display [19] that positions each identified example against the dimensions to begin to think about how to group these dimensions in a way that conveys the necessity and utility of moving from what we are calling an individualistic model of teaming to a distributed model of teaming. In the following sections, we will describe what the individual model of teaming looks like and its connection to instructor discomfort, what a distributed model of team could look like, and how we plan to contribute to the shifting from an individual to distributed model of teaming using our identified dimensions.

Preliminary Results

We have previously described an individualistic model of teaming [17] as one that seems to assume that centrally-produced slides and videos does a comprehensive job to teach students about teaming, that intervention is unnecessary until problems are severe, and that these

interventions should be done in a subtle way with the entire team. We now see that there is more complexity to our data that doesn't always neatly line up with this model of teaming - that is, the positioning of an individualistic vs cultural model - and we are working to reframe it.

We are still holding onto the idea of isolated and singular treatment and diagnosis of teaming issues, especially relating to marginalization. In this idea, we see an instructor perspective that assumes students have a "good enough" ability to understanding the complexity of teaming and marginalization through very limited centrally-produced content, and difficult issues of marginalization can be addressed through one-off subtle and implicit interventions provided to the whole team by the instructor alone when conflict reaches a point so severe that it is hard to repair the team dynamics. However, the naming of this as "individualistic" doesn't seem to fit, and a contrasting position doesn't seem to always fit the idea of a "cultural" model. In the space that remains in this short WIP, we share some of our considerations in trying to find a better framing than this individualistic/cultural one, focusing on the reasons that instructors treat marginalization as a one-off. We understand from the transcripts that the instructors we spoke with are uncomfortable talking about or thinking about marginalization, and wonder how this one-off approach is related to this self-reported discomfort. Here we briefly explore how instructor discomfort appears in, first recognizing, and then addressing, marginalization.

To think about how instructors come to *recognize* certain intra-team behaviors as marginalization, we draw on the selective incivility theory introduced earlier. Instructors report that they are hesitant to call out team behavior that resembles marginalization because they do not want to escalate an issue that is due to what instructors N and S called "personality conflicts" rather than marginalization. We ask ourselves, are they feeling unclear on whether teammates being selectively uncivil targeting minoritized teammates (as per the theory), or whether somehow American undergraduate engineering culture rewards incivility between teammates? In other words, are they trying to decide whether some action was discriminatory behavior particularly requiring their intervention, or is it some kind of just "expected" or culturally-acceptable rudeness? (Of course, why would the latter somehow be acceptable?) In contrast, study participants could be telling us that they were more likely than not to misunderstand a situation and make it worse by intervening. Instructors seemed more uncomfortable about having made a mistake in identifying harassing behavior when there "was none" than about letting teammates target other teammates repeatedly and successfully. This seems backwards, and suggests some instructors were overly concerned about presenting themselves as skilled to majority students or to more powerful colleagues who perhaps would diminish certain actions as discriminatory, a microinvalidation in itself. But making mistakes helps us learn, and addressing marginalization when there is none protects targets in the future, while overlooking marginalization because we are not sure protects perpetrators over targets.

Addressing marginalization seems just as uncomfortable for these instructors to do as recognizing it in the first place. We saw multiple instructors demonstrate this discomfort in multiple ways, including but not limited to their own identities and experiences, or to their inadequate intervention training or tools. Instructors again seemed extraordinarily anxious not to make any mistakes, given they conceptualized a team's intervention as a one-off - in other words, their intervention had to be perfect because they only got one shot. We suspect this might have more to do with their overcoming their insecurity to confront problems a second time than some kind of pedagogically-justified reason to only address a problem once. That being said, we

also had two instructors who described different reasons for they felt like they needed to be "sure" before intervening - one described being intimidated about talking about race and gender as a member of marginalized communities in the current political climate, and the other talked about having been told by a student that the instructor was being too political in their classroom and they should focus on teaching. (We note that this university's state legislature passed anti-DEI legislation in 2024; while this study's interviews were collected before this date, a climate that equated discriminatory behavior as equivalent to free speech had been growing for years.)

We are using this dive into instructors' discomfort regarding recognizing then addressing marginalization to help us articulate what a more successful and "distributed" (rather than cultural) model of teaming might look like. In this distributed model of teaming, instructors would treat marginalization as a core teaming issue that must be comprehensively discussed, reinforced, and disrupted throughout the course, rather than a one-off with limited course content. In this model, the responsibility to intervene is not solely that of the instructor, but is instead distributed across all members of the classroom (including peer teachers, TAs, and teammates), who would also have the tools to do so effectively and repeatedly. In the circumstances where someone made a mistake in an intervention, they would learn from that experience and be able to try again, or apply that learning to the next such circumstance. In this model, improving teaming and reducing marginalization would become an ongoing process where everyone sees, names, and takes responsibility for marginalization.

We started to articulate four dimensions that differentiated the individualistic model from the distributed one: *visibility, proactivity, growth,* and *shared responsibility,* and to see parallels between these four dimensions and Sue et al.'s [11] microintervention strategies. We relate our dimension of *visibility* to Sue et al.'s "making the invisible visible," meaning instructors should be explicit when teaching so that everyone is able to put a name to microaggressions and marginalization in teams. Through *proactivity*, linked to Sue et al.'s "disarming microaggressions," instructors address marginalization directly, early, and often. *Growth* connects to Sue et al.'s dimension of "educating the perpetrator," and conceives of understanding marginalization as an ongoing process of growth, where instructors are encouraged to try new strategies to disrupt marginalization and make mistakes to help them learn how to improve. Lastly, through *shared responsibility* linked to Sue et al.'s dimension of "seeking external reinforcement or support," instructors would pass on strategies and tools to other teaching team members, and to students themselves in the classroom, to distribute the responsibility to make the invisible visible, disarm microaggressions, and educate the perpetrator.

Our future work will develop these dimensions and models to illustrate their relationships to selective incivility theory and Sue et al.'s microintervention strategies to provide instructors with different tools and strategies to cultivate a distributed model of teaming.

Acknowledgements

This material is based upon work supported by the National Science Foundation under Grant No. # 1936778. We thank the study's participants for sharing their experiences and time with us. We acknowledge the contributions of Cara Margherio, Elizabeth Litzler, and Rae Jing Han at the Center for Evaluation & Research for STEM Equity who collected or curated the instructor interviews used for this paper.

References

[1] ABET, "Criteria for accrediting engineering programs," p. 28, 2009.

[2] K. J. Cross and M. C. Paretti, "African American Males' Experiences on Multiracial Student Teams in Engineering," *J Women Minor Scien Eng*, vol. 26, no. 4, pp. 381–411, 2020, doi: 10.1615/JWomenMinorScienEng.2020033004.

[3] J. Wolfe and E. Powell, "Biases in Interpersonal Communication: How Engineering Students Perceive Gender Typical Speech Acts in Teamwork," *Journal of Engineering Education*, vol. 98, no. 1, pp. 5–16, 2009, doi: 10.1002/j.2168-9830.2009.tb01001.x.

[4] J. Wolfe, E. Powell, S. Schlisserman, and A. Kirshon, "Teamwork in Engineering Undergraduate Classes: What Problems Do Students experience? : American Society for Engineering Education," presented at the 2016 ASEE Annual Conference & Exposition, New Orleans, LA, 2016. Accessed: Jan. 21, 2019. [Online]. Available: https://www.asee.org/public/conferences/64/papers/16447/view

[5] M. Keogh, M. Zarske, and J. Tsai, "Active Learning Group Work: Helpful or Harmful for Women in Engineering?," in *2018 ASEE Annual Conference & Exposition Proceedings*, Salt Lake City, Utah: ASEE Conferences, Jun. 2018, p. 29748. doi: 10.18260/1-2--29748.

[6] "Research," CATME. Accessed: Feb. 07, 2024. [Online]. Available: https://info.catme.org/instructor/history-research/research/

[7] D. A. Dickerson, S. Masta, M. W. Ohland, and A. L. Pawley, "How Can We Identify Teams at Risk of Marginalizing Minoritized Students, at Scale?," presented at the ASEE Virtual Annual Conference, Virtual conference: American Society for Engineering Education, Jul. 2021. [Online]. Available: https://peer.asee.org/37250

[8] D. Dickerson, S. Masta, M. W. Ohland, and A. L. Pawley, "Is Carla Grumpy? Analysis of Peer Evaluations to Explore Marginalizing Behaviors in Engineering Student Teams," *Journal of Engineering Education*, vol. In review.

[9] J. Grant, S. Masta, D. Dickerson, and A. Pawley, "'I Don't Like Thinking About this Stuff': Black and Brown Student Experiences in Engineering Education," presented at the ASEE Annual Conference and Exposition, Minneapolis, MN, Jun. 2022.

[10] D. W. Sue *et al.*, "Racial microaggressions in everyday life: Implications for clinical practice.," *American Psychologist*, vol. 62, no. 4, pp. 271–286, 2007, doi: 10.1037/0003-066X.62.4.271.

[11] D. W. Sue, S. Alsaidi, M. N. Awad, E. Glaeser, C. Z. Calle, and N. Mendez, "Disarming racial microaggressions: Microintervention strategies for targets, White allies, and bystanders.," *American Psychologist*, vol. 74, no. 1, pp. 128–142, Jan. 2019, doi: 10.1037/amp0000296.

[12] L. M. Cortina, "Unseen Injustice: Incivility as Modern Discrimination in Organizations," *Academy of Management Review*, vol. 33, no. 1, pp. 55–75, Jan. 2008, doi: 10.5465/amr.2008.27745097.

[13] L. M. Cortina, D. Kabat-Farr, E. A. Leskinen, M. Huerta, and V. J. Magley, "Selective Incivility as Modern Discrimination in Organizations," *Journal of Management*, vol. 39, no. 6, pp. 1579–1605, Sep. 2013, doi: 10.1177/0149206311418835.

[14] L. M. Andersson and C. M. Pearson, "Tit for tat? The spiraling effect of incivility in the workplace," *Academy of Management Review*, vol. 24, no. 3, pp. 452–471, 1999.

[15] M. E. L. Bush, *Breaking the code of good intentions: everyday forms of whiteness*. Lanham, Md: Rowman & Littlefield Publishers, 2004.

[16] A. E. Castagno, "'I Don't Want to Hear That!': Legitimating Whiteness through Silence in Schools," *Anthropology & Education Quarterly*, vol. 39, no. 3, pp. 314–333, Sep. 2008, doi: 10.1111/j.1548-1492.2008.00024.x.

[17] A. L. Pawley, C. Margherio, S. Masta, D. Dickerson, and M. W. Ohland, "Instructors' understanding of teaching first-year engineering teaming: characterization and redirection," in *Conference Proceedings 2023 Canadian Engineering Education Association-Association canadienne de l'éducation en génie*, Okanagan College and UBC-Okanagan, Jun. 2023, p. Paper 28.

[18] S. Masta, J. Grant, C. Margherio, D. Dickerson, M. Ohland, and A. Pawley, "On Faculty Responsibility for Increasing Students' Sense of Support in the Classroom: Lessons from I-MATTER about Black and Brown Students," in *2023 ASEE Annual Conference & Exposition Proceedings*, Baltimore, Maryland: ASEE Conferences, Jun. 2023, doi: 10.18260/1-2--43758.

[19] M. B. Miles, A. M. Huberman, and J. Saldana, *Qualitative Data Analysis: A Methods Sourcebook*. SAGE Publications, 2018.