

Practitioner Learning Community: design of instructional content, pedagogy and assessment metrics for inclusive and socially just teaming practices

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Practitioner Learning Community: Design of instructional content, pedagogy and assessment metrics for productive, inclusive and socially just teaming practice

Abstract

This paper describes the development of and outcomes from a Practitioner Learning Community (PLC) model used to design instructional content, pedagogy, and assessment metrics for inclusive, socially just teaming practices. Comprised of postdoctoral researchers, instructors, and tenure-lined research faculty, our PLC used strategies to produce sustainable instructional shifts, including those that: worked to cultivate trust among participants; leveraged existing beliefs/understandings; offered long-term, regularly-spaced interventions; considered institutional culture and context; and linked instructional outcomes to faculty participants' assigned work. PLC members developed content and teaching tools that supported a number of areas, including development of: processes for team norming; curricula for functional teaming (e.g., conflict management and effective communication); modules to engage students in the examination of complex structures, systems, and ideologies that sustain discrimination and inequities in the practice of engineering; and assessment instruments to measure student teaming competencies. This paper provides a framework for supporting the exploration and development of effective and inclusive teaming practices at other universities to address the new ABET student outcome #5 and other challenging, unfamiliar topics within engineering. Given the success of the PLC model in the current context, those interested in developing a PLC at their own institution might consider adapting this framework to fit within their own context and culture.

Introduction and Background

Engineering work relies on effective collaboration and communication among diverse groups of engineers and scientists engaging in partnership with broader constituencies (managers, technicians, end users, among others). And while all engineering educational programs require student teamwork, instruction on effective and inclusive teaming practices is only occasional, and if present, the outcomes are rarely assessed. The efforts described in this paper around the development and implementation of inclusive teaming instruction were enabled to a great extent by our broader university- and college-level contexts. Moreover, we leveraged the support of the unit-level *REvolutionize Engineering and Computer Science Departments* (RED) initiatives and the changes to ABET programmatic assessment criteria. In this section, we situate this discussion within local institutional efforts as well as broader shifts in national accreditation standards. We then describe and critique elements of existing engineering cultures that might present challenges toward progress in creating inclusive and socially just teaming practices. Notably, we combine these strands to develop a response to noted challenges and opportunities through the activities of our Practitioner Learning Community (PLC).

Institutional Context

As described in Bothwell, Akkaraju, McGuire, Tran, & Zigler (2018a), Oregon State University has recently taken a number of significant steps to advance equity, inclusion, and diversity, and the College of Engineering (COE) has embedded a goal in its strategic plan to become a national model of inclusivity and collaboration. Institutional goals, accompanying shifts in policies, as

well as availability of increased professional development opportunities concerning equity, inclusion, and social justice, provided a strong backdrop for the work our PLC undertook. Of particular relevance was alignment of our work with two projects engaged by the newly formed COE Change Team: (1) *Development of a scaffolded approach to enhancing undergraduate students' knowledge and skills supporting inclusive and socially just teaming practice*; and (2) *Design of modules to enhance graduate students' capacities to engage issues of inclusivity, equity, and social justice* (see Bothwell et al., 2018a for more detail). Overlapping membership on the COE Change Team and our PLC ensured synergy across the groups' efforts.

Changes to Programmatic Accreditation

At the same time, ABET has undergone revision to their accreditation criteria, in particular those concerning criterion 3, or student learning outcomes (Sussman, Brackin, & Rajala, 2016). Instead of the 11 outcomes specified by a-k in *EC 2000*, ABET has condensed and reformulated requirements around 7 student outcomes. By and large, the changes have involved a reorganization of how and where learning outcomes are specified. But some changes have sparked debates surrounding the kinds of skills engineers ought to have after graduation as well as the role of ABET in engineering education and programmatic assessment (Matos, Riley, & Akera, 2017).

One noteworthy change in criterion 3 concerns student outcome #5. Specifically, outcome #5 states that, upon completion of an engineering degree program, students should be able to “function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.” Of note in this revised criterion is the language related to creating a *collaborative and inclusive environment*. This change is noteworthy for a few reasons. For one, it signals ABET's acknowledgment of the importance of inclusivity in teamwork and recognition of the need for it in modern practice. Inclusive, diverse teams design better solutions and respond to problems more effectively than teams that lack inclusive climates. This change is also important because it presents new challenges for engineering faculty who must demonstrate they have achieved this outcome in their class.

Engineering Culture

Given the history of engineering as a discipline of *exclusion*, meeting the new ABET outcome is likely to be difficult for some engineering faculty. Researchers have explored engineering culture and dominant paradigms through a range of methodologies and empirical approaches (e.g., (Bucciarelli, 2001; Faulkner, 2000; Tonso, 2006; Trevelyan, 2013). Some studies describe engineering culture as girded by problematic ideologies that reinforce science and engineering work as objective, using objectivity to justify technical work's disconnection from social, political, and cultural forces in ways that prevent authentic movement towards socially just practice (Cech, 2013; Riley, Pawley, & Slaton, 2013). Other findings point to the persistence of cultural norms that emphasize and prioritize technical skills over those related to communication, teamwork, intercultural competence and others often termed professional—even *soft*—skills (Faulkner, 2000, 2007; Tonso, 2006; Trevelyan, 2012). This tendency to dichotomize engineering skills in terms of hard/soft or technical/professional also drives perceptions of what “counts” as engineering. Put differently, by positioning engineering as a primarily technical

discipline, and imposing a false dichotomy between technical and social, learning related to the latter can feel out of place and prevent the deeper learning needed for effective practice.

This existing culture does two important things when it comes to pedagogical practices. First, the general lack of discussion concerning issues of diversity, equity, and inclusion might lead engineering faculty to question the appropriateness of learning related to such topics within an engineering context. If we, as a profession, do not recognize issues of diversity, equity, and social justice as integral to the success and advancement of our field, it is perhaps only reasonable to push back on educational interventions that target those issues. As a result, many faculty members might question the value of such learning and resist implementation in their classrooms. Second, even when faculty are interested in addressing issues of inclusivity and social justice in their classrooms, they might not feel they have the requisite knowledge and skills to facilitate that kind of learning. Given the noted issues of social/technical binaries present in engineering, it makes sense that an engineering professor, who takes pride in their technical knowledge and skills, might feel unqualified to address the social, cultural and political dimensions of engineering that comprise diversity-focused learning.

In response to transformational goals at the university-, college- and unit-levels, changes to accreditation criteria, and noted potential challenges and barriers to implementation (and assessment), we formed an interdisciplinary PLC. The purpose of this paper is to describe the process of forming our particular PLC, the guiding principles and salient features that informed our efforts, and the products and outcomes of our collaborative work.

Approach: Practitioner Learning Community

Researchers, instructors, and tenure-lined research faculty from two units within the COE participated in a PLC focusing on the design of instructional content, pedagogy and assessment metrics for productive, inclusive, and socially just teaming practices. The PLC was designed as an inquiry-based learning opportunity, providing a platform for participants to discuss practices of effective team formation, teamwork assessment, knowledge and knowing (e.g., epistemology), and socially just teaming practices. While there were only six PLC participants in total, a handful of additional instructors in the School of Chemical, Biological and Environmental Engineering implemented emerging artifacts and products. Notably, conversations among those in the PLC and others implementing the products is ongoing.

Research has shown that effective strategies used to promote change in STEM instructional practices have several characteristics in common (Henderson, Beach, & Finkelstein, 2011): they are aligned with or seek to change the beliefs of the individuals involved; they involve long-term interventions, lasting at least one semester and often longer; and they are designed to be compatible with the understanding of the university as a complex ecosystem governed by a range of stakeholders and competing interests. The recent report on systemic change to STEM post-secondary pathways by the National Academies of Sciences, Engineering, and Medicine referenced this work and highlighted PLCs as reflecting these important features (National Academies of Sciences and Medicine, 2016). This report also indicated the importance of simultaneously addressing incentive practices and the values of the academy in order to ensure the institutionalization of the instructional shifts. In designing our PLC, we ensured each of these elements were present and will expand on each in turn.

Strategy 1: Aligned with or seek to change beliefs of participants

The review compiled by Henderson and colleagues (2011) suggests that pedagogical shifts are more likely to occur and be sustained if faculty beliefs about and foundational knowledge of a particular instructional practice are aligned with the change trying to be implemented. That is, faculty development is more effective when faculty can connect their learning to domains or topics they already understand well. There can be alignment at the outset of an intervention, but most often, the intervention itself must bring about a shift in faculty beliefs and understanding while also providing new pedagogical tools. PLCs have been identified as useful interventions by providing the environment necessary for changing faculty beliefs, thus producing changes that are deeper and sustained (Kezar, 2011).

PLC members were encouraged and incentivized to enroll in the Oregon State University's Difference, Power, and Discrimination (DPD) Academy. This professional development opportunity consists of a 60-hour immersive seminar that introduces theories of systems of oppression through readings, lectures, films, discussions, and experiential activities. Participants engage in personal reflection about their own locations in relation to power and privilege. Moreover, they are challenged to examine how their own disciplines— including curricular content and pedagogical practices— have been constructed in ways that reproduce hierarchy and dominance. Engaging PLC members in this professional development activity prior to focusing on curricular shifts relative to inclusive and socially just teamwork was both intentional and valuable. Specifically, this immersive experience provided a means to begin disrupting the problematic, dominant narratives of engineering culture through facilitating “sensemaking” of personal experiences of discrimination within institutions broadly, and within classrooms in particular (Kezar, 2011; Kezar & Eckel, 2002). This seminar also introduced the PLC members to critical pedagogies (e.g., (Bothwell et al., 2018b; Freire, 2000; Giroux, 2011; hooks, 2010; Taylor, Lutz, Hampton, Lee, & Watford, 2017) as a means to transform classroom experiences.

Therefore, when the PLC commenced, we could communicate with a common language and, importantly, a shared critical lens. Conversations problematizing engineering culture and its history of exclusion continued through PLC meetings, which served as a means to deepen the knowledge introduced during the DPD Academy and further broaden members' understanding of our field. This new knowledge was then applied to the re-visioning of the outcomes we sought for students and construction of content and activities to secure these competencies.

Strategy 2: Involve consistent, long-term interventions

Literature also suggests that changes in instructional practices are more likely to be adopted and integrated when the interventions are long term, defined as lasting a term or longer (Henderson et al., 2011; Henderson & Dancy, 2007). This structure is in contrast to delivering short 1-2 hour seminars designed to present “best practices,” with the expectation that audience members will adopt them. This particular mechanism of change has been shown to be ineffective (Henderson et al., 2011). Our PLC is now in its second consecutive year with the same core membership (although one member assumed a faculty position at another university and relocated). Kezar (2011) noted that long-term interventions allow for opportunities for sustained deliberation of change and provide ongoing support networks and communities for the change agents. We have certainly found this to be true for our group.

We also designed the PLC to have consistent meeting times throughout the academic term—usually once every two or three weeks for one hour. In contrast to a workshop or similar one-off learning experience, PLC members met with regularity to discuss how they had applied what they learned in the PLC, the results of implementing and piloting different instruments, and other activities supported by the community. The consistency in meeting intervals was important because it gave PLC members a more sustained interaction with each other and provided space to dive deeper into practice-oriented issues and receive feedback to improve subsequent approaches. By establishing a consistent meeting time and space, we increased the mutual accountability of the team, which helped to drive progress on our noted goals.

Strategy 3: Change strategy designed with an understanding of and compatible with the university's culture and context

As described above, our efforts were enabled by an institutional context (at all levels) that was seeking to provide transformational learning experiences to students and to advance goals of equity, inclusion, and justice. Further, shifts in ABET student outcomes provided additional motivation for faculty to engage in design and implementation of effective and inclusive teaming instruction across our curricula. We were also able to take advantage of a culture at Oregon State University that encourages professional development as well as long-standing programs that provide that development.

One contextual barrier that could have impeded our progress if not intentionally addressed was the underlying incentive system and values present at a research-intensive university. Research (e.g., Austin, 2011; Brownell & Tanner, 2012; Fairweather, 2008) suggests that offering professional development opportunities or creating change mechanisms like learning communities without addressing the incentive system and values in academia will result in short-term shifts. At most research-intensive universities, the reward and approbation structure aligns with research productivity to a greater extent than with contributions to advancements in teaching and learning. Asking faculty to dedicate significant amounts of professional time to transforming learning experiences in their classrooms and across programs could have negative implications during their annual evaluations, reducing the likelihood of merit raises and advancement. Partly in response to this historical and limited framing of evaluation, recent initiatives in the COE have targeted the process by which employees are evaluated to better support university values in relation to effective teaching and to clearly outline expectations for every faculty member to promote a more inclusive and collaborative community (for more information about COE's strategic goal to become a national model of inclusivity and collaboration see Bothwell et al., 2018a).

The instructors and tenure-lined faculty who engaged in the PLC were able to take advantage of the new evaluation process and detail the inclusive teaming work in their annual review form, and in one case, a mid-tenure review dossier. All received credit for their contributions, and while this is important, there is little evidence that this recognition weighed heavily in incentivizing involvement in the PLC. Rather, people participated because they cared about students' development into competent and responsible professionals. However, the formal recognition and credit offered reinforces the stated values of the college and with time may provide incentive to those less inclined to contribute to these sorts of efforts. Another means for administration to show they value instructional innovation and efforts to advance equity and inclusion in classrooms is to provide formal shifts in assigned duties or summer salary. During

academic year 2017-18, two members received compensation for their efforts. One received a course release in order to provide leadership for the PLC and two COE Change Team projects. A second member was given a month of salary for their efforts. While no single member is receiving compensation during the current academic year, the broader PLC team did receive recognition and a small monetary award through the Chemical, Biological and Environmental Engineering Teaching Fellow Innovation Program, resourced by the Oregon State University RED funds.

As described above, our PLC efforts built upon existing models known to be effective at encouraging pedagogical shifts as well as practices that encourage curricular and organizational transformation as they relate to equity and justice. The novelty of our approach comes in the synthesis of different research-based frameworks such as organizational learning, critical theory, and frameworks for realizing social justice and equity. Our readings, conversations, and the development and implementation of products embraced an interdisciplinary approach and valued the contributions of other fields and outside perspectives. By combining concepts from other fields with engineering-specific content, we were able to more meaningfully engage with issues of culture, power, privilege, etc., in ways that offered authentic integration and application of these concepts into engineering education contexts.

Outcomes

Two categories of outcomes emerged from our efforts: (1) a process model for a PLC that might be able to transfer to other institutional contexts; and (2) artifacts and products for use in classrooms. Each is discussed below.

Critical elements of the PLC Structure

Two of the most important and intentional elements of our PLC were trust and community. In order to enable instructional changes, PLC participants must be vulnerable in a number of ways. For example, they have to be willing to open themselves to shifting beliefs and practices, and to share outcomes of new instructional content and strategies piloted in their courses, including negative experiences. An additional layer of vulnerability was present in our PLC due to examining the intersections of oppression and how their combinations play out in our engineering programs and classrooms. These conversations can be unsettling for everyone and can spark resistance from a wide range of students (Goodman, 2011), especially when one is engaging from a position of privilege.

Several strategies were used to foster trust and rapport among PLC members. First, the work was framed as being supportive, formative, and voluntary (not evaluative), with goals to be reached through participation, reflection, feedback, and dialogue among participants. During our first meeting, members were asked to introduce themselves in ways that linked them to their social and cultural contexts, important elements in reflective conversations about social identities. It is not until tens of minutes later that individuals were asked to place themselves within their role at the university. Intentionally sequencing the questions in this way models a space where there is an expectation that members bring more than just their professional self into the space. Coffee and assorted hot beverages, as well as small snacks (cookies, brownies, fruit plate, etc.) were available at each meeting. This also provided an unspoken but intentional cue towards care and relationship.

The first meeting also provided time for members to collectively frame our work. We set norms and expectations for ways we would interact and be accountable to one another and the work as a whole. We laid out ground rules that started with the assumption and belief that all PLC members were speaking from an interest in learning. For instance, we recognized that learning about diversity, equity, and inclusion can involve acquiring new language or modifying one's current lexicon. As a result, we provided a "safe space" where members of the PLC were able to communicate their thoughts and feelings in ways that were free from stigmatization and, if needed, corrected with compassion. By starting from a place of trust and belief that each member wanted to genuinely learn and engage with these challenging topics, we provided space for members to express views and ask questions in their own words and learn from their potential failures without being called out.

While our conversations and instructional strategies were intended to be emergent, it was important at the outset to reflect on the outcomes we sought. We identified current teaming practices in our curricula, associated trouble spots, and opportunities for improvement. Subsequently, we developed common, agreed-upon goals that reflected all members' unique needs and interests. Each member then decided which aspect of the work was most interesting and most closely aligned with their teaching responsibilities. Small teams (2-3 members) were formed to engage with specific tasks. This latter step was important in that it provided both a motivation to engage the work and a means to pilot the new instructional strategies.

From the perspective of the authors and PLC members, the PLC provided a consistent space for its members to explore the concepts of social justice and inclusivity as they relate to curriculum, to our students, and to our own self-development. The environment was challenging but inviting and respectful, allowing for authentic discussion of ideas for teaming instruction activities and for an opportunity to receive critical feedback. The variety of perspectives and experiences of the PLC members improved the quality of the teaming activities and modules that emerged, and also promoted the professional and personal growth of the members. Facilitating classroom discussion of teaming, diversity, and inclusion is something that is very different from traditional instruction of fundamental concepts in engineering science. Having a group of supportive faculty to meet with, most of whom were also embarking on this task for the first time was reassuring. The PLC provided a sense of accountability, legitimacy, and validation for its members concerning the work of developing and understanding socially just and inclusive teaming practices. Without the support of this community, it would be difficult for members to consistently engage in this important work when competing faculty obligations can take priority.

Artifacts and Products of the PLC

Outcomes from our PLC centered on two major development areas. First, we created a range of learning modules to address topics related to teaming, such as working across interpersonal differences; unconscious biases, examination of complex structures, systems, and ideologies that sustain discrimination and the unequal distribution of power and resources in the practice of engineering; and a critical examination of engineering history, among others. We also developed and piloted a functional teaming curricula, and leveraged existing research to create assessment instruments and peer feedback mechanisms that address issues of justice and inclusivity within teams. The artifacts are discussed in more detail below.

Adaptable Learning Modules

A key outcome of the PLC was the development of modular activities to facilitate student learning about inclusive teaming and approaches for creating inclusive environments. Driven by practical concerns and experiences of members in the PLC, learning modules were designed with portability and flexibility in order to mitigate noted barriers to faculty adoption.

One module focused on identifying, understanding, and productively working across differences in personality and individuals' strengths and preferences. Students were asked to respond to a personality-type instrument (e.g., MBTI, StrengthsQuest, etc.) and reflect on their results. The learning module was designed to facilitate conversations around interpersonal differences and productive strategies for navigating conflicts based on them. The goals of this particular module are twofold. First, we equip students with the language needed to describe and articulate key differences among team members. Second, building on our first goal, we provided students with strategies for navigating differences in order to accomplish a collaborative task. Through these two aims, students more effectively managed the social interactions and conflicts that arose throughout the normal course of teamwork and better met intended outcomes.

However, encouraging and facilitating micro-interactions and interpersonal skills are one of many components related to inclusive, socially just engineering teams. It is vital that engineering team members are civil and respectful to each other, but it is perhaps equally important that we contextualize these activities within the broader engineering landscape and history. As a result, we also developed a module that addresses topics of implicit biases and their influence on engineering teamwork. For instance, we explored the role of gender bias on engineering teams (e.g., prove-it-again, tightrope bias) and again provided students and faculty with the language needed to identify and address injustice as it occurs throughout teaming interactions.

We also developed modules where students explored and problematized dominant ideologies framing current engineering culture (e.g., meritocracy, depoliticization, social/technical dualism). We developed real-life cases and vignettes that identify links between engineering practice, inclusion, and society and, importantly, explicated the barriers to the evolution of engineering into a socially just profession (Cech, 2013, 2014). Designed to be delivered in our orientation sequence, the activities centralize the social and political dimensions of engineering so that they stand firmly beside the technical dimension. Critical pedagogies such as product archeology (Taylor et al., 2017), critical image analysis, and theatre of the oppressed (e.g., Bothwell, Furman, et al., 2018b; Freire, 2000) will be used to move students into and through these conversations.

The intent of these modules was to provide accessible content for faculty and students that might apply across a range of engineering disciplines, courses, and program levels. We also wanted to avoid the likelihood of outcomes related to inclusive teaming getting sequestered in first-year or senior design courses, as is common with other professional or non-technical learning outcomes. By developing flexible content informed by input from engineering instructors and practitioners, we enhanced the potential for adoption *throughout* engineering curricula in ways that more intentionally communicate the importance of inclusion in teamwork while also offering a broader range of assessment points for programmatic accreditation.

Functional Teaming Practice and its Assessment: Piloting in senior-level laboratory and design sequences

In addition to the modules described above, early-stage, functional teaming curricula (e.g., team norming, conflict management, effective team communication, and team roles) evolved from conversations in the PLC. These modules were piloted in senior laboratory and design sequences (Malette, Bothwell, & Kelly, 2018), courses that have significant team components, where weekly- and term-projects are completed by student teams of three. The students were provided with teaming tools and instruction to enable them to engage in successful teaming practices. For example, we emphasized team norming during the team formation stage, which included construction of a team-generated contract specifically outlining the values that would guide team interactions, as well as expectations of member's roles, communication methods, timeliness for contributions, means to navigate conflict, among others. This provided a foundation for member accountability, and a basis for reflection as projects progressed.

Members of the PLC identified student-to-student peer review and student self-reflection as critical elements for successful and inclusive team-based work. Towards this end, teams were asked to complete a formal, mid-term team check-in/reflection. A similar team reflection occurred at the end of the term and included a survey-based peer feedback instrument that provided additional data. Development of valid and reliable assessment instruments to measure student competencies in functional and socially just teaming was also a focus of our PLC. While this work is emergent, our current approach adapts concepts from organizational justice research (Colquitt, 2001; Colquitt, Noe, & Jackson, 2002). In particular, the justice measure items (procedural justice; distributive justice, interpersonal justice and informational justice) outlined in Colquitt (2001) are reflected in the mid-term and end-of-term team reflection exercises. This framework provides measures related to the way information is shared and accessed, how plans and decisions are made, and other issues concerning the equity within a team. In addition, current versions of CATME.org (Comprehensive Assessment of Team Member Effectiveness) provided a means for students to rate themselves and their teammates on various elements related to effective teaming, including: (i) contributing to the team's work; (ii) interacting with teammates; (iii) keeping the team on track; and, (iv) expecting quality. Teams reviewed responses from both assessment instruments for connecting themes, and generated a list of recommendations for improvement.

Conclusion

Teamwork is an essential skill for professional engineering practice. Peer-to-peer interactions in team projects has traditionally been a target for student complaints for a variety of reasons, many of which center on the issue of inclusivity. Furthermore, engineering has traditionally been a challenging field of work for people who do not identify with the dominant categories of social identity that exist in US culture (e.g., white, able bodied, straight). To address these issues and centralize the social, interpersonal aspects of engineering, we created a Practitioner Learning Community focused on inclusive teaming. By fostering an environment of mutual respect, curiosity, and genuine commitment to learning, we developed a set of rules for interacting and communicating that provided space for the conversations needed for authentic movement toward socially just practice. In turn, these practices led to the creation of a range of instructional and assessment tools to address and understand learning related to inclusive, socially just teamwork practices.

As we deepen our understanding and experience in teamwork instruction, we are becoming better positioned to sort instructional content and skill development into a progressive framework across introductory, 2nd- and 3rd-year core engineering courses, and capstone courses so as to guide and hone students' teamwork competences. Incorporating teaming instruction across the program provides students with opportunities to repeatedly practice functional and socially just teaming skills. As we move forward and continue to meet as a PLC, there are a number of questions that need to be answered. For example, how many courses need to explicitly develop students' socially just and inclusive teaming skills in order to produce a meaningful outcome? What is the most efficacious scaffolding strategy and at what levels within a program should specific skills and content be delivered? Do PLC members need to complete a similar immersive professional development experience as that described above or is it enough to have one or more PLC members versed in systems of oppression theories and critical pedagogies? Evaluation data would also provide insight as to how best sustain faculty engagement (e.g., what are the best follow-up strategies, and does inclusion of annual review metrics targetting contributions to equity and justice significantly motivate engagement in these sorts of efforts?). It is the hope of the authors that the description of the development of the PLC can serve as a model for creating them elsewhere. As the project moves forward, it is our intention to share products and artifacts for adaptation at other institutions.

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