

Reifying Dominant Ideologies: Consequences of Decoupling Equity from Ethics in Engineering Education

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Abstract— In this paper, we conduct a critical, secondary analysis of three engineering leadership research projects to explore the consequences of separating ethics from equity in engineering education and practice. Our findings suggest that by pairing ethics with equity, the Canadian Engineering Accreditation Board (CEAB) has raised the profile of professional responsibility among engineering education administrators. Unfortunately, by treating ethics and equity as distinct skillsets rather than integrated epistemological practices, we fail to disrupt powerful ideologies in the profession. In the process, we run the risk of universalizing ethical dilemmas faced by socially advantaged engineers, masking career mobility penalties faced by marginalized members of the profession and leaving engineering leaders with strong social impact records off the hook for inequity. In short, by decoupling equity from professional ethics, we leave societal patterns of privilege intact in workplaces designed for something other than teaching and learning.

Keywords—equity, engineering ethics, accreditation, professional practice, meritocracy, depoliticization, lifelong learning, social justice

I. INTRODUCTION: ACCREDITATION IS AN IMPERFECT CATALYST FOR BRIDGING ETHICS AND EQUITY

Curricular attention to professional ethics has a long history in engineering education but it has only recently been taught in ways that address equity, diversity, and inclusion (EDI) ¹. Even when ethics is taught with explicit attention to diversity and inclusion, the “E” in EDI often goes missing [1]. Equity has remained on the sidelines as other social impact issues such as health, safety, and environmental sustainability have been integrated into engineers’ professional practice [2-4]. This has been the case despite four decades of research identifying gender and racial under-representation in the profession [5-7]. While EDI efforts in the form of courses, training, and multicultural celebrations have increased over the years, these interventions have done little to challenge the cultural norms of depoliticization and meritocracy in engineering [8-10]. One of the reasons for this limited impact, is that equity and social justice are treated as intellectually distinct from core

engineering subject-matter, and thus outside the responsibilities of engineering educators.

The presence of academic silos separating equity from core technical subject matter is not unique to engineering. Even in the social sciences and humanities, disciplinary classification systems have separated equity from many other fields, including applied ethics. This means that not only is EDI largely ignored in applied ethics coursework, but also that ethical analyses tend to go missing in EDI interventions [11-13]. Sociology (the disciplinary home of equity) is located in the social sciences, while philosophy (the disciplinary home of ethics) is located in the humanities. Interestingly, by standing outside of both the humanities and social sciences, engineering educators may have an easier time bridging these two “non-technical” fields.

The Canadian Engineering Accreditation Board (CEAB) has effectively mandated such a bridge by pairing ethics with equity in its 10th graduate attribute (~ABET learning outcomes). As a result, no Canadian engineering program is permitted to grant degrees without demonstrating that all students have been exposed to curricular elements addressing ethics and equity. Unfortunately, this pairing has often functioned as pedagogical “parallel play” with ethics and equity being taught separately, rather than as intersecting dimensions of engineers’ professional practice. Additionally, as Riley pointed out a decade ago, the imposition of accreditation-based learning outcomes in engineering education is insufficient for catalyzing transformational change with respect to social justice [14]. As long as ethics and equity are treated as independent graduate attributes or learning outcomes, rather than intersecting epistemological practices, they stand very little chance of being meaningfully integrated into the socio-political structures and culture of engineering education, leaving regulatory bodies, individual graduates and their respective employers responsible for fostering ethical and equitable change in the profession.

¹ In this paper, we use Canadian linguistic terminology with US parallels. For example, we use the term “CEAB graduate attributes” instead of “ABET learning outcomes,” and EDI (equity, diversity, inclusion) instead of DEI.

Our primary objective in this paper is to support socially just engineering practice by responding to the following question: *What are the consequences of decoupling equity from ethics in engineering education?*

We respond to this question by analyzing three studies on engineering leadership through a conceptual lens based on Cech's analysis of dominant ideologies in engineering education [15], and Riley's critique of outcome-based education [14]. After defining the terms ethics, equity, and social justice, we examine the implicit theory of change underlying accreditation. We then share our conceptual lens drawing on Cech's and Riley's key arguments and use it to conduct a critical secondary analysis of three projects. Finally, we identify consequences for separating equity from ethics in engineers' professional practice and discuss implications for engineering educators committed to socially just change in the profession.

II. DEFINING TERMS: ETHICS, EQUITY AND SOCIAL JUSTICE

For the purpose of this paper, we define *ethics* as "moral principles that govern a person's or group's behavior," and *equity* as "a process of naming and addressing historic and current power imbalances that systemically disadvantage marginalized groups." [16, 17] When we characterize ethics using the notion of "moral principles" we are making a distinction between morality and values. Individuals may hold a wide range of conflicting values, but it is impossible to be moral at the level of the collective without addressing equity. Additionally, while it is possible to intellectually disentangle ethics and equity, the reality of engineers' professional practice is that their day-to-day decision-making processes take place in organizations shaped by intersecting systems of oppression. As a result, the intellectual cleaving of equity from ethics has practical consequences for social justice in the profession.

Social justice is more difficult to define since it has been used by many different theorists in paradigmatically distinct ways. For this paper, we draw on Freire's critique of the banking system of education [18-20] in our definition of social justice. Freire's concern with formal schooling is that it replaces the creative process of socially contextualized thinking and acting with the depositing of facts and tools into the minds of students. When it comes to teaching CEAB GA-10 "ethics and equity," we believe that decontextualized lessons on ethics and equity leave Freire's banking system intact. That is, we are unlikely to bring about socially just change by depositing ethical theories or equity concepts into the minds of our students. Instead, the pursuit of socially just engineering education must be a dynamic reversal of banking education—the return to creative, interdependent, deeply contextualized knowledge creation addressing systemic inequities in a profession that is anything but neat.

Our main argument in this paper is that we stand a better chance of eliminating systemic inequities in the profession if we resist the urge to treat ethics and equity as discrete content

areas mandated by an external entity. Instead, we must reflect on and challenge intersecting systems of oppression from our specific, socially located vantage points, collectively creating and re-creating ethical professional practice norms in our specific organizational and disciplinary contexts. This dynamic, contextualized process has been characterized by critical theorists as critical consciousness for transformative action [18, 20, 21]. Freire describes critical consciousness as a practical act—a process of recognizing oppressive forces and acting against them. Learning to define equity and ethics is important, but this cognitive activity does little to compel students or instructors to make ethical decisions in pursuit of social justice, leaving dominant ideologies intact.

III. CANADIAN ENGINEERING ACCREDITATION CONTEXT

The Canadian Engineering Accreditation Board (CEAB) was established by Engineers Canada in 1965 to accredit undergraduate engineering programs in the country, with Engineers Canada becoming a signatory to the Washington Accord in 1989. In response to the question, "why does the accreditation board exist?" the CEAB website indicates three key purposes: 1) ensuring Canada's engineering education system remains among the best in the world, 2) setting national standards, and 3) applying professional expertise to the assessment of engineering programs [22]. Implicit in these purposes is a theory of change founded on standardization. That is, Canadian engineers will make a greater global impact if we set a high and consistent bar for the programs that train them. Since 2011, this standard was set through the establishment of 12 graduate attributes: 1) engineering knowledge base, 2) problem analysis, 3) investigation, 4) design, 5) using engineering tools, 6) individual & team work, 7) communication skills, 8) professionalism, 9) impact of engineering on society & the environment, 10) ethics & equity, 11) economics & project management and 12) life-long learning. Every Canadian engineering program pursuing accreditation is mandated to demonstrate that graduating students are exposed to and assessed on all 12 of these graduate attributes (GA).

GA-10—"ethics & equity" requires Canadian engineering programs to graduate students with the ability to apply "ethics, equity, and accountability" to an unnamed referent (presumably their education and professional practice) [23], but it remains unclear what impact this large-scale, centralized reform effort has had on the culture of engineering education and practice across the country. Haralampides and her colleagues delivered a talk shortly after GA-10 was announced to underline the unique opportunity for engineering educators dedicated to social justice [24]. Nearly a decade later, we analyze three research projects on engineering leadership in university and workplace contexts to examine how this opportunity is being taken up or left untapped. We do this through a critical conceptual lens drawing on Cech's and Riley's analyses of dominant ideologies and outcomes-based education in engineering.

IV. CONCEPTUAL LENS: CAN OUTCOMES-BASED EDUCATION TRANSFORM DOMINANT IDEOLOGIES IN ENGINEERING?

Two powerful texts help us analytically distinguish between accreditation-mandated “ethics and equity” learning outcomes and the enactment of ethical and equitable practice. The first is Cech’s analysis of dominant ideologies in engineering education [15] and the second is Riley’s critique of outcomes-based education as an educational reform strategy [14]. The assumption we are making here is that the persistence of dominant ideologies in engineering culture may function as an indicator of an EDI intervention’s impact. The EDI intervention we are foregrounding here is the deliberate pairing of equity with engineering ethics through accreditation-driven reform.

Cech’s chapter on the (mis)framing of social justice [15] begins with a story about her attempt to raise a social justice issue in her undergraduate engineering ethics class. The backlash she faced while discussing affirmative action policies prompted her to theorize why it was so difficult to introduce social justice into engineering education. Her explanation was that cultural norms within the profession frame social justice as separate from engineering. Cech draws on the science and technology studies (STS) literature to identify two dominant cultural ideologies within engineering education—meritocracy and depoliticization. She defines *depoliticization* as “the belief that engineering work should disconnect itself from social and cultural realms because such realms taint otherwise pure engineering design methodologies” (p.71). Similarly, she defines *meritocracy* as “the belief that success in life is the result of individual talent, training, and motivation, and that those who lack such characteristics will naturally be less successful than others” (p.73). She argues that these two ideologies frame inequality as irrelevant to engineering practice, making it difficult to bring about social justice in the profession. Her conceptually rich critical analysis helps us identify barriers to change within engineering culture, but it stops short of addressing the procedural weaknesses of large-scale centralized reform efforts rooted in standardization and accountability.

Riley’s analysis of outcomes-based education closes the gap, using ABET as an example [14]. In her paper “Aiding and ABETing: The bankruptcy of outcomes-based education as a change strategy” she draws on K-12 educational policy studies to explain why accreditation not only failed to bring about substantive change in engineering education, but also to argue that it was integral to the reproduction of existing social norms in the profession. Her key conceptual contribution is to apply Capper and Jamison’s critique of outcomes-based education (OBE) [25] to ABET’s engineering accreditation efforts. Her main point, as we understand it, is that ABET’s reliance on OBE as a systemic mechanism for large-scale educational reform constrains its potential for deep, transformative change, particularly in the domains of equity, social justice, and engineering culture.

Connecting Cech’s and Riley’s critical contributions to engineering education, we examine whether centralized change efforts that explicitly mandate the pairing of equity with professional ethics in engineering education may transform the powerful conservation force of dominant ideologies in engineers’ professional practice.

V. METHODOLOGY: CRITICAL, SECONDARY ANALYSIS OF ENGINEERING LEADERSHIP RESEARCH

The three research projects we analyze in this paper began as engineering leadership inquiries. We briefly describe them here, then share our critical secondary analysis in the next section. For readers interested in the application of ethical theories to professional practice, we wish to be explicit that none of our projects directly examined the application of deontology, virtue ethics, rights-based ethics, utilitarianism or any other ethical theory to engineers’ work. We value these and other ethical traditions and regularly integrate them into our teaching, but they are not the subject of our research program or this paper. All three studies analyzed in this paper are, however, situated in engineering-intensive organizations whose employees are obligated by professional regulatory bodies to hold the public paramount, and are thus legally bound to prioritize a codified version of ethical practice. As such, they provide us with useful insights about the ethical practices of engineers with differential access to patterns of privilege in their organizations, their profession, and society.

The first of these projects is the most directly related to engineering ethics. Our Engineering Ethics and Equity case study project (EEE) [16, 17, 26-28] began in 2013 as an administrative response to accreditation. Our research question merged professional ethics with leadership by asking: “how do engineers navigate ethical dilemmas?” We conducted 22 critical incident interviews, generated anonymous case studies highlighting the ethical dilemmas described in each interview, developed a workshop on engineering ethics and equity using a subset of the case studies, then analyzed the impact of our curricular intervention in four classes. Over the course of eight years, we have learned about the interdependent nature of ethics and equity in engineers’ professional practice [17, 28]. That is, engineers navigate ethical issues on an uneven terrain reflecting systems of oppression in their organizations, their profession, and society.

The second study—Engineering Leadership Project 2 (ELP2) examined how senior engineers learned to lead over the course of their careers. To answer this question, we conducted career history interviews with 29 engineers who had been working for at least 25 years. They worked in eight different industries and had been identified by key informants in their organizations as leaders. We analyzed interview transcripts through a conceptual lens based on Lave and Wenger’s situated learning theory to account for the role of social identity formation and unintended learning processes in engineers’ professional development [29]. A key finding in this project

was that participants learned to lead in ways that corresponded with five distinct career paths. Individuals on each path, whose demographic make-up reflected broader patterns of privilege in society, experienced differential access to career mobility and leadership development opportunities [30-33].

The third project—More than recruitment and retention: Tracking inequity in engineers’ career paths (EC-EDI) was a follow up to our ELP2 finding that senior engineers pursuing non-traditional paths were more likely to be penalized for excellence in two non-technical domains [30]. We set out to test this small, localized finding with a larger, national sample of engineers. The resulting project, funded by the Social Sciences and Humanities Research Council of Canada (SSHRC) investigates the following research question: “What do the career paths, mobility patterns, and workplace experiences of Canadian engineers reveal about structural inequity in the profession?” To answer this question, we surveyed 980 Canadian engineering graduates with at least ten years of professional experience. While we have yet to complete data analysis, one early finding suggests that Canadian engineers engage in some social impact activities more than others, with EDI structured into fewer job descriptions than health, safety, and sustainability [4]. This preliminary finding is relevant to our current line of analysis because it suggests that equity lives even further on the periphery of engineers’ professional practice than other social impact issues. Please see Table 1 for a summary of the three projects.

TABLE I: SUMMARY OF ENGINEERING LEADERSHIP PROJECTS ANALYZED IN THIS PAPER

Project Title	Engineering Ethics & Equity Project (EEE) (2013-2020)	Engineering Leadership Project 2 (ELP2) (2014-2020)	Engineering Career Paths & EDI (EC-EDI) (2021-present)
Research Question	How do engineers navigate ethical dilemmas?	How did senior engineers learn to lead?	What do Canadian engineers’ career paths reveal about structural inequity in the profession?
Data Generation	Critical incident interviews (n=22)	Career history interviews (n=29)	National survey (n=980)
Findings	Equity issues are more salient in ethical dilemmas of marginalized groups than in those of white, male peers.	Engineers on non-traditional career paths are often penalized for excellence in non-technical domains.	Some social impact issues (health, safety, sustainability) have been integrated into engineers’ work more prominently than others (EDI)

In this paper, we conduct a *critical, secondary analysis* of key findings from each of these research projects. *Secondary analyses* involve lines of inquiry that differ from those which initially drove the study [34]. They are especially helpful when studying phenomena that are difficult to talk about or evade participants’ attention. In this case, we reflect on our key findings in three engineering leadership projects through a conceptual lens combining Cech’s notion of dominant

ideologies and Riley’s critique of learning outcomes as a catalyst for educational reform. With a few exceptions, we believe participants’ reproduction of inequity is neither explicit nor deliberate. This makes it difficult to study dominant ideologies through surveys, interviews, or other self-report instruments. The *critical* aspect of our analysis allows us to examine the persistence of dominant ideologies in engineers’ professional practice even if participants fail to comment on it.

VI. FINDINGS: CONSEQUENCES OF DECOUPLING EQUITY FROM ETHICS IN ENGINEERING

We have divided our findings into two sections driven by our conceptual framework, 1) the persistence of dominant ideologies in engineering, and 2) the impact of accreditation-driven reform. Please see Table 2 for a summary of our findings.

A. Dominant ideologies in engineering education enable deficit thinking

To examine the impact of dominant ideologies in engineers’ professional practice, we ask two related questions drawing on Cech’s chapter on the (mis)framing of social justice in engineering education: What happens if we ignore power in engineers’ professional practice (depoliticization)? And what happens if we ignore structural supports and constraints in our conceptions of excellence (meritocracy)?

Our engineering ethics and equity project (EEE) taught us that ignoring patterns of privilege masks the uneven terrain on which engineers grapple with ethical issues. For example, women, racially minoritized and LGBTQ2S+ identified engineers who participated in our study were more likely to name sexism, racism, and homophobia in their ethical dilemmas than white, male, heterosexual interviewees [28]. To be more specific, 5/7 women and 1/8 men named sexism; 2/4 racially minoritized engineers and 0/11 white engineers named race; and 3/3 LGBTQ2S+ engineers and 0/12 heterosexual engineers named homophobia when discussing their ethical dilemmas. When engineers burdened by discrimination take longer to navigate ethical issues than others, observers who believe in political neutrality and meritocracy may presume that they are more sensitive, insufficiently resilient or not cut out for the “rigours” of the profession in comparison to their white, cis-gender male, heterosexual colleagues. These powerful ideologies reify a deficit mentality of engineers whose ethical dilemmas are materially intensified through the added weight of discrimination.

Moving on to ELP2, we learned that many senior leaders characterized their organizations as flat despite differential advancement patterns for individuals on distinct career paths. Participants often explained these career mobility differences through functional specialization. For instance, engineers with strong social skills were regularly tapped to manage failing projects across departmental units (boundary spanners), while engineers who reflected organizational norms were tapped for early stretch assignments on high-profile projects (company men). A

third group of engineers identified as innovative contributors to teams often failed to be tapped at the pace they saw fit (entrepreneurs). While our sample was small and localized, it is important to note that white women were over-represented among boundary spanners, racially minoritized and internationally trained men were over-represented among entrepreneurs, and white men made up all of the company men [30, 32]. The only racially minoritized woman we interviewed left her engineering-intensive organization to work in a non-technical sector, moving along a career path we called “invisible engineers.”

TABLE 2: CRITICAL SECONDARY ANALYSIS OF ENGINEERS’ PROFESSIONAL PRACTICE

	Engineering Ethics & Equity Project (EEE)	Engineering Leadership Project (ELP2)	Engineering Career Paths & EDI (EC-EDI)
Depoliticization <i>What happens when we ignore power/status?</i>	Ignoring societal patterns of privilege masks the uneven terrain on which engineers grapple with ethical issues.	Asserting that professional organizations are flat but specialized rationalizes differentiated mobility patterns.	Grouping health, safety & sustainability with EDI allows organizations to claim a moral high ground without disrupting inequity.
Meritocracy <i>What happens when we ignore structural supports & constraints?</i>	When we ignore the burden of discrimination faced by some engineers, we may assume they are not cut out for the rigours of the profession.	When we ignore differentiated mobility by presumed “fit,” we may assume marginalized groups who fail to be promoted are better suited to less advanced roles.	When we celebrate senior leaders as industry beacons for health, safety, and sustainability, we may deflect attention from their EDI records.
Observed impact of mandating ethics & Equity in engineering education <i>How far does accreditation reach?</i>	Pairing ethics & equity has supported our curricular innovation efforts, but backlash leaves us wondering about changes to engineering culture.	Unclear how CEAB impacts professional practice.	Unclear how CEAB impacts professional practice.
Consequences of decoupling equity from engineering ethics <i>So what?</i>	Universalizes ethical dilemmas experienced by white, male, heterosexual engineers.	Masks increased service load & career mobility penalties faced by marginalized groups.	Centers social impact issues that leave dominant ideologies intact, masking the peripheral status of EDI.

As we read these findings through our conceptual lens critical of depoliticization and meritocracy, we became increasingly attentive to the powerful factor of “fit” [35, 36]. This line of thinking requires us to unpack deeply held assumptions about fairness in professional advancement practices. First, the notion of depoliticization enables engineers working in professional organizations to characterize their firms as structurally flat. This assertion of status equality facilitates unproblematic acceptance of

differentiated advancement patterns by speciality, which may then be differentially rewarded. When we ignore differentiated advancement patterns, we may assume that engineers who are members of under-represented groups fail to be promoted to CEO (boundary spanners) or fail to stick around long enough to be promoted to senior management (entrepreneurs) because they are better suited to other roles or insufficiently loyal to be worth promoting. This largely invisible process seeds deficit thinking about the career mobility of women and racially minoritized engineers without problematizing the actions of those responsible for grooming the next generation of CEOs, limiting career mobility for the next generation of conflict managers, or overlooking the next generation of innovators.

Finally, preliminary findings on our engineering career paths and EDI project (EC-EDI) suggest that health and safety (60%) and environmental sustainability (50%) were more often integrated into the occupational responsibilities of Canadian engineers than EDI (31%) [4]. Most directly related to our current line of analysis, women (both white and racially minoritized) were over-represented in the subset of engineers who had EDI integrated into their work, which was not the case for other social impact issues [4]. This reinforces our ELP2 finding that that women, particularly those on “boundary spanner” and “invisible engineering” paths, carried additional responsibilities for equity work [33]. It also supports our EEE finding that under-represented groups of engineers carried additional equity-related burdens when navigating ethical dilemmas than did their white, male, heterosexual peers [28]. Returning to our critical secondary analysis, we argue that depoliticized blurring of social impact issues may deflect attention from senior engineers’ records on equity, if they have strong records on environmental sustainability, health and safety. While we believe it is important to celebrate the sustainability achievements of engineering CEOs, it is vital that we do not lose sight of EDI in the process. Related to this point, we cannot presume that advancement is always a product of merit. Engineers who are promoted for their strong leadership on health, safety, and sustainability are no more deserving of career advancement than their colleagues tasked with EDI portfolios. In fact, the latter stand a better chance of addressing persistent recruitment and retention issues when driving strategic decision-making at the senior leadership level.

At the risk of over-simplifying multifaceted professional dynamics, our critical, secondary analysis of key findings in three engineering leadership research projects suggests that by embracing depoliticization and meritocracy as truths, we may accept career mobility patterns that reify structural inequity as inevitable. Stated more directly, the persistence of dominant ideologies in engineering combined with essentialist assumptions about what racially minoritized, female, and internationally trained engineers excel at may

explain recruitment and retention failures better than a deficit-driven “leaky pipeline” metaphor.

B. What kind of transformation does accreditation produce?

How can we catalyze socially just change in engineering given the power of depoliticization and meritocracy? One way to do this is to impose large-scale, centralized reform on programs that socialize new generations of engineers. By pairing equity (a social issue that remains on the margins of engineering education) with ethics (a feature of engineers’ professional licensing requirements) we may bring about increasingly equitable change. Engineers Canada supported this direction in 2011 when they named “ethics & equity” as the 10th graduate attribute to be assessed by the CEAB. This introduced an opportunity for engineering educators already dedicated to social justice to catalyze equitable change in our respective classrooms [24, 37, 38]. After an initial grace period, this GA was mandated across Canada.

While our second layer of analysis does not permit us to assess the effectiveness of the 10th GA on a national scale, it does help us consider Riley’s warning about the limitations of outcomes-based-education in the context of our own accreditation-based intervention.² How did our EEE project (supported by GA-10) enhance social justice at the institutional and classroom levels?

Our experience as a team of engineering educators who were institutionally supported to develop an intervention for GA-10 suggests that the accreditation process catalyzed two important changes: it elevated the status of equity for senior administrators at our university, and it catalyzed resource distribution in support of our engineering ethics and equity case study project. Thus, accreditation proved to be a useful catalyst for driving curricular change at the senior administrative level, raising the bar for ethics and equity in the faculty. Our experience delivering and assessing this intervention in 30 classrooms over six years, however, suggests more uneven results [17]. Even when instructors invited us into their classrooms and students openly engaged with the case studies, it became clear to us that a single, drop-in workshop integrating ethics and equity content into students’ analyses of ethical dilemmas did little to transform the culture of engineering education in the faculty. At its best, it taught students how to apply introductory ethical theories and equity concepts to their lived experiences. At its worst, our intervention incited backlash that shut down critical dialogue [17].

The challenge we experienced illuminates a potential weakness in our national reliance on accreditation as a driver of socially just change, but we are not recommending the removal of CEAB GA-10. There are important benefits

to the explicit naming of learning outcomes that may otherwise remain on the periphery of engineering education. When it comes to technical subject matter that is already prioritized in the core curriculum, national accreditation makes little difference. In the case of more peripheral graduate attributes like ethics and equity, however, national accreditation standards raise the profile of the work, often unlocking resources in support of curricular innovation.

Raising the profile of ethics and equity is a necessary but insufficient condition for catalyzing socially just change in the profession. As critical transformative educators, we believe this is the case because mandating content leaves the “banking system of education” [18-20] intact. That is, by limiting social justice education to the depositing of ethics and equity concepts into the minds of students, we restrict our ability to catalyze epistemological curiosity in the next generation of engineers. If ethics and equity are not accepted as core aspects of engineers’ professional practice, they will remain peripheral to the design processes.

The situation is even more stark in industry where no such national mandate exists. The licensing exam used to assess engineers in training (EITs) on their understanding of provincial ethical codes, remains silent on equity. Even if this changes, only 30% of engineering graduates in Canada pursue a professional engineering license [39]. Thus, even the surface-level engagement mandated at the undergraduate level through CEAB GA-10 disappears in the context of engineers’ professional practice.

VII. DISCUSSION

Returning to the question that drove our inquiry: *What are the consequences of decoupling equity from ethics in engineering?* Stated differently, “So what” if accreditation fails to catalyze the integration of equity into ethics?

By using the word “consequences” we may be skewing the reader’s mind in a negative direction, but consequences can be positive as well. The retention of discipline-specific boundaries would permit subject-matter experts in both ethics (philosophy) and equity (sociology) to engage engineering students in deep theoretical dives. Treating ethics and equity as complex fields with paradigmatically diverse epistemologies is more likely to take place when we hire disciplinary specialists in each field to generate and teach curriculum. Deep dives scaffolded by disciplinary experts are not only more likely to be impactful, but also more engaging to students than finger wagging lessons about how to avoid getting into trouble at school or at work.

Without discounting the importance of disciplinary deep dives taught by subject-matter experts, it behooves us to consider the negative consequences of decoupling equity from ethics in engineering. Normalized conversations about an increasingly packed curriculum combined with the historically

² The one caveat we include is that while CEAB and ABET are both signatories to the Washington Accord, and thus have comparable roots and structures by design, the CEAB has explicitly named equity as a graduate

attribute, while ABET has formalized less specific social impact dimensions as learning outcomes.

legitimized status of ethics as a professional responsibility means that equity may fall off the table. This already happens in many universities and workplaces when the “e” of EDI is suppressed, leaving diversity and inclusion as depoliticized stand ins. When this happens, we may meet accreditation standards by teaching students what it means to behave as an ethical professional who follows the code, respects demographic diversity, and sets out to include others in their work. Our central critique of this approach is empirical. It has been tried for several decades leaving patterns of privilege intact in the profession. The omission of equity permits normative aspects of professional practice to dominate and consequently suppresses critical analyses of engineering culture.

To get a closer look at the consequences of decoupling equity from ethics in engineers’ professional practice, we ask the question again with each of our three research projects in mind. The engineering ethics and equity case study project (EEE) suggests that by decoupling equity from ethics, we run the risk of universalizing ethical dilemmas of socially advantaged engineers, ignoring the added weight carried by those who regularly face discrimination. Recall that we invited all participants to identify an ethical dilemma from their careers but only those who had to carry the extra weight of discrimination invoked equity in their narratives. If we fail to integrate an equity analysis into our examination of ethical case studies, we may label those who carry heavier loads as lacking “grit.”

Similarly, our analysis of senior engineers’ career history interviews (ELP2) taught us that by ignoring equity, we run the risk of masking increased service load and career mobility penalties faced by under-represented groups of engineers. The connection to professional ethics in this case is more tenuous than in our engineering ethics case study project, but by ignoring equity in career advancement and professional development decisions, it is possible for senior engineers to view existing promotion practices as meritorious and therefore ethical.

Finally, our national EC-EDI survey taught us that by grouping social impact issues in a single bin, we run the risk of masking the peripheral status of equity work and undervaluing those tasked with doing it. The over-representation of racially minoritized and white women among the 30% of engineers whose work responsibilities include EDI may help us penetrate the mystery of “retention” problems. If under-represented members of the engineering profession are more burdened by work that lives on the lower status side of a socio-technical binary, they may be driven to exit the profession—either by finding other work, or by having their professional belonging repeatedly questioned by colleagues [40-42]. These two related forms of professional exit have nothing to do with personal choice or poor fit. Rather they are the product of structural exclusion baked into the profession, with social justice “mis-framed” [15] as not “real” engineering. If this analysis holds weight across engineering contexts, the mysterious “retention” problem could be addressed in a rather straightforward way. By framing EDI work as “real” engineering, we could reverse the incidence of professional exit among under-represented groups of engineers.

Taking the three projects together, our critical, secondary analysis has taught us that by decoupling equity from engineers’

professional practice we leave dominant ideologies intact. More specifically, by separating equity from ethics, we implicitly separate social justice from moral authority. This process is increasingly visible when we call out the specific ideologies identified by Cech in her paper on the mis-framing of social justice in engineering education [15]. Depoliticization and meritocracy—the two ideologies she names, are not only powerful organizing forces in engineers’ professional practice, but also work in concert. The assumption that technical problem-solving ought to be detached from the socio-political context in which it occurs (depoliticization), fortifies the professional assumption that engineers advance based on universally agreed upon excellence (meritocracy).

Following in Cech’s conceptual footsteps, we argue that the acceptance of these dominant ideologies in a materially and culturally inequitable world leads to the reification of deficit thinking [43, 44]. This largely unacknowledged deficit mentality leads to the interpretation of differentiated career paths as the product of essential differences in the competencies of demographically diverse groups [30]. In the process, structural barriers overwhelmingly faced by minoritized members of the profession may be ignored, leaving persistent “retention” issues intact.

Finally, heeding Riley’s warning about outcomes-based education as an ineffective educational change strategy [14], our experience implementing an accreditation-driven ethics and equity curricular intervention at one Canadian university suggests that the explicit mandating of “ethics and equity” as a learning outcome is a necessary but insufficient condition for achieving socially just change in the engineering profession [45, 46]. Engineers’ Canada placed ethics and equity on the radar of senior administrators at our university, but more can be done to support social justice in engineering education and practice.

VIII. IMPLICATIONS FOR PRACTICE: BUILDING CAPACITY FOR SOCIALLY JUST CHANGE

What happens when engineering graduates who have been exposed to professional ethics and equity as independent learning outcomes enter workplaces set up for a purpose other than teaching and learning? A short answer to this question is that we pass the responsibility for socially just engineering practice on to employers with an uneven record on this work, leaving existing patterns of privilege intact. What can we do as engineering educators to disrupt this process?

Accreditation-based reform in the Canadian engineering education landscape has relied on centralized mandates to bring about equitable change. While CEAB-GA10 provides Canadian engineering educators with an important opportunity to raise the profile of ethics and equity in the undergraduate curriculum [24], we cannot simply deliver workshops on ethical theory or equity concepts if our goal is socially just professional practice. Rather, it is time to supplement the policy instrument of national *mandates* with locally relevant *capacity building* networks [47].

In the case of undergraduate engineering education, we may begin where we are—building capacity for socially just education by convening a small group of faculty, staff, students, and alumni dedicated to teaching and learning professional ethics and equity in our own programmatic contexts. While

institutions such as the [Engineering Change Lab](#) do this work at the national level, localized approaches to curricular reform stand a better chance of countering the anxiety-producing “steering at a distance” feel of centralized, accreditation-driven reform.

As a small group of social justice-minded engineering educators, students, and staff familiar with the local programmatic context, we could engage in our own teaching and learning processes, adopting Freire’s notion of critical consciousness for social transformation [18]. Freire’s concern with formal schooling was that it replaced the creative process of socially contextualized thinking and acting with a more instrumental process of depositing inert facts into the minds of students who then use relevant tools to solve neatly framed problems. By engaging local actors in the creative pursuit of addressing equity issues in our classes, committees, service responsibilities, institutional policies, workplaces, clubs, departments, and research projects, we stand a better chance of unraveling dominant ideologies that oppose equitable change in the profession. This is not simply a process of airing our collective grievances. Rather, it reflects the Freirean practice of “reading the word and the world” [19].

One of our reviewers invited us to provide recommendations about “how to begin this work in the US, when ABET has not prescribed anything close to CEAB-GA10.” While this may be the case, social justice minded engineering educators in the US have been involved in this kind of activist network for decades, often blending equity with ethics while reading their institutional contexts. One of the more established ones is the Engineering Social Justice and Peace” (ESJP) network. This longstanding group of engineering education activists have conferences, a journal, and an updated repository of resources to support their work. Similar networks exist in other professional and national contexts.

By decentering formal curricular elements, local activist networks can use engineering culture, current events, and shared experiences as our texts, and critical frameworks as the lenses through which we read these practical, locally contextualized texts. When we engage in this critical reading process through our teaching, our committee work, our supervision, our service commitments, and our research, we position ourselves well to disrupt dominant ideologies in the profession. International networks of engineering educators doing similar work in their own locally relevant ways teach us to iterate on our ethical and equitable practices across local and global contexts. Students, professors, sessional instructors, and staff who are involved in this creative pursuit are more likely to retain and build on our reciprocal teaching and learning processes over the course of our careers, shaping engineering education and professional practice in our wake. Treating ethics and equity as an *integrated*, creative, life-long learning process instead of content to be memorized, regurgitated, and assessed may not bring about immediate cultural change, but it will prepare us to teach, live, and work ethically and equitably in pursuit of social justice.

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