Engaging in STEM education equity work through a course: studying race, class and gender theory in engineering education

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Engaging in STEM education equity work through a course: studying race, class and gender theory in engineering education

Abstract

Each of the authors are currently enrolled as students or serving as an instructor in a graduate-level engineering education course which is cross-listed with the women’s, gender, and sexuality studies program at a large research university in the Midwest. Through engagement with podcasts, readings, reflection, and discussion with others, this course seeks to help participants explore theories of race, class, and gender in engineering education, and how they can be applied in research and practice. Each of the involved authors occupy different disciplinary locations in the educational equity research space, including engineering education, technology education, chemistry education, and multicultural education. Additionally, each author holds different social identities such as: students who are of color and/or white, students who are from domestic or international backgrounds, students who are from diverse socioeconomic and sociocultural upbringings, and students of various gender identities. Within the associated presentation, the authors share how the course has influenced their personal and academic positions, and how it informed their research. Each author presents their research interests; how they have included race, class, and gender in their work before taking the course, if at all; and how participating in an open and safe educational environment may have affected their research directions. Each has completed a reflection of how they have uniquely engaged with theories of race, class, gender, and contemporary theories of change as frameworks for the basis of their assertions. As the next generation of scholars, the authors emphasize the importance of thoughtful theorizing of race, class, and gender in all research across STEM education disciplines, and beyond, and encourage others to find meaningful opportunities to do the same.

Keywords: race, class, gender, intersectionality, theory, classroom intervention, reflection

Introduction

“Diversity” has become an important watchword in engineering education practice and research, a requisite for funding, research programs, and essential for publications. However, embedded concepts of race, class, and gender, have been under theorized within engineering education research and pedagogy, though such a theorization could greatly affect the work being done in the field. This paper describes a course intended to help participants explore existing explicit theories of race, class, and gender, introduce participants to alternative social theories on these concepts in educational contexts, and help them learn to apply such theories to engineering education research and engineering studies.

The idea for this paper came from the first author, as one of the students in the course. The other authors are currently also enrolled as students or serving as instructors in the graduate-level engineering education course, which is cross-listed with the women’s, gender, and sexuality studies program at a large research university in the Midwest. Each of the involved authors occupies different disciplinary locations in the educational equity research space, including engineering education, technology, chemistry education, and multicultural education. Additionally, each author occupies different social identities, including students who are of color.
and/or white, students who are from domestic or international backgrounds, students who have had different socioeconomic and sociocultural upbringings, and students of various gender identities.

In this reflective paper designed for instructors, the authors share in a narrative format how the course has influenced their personal and academic positions, and how it has informed their research. Each author presents their research interests; how they might have included race, class, and gender in their work before taking the class, if at all; and how participating in an open and safe educational environment might have affected their research directions. Each author also presents how they have uniquely engaged with theories of race, class, gender, and contemporary theories of change as frameworks for the basis of their assertions.

Course Design and Description

*Alice, instructor:* I designed this course for more senior graduate students in or with interest in engineering education research and related fields, and who are interested in developing a more theorized understanding of the concepts of race, class, gender, diversity, and other topics related to broadening participation in engineering education. This is the second time I have offered the course.

Learning Objectives

These learning objectives are the ones I am anticipating for the next iteration of the course, as they have changed over the course as I discovered my own blind spots. For example, even though I had committed one class period to discuss Whiteness and Critical White Theory, that notion did not explicitly appear in the learning objectives until the day we discussed the topic.

Here are the current learning objectives:

1. Define race, class, and gender, demonstrate how they are social constructions that change over time and identify mechanisms by which they have become so constructed over history;
3. Identify how different theories of race, class, and gender are being used in contemporary engineering education research, and situate your own work;
4. Improve your ability to ground engineering education research that makes explicit or implicit use of gender, race, and class concepts in the appropriate theoretical paradigm.
5. Apply theoretical insights from theories offered in class to your own research and reviews of others’ work.
6. Improve your analytical, argumentative writing through drafting, review, and revision.

We begin each class period with a mention of which learning objectives seem particularly salient to that day’s discussions and draw more explicit lines between the learning objective and specific arguments from the day’s readings.
Structure of the Course

Class routine
The course is a 16-week, 3-credit course, with one 2:50-hr class meeting per week. I organize the class into the following routine (while acknowledging that we generally run out of time at the end of the class and reflection is short to absent):

0:00  Welcome, centering activity (a minute or so of a meditative question to help students bring their minds into class from whatever they were doing beforehand).
0:10  Housekeeping - announcement of and questions about upcoming assignments, decisions that need to be made as a class.
0:30  Learning objectives for today
0:35  Podcast episode discussion
1:05  Discussion of theory reading
1:30  Break
1:40  Continuing discussion of theory
      Extension to engineering education research work
      Small groups and report out; or large group discussion
2:40  Takeaways from today
      Reflection
      Reminder of assignments and readings for next week
2:50  Dismiss

The discussion topics can be often very heavy and emotional, and affect course participants very differently. I reflect at the end of this paper about how I should acknowledge this differential experience better in future iterations of the course.

Weekly topics
The weekly topics were organized as in Table 1. For most class periods, I tried to combine a theoretical reading with an engineering education research (EER) reading. Sometimes when the reading felt particularly heavy, I skipped the EER reading and incorporated treatment of EER in our in-class discussion. I had organized the previous instantiation of this course first around class, race, and gender theories before talking about intersectionality; this time, I put a textbook about intersectionality up front to frame all our subsequent discussions, and this worked much better, I think. I also assigned a podcast episode from one of two seasons of the “Scene on Radio” podcast, hosted through the Center for Documentary Studies at Duke University. These
were opportunities for another mode of new material for participants, but also had a transcript available for accessibility if necessary.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
<th>Readings (to discuss in class, so read in advance)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>Intersectionality 1/3</td>
<td>Seeing White Podcast Episode 3 Hill Collins &amp; Bilge (2016), Chapters 1-2 Foor et al. (2007)</td>
</tr>
<tr>
<td>4</td>
<td>Intersectionality 2/3</td>
<td>Seeing White Podcast Episode 4 Hill Collins &amp; Bilge (2016), Chapters 3-5</td>
</tr>
<tr>
<td>5</td>
<td>Intersectionality 3/3</td>
<td>Seeing White Podcast Episode 5 Hill Collins &amp; Bilge (2016), Chapters 7-8 Riley et al. (2014)</td>
</tr>
<tr>
<td>7</td>
<td>Race theory</td>
<td>Seeing White Podcast Episodes 7 and 8 Omi and Winant (2015), Chapters 1, 2, 4</td>
</tr>
<tr>
<td>8</td>
<td>Gender theory</td>
<td>Seeing White Podcast Episode 9 Connell &amp; Pearse (2015), Chapters 1, 4, 5, 7</td>
</tr>
<tr>
<td>10</td>
<td>Critical race theories</td>
<td>Seeing White Podcast Episode 11 Delgado &amp; Stefancic (2017), Chapter 1, 5, another you choose Pawley, Mejia, &amp; Revelo (2018)</td>
</tr>
<tr>
<td>11</td>
<td>Critical white studies</td>
<td>Seeing White Podcast Episodes 13, 14</td>
</tr>
</tbody>
</table>
For the next iteration, I am contemplating filing the theories a bit differently, thus:

<table>
<thead>
<tr>
<th>Week</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>Class theory</td>
</tr>
<tr>
<td>7</td>
<td>Race theory</td>
</tr>
<tr>
<td>8</td>
<td>Critical race theories</td>
</tr>
<tr>
<td>9</td>
<td>Critical white studies</td>
</tr>
<tr>
<td>10</td>
<td>Gender theory</td>
</tr>
<tr>
<td>11</td>
<td>Feminist theories</td>
</tr>
<tr>
<td>12</td>
<td>Masculinities</td>
</tr>
<tr>
<td>13</td>
<td>Queer theory, Crip theory</td>
</tr>
</tbody>
</table>

This presents a bit of a problem with respect to the podcast episode threading, but this is not insurmountable.

Assignments
I assigned three main assignments to students in Fall 2018. They are outlined in Table 3 and described below.

Table 3. Course Grading and Evaluation

<table>
<thead>
<tr>
<th>Percentage</th>
<th>Assignment Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10%</td>
<td>Community engagement (participation in class)</td>
</tr>
<tr>
<td>30%</td>
<td>Reading journal: 2 instances x 15%, due Weeks 8 and 14</td>
</tr>
</tbody>
</table>
| 60%        | Synthesis project  
|            | 3% Scoping due Week 5  
|            | 6% Accountability checkpoints due Week 7, 9  
|            | 6% Draft to instructor due Week 11  
|            | 6% Peer review due to reviewer wk 13, due to author wk 14  
|            | 30% Final draft due Week 15, option for regrading after revision due Dec 12.  
|            | 10% Presentation in Week 15 or 16 |

*Community engagement* recognizes that we are learners together in the class, and with other researchers and community members. Students are expected to come to class, having completed the readings, prepared to discuss their understandings and engage constructively with the ideas others contribute.

Students are expected to keep a *reading journal*, where they reflect relatively privately about the readings and how they relate to their work, identity, role in research, and research subject matter. Students write weekly entries, and the journals are submitted at two points during the term. Students are invited to share reflections publicly on the discussion board, but this is entirely optional.

The *synthesis project* is to show students have individually met the course learning objectives. They get to choose between a set of 5 options, drawn with inspiration from Prof. Monica Cox and Prof. Meggin McIntosh: a literature review, position paper, original research or essay; a grant proposal; a policy analysis; a technology/media/art/design project; or another option following a structured handout to scope it, to be approved in advance.

*Grading*

My educational philosophy with respect to grading graduate students is that grading should be used as a tool to give feedback to students rather than an evaluative power that instructors hold over students to force good behavior. I, therefore, follow the following scheme for assignments and overall grading:

Specific assignments are evaluated using a check minus, check, or check plus framework, as outlined in Table 4.
Table 4. Assessment Framework

<table>
<thead>
<tr>
<th>Writing</th>
<th>Ideas</th>
</tr>
</thead>
<tbody>
<tr>
<td>✗</td>
<td>Not turned in</td>
</tr>
<tr>
<td>✓</td>
<td>Needs extensive revision (not grounded, unclear, poor organization, not engaging, grammatical or spelling mistakes)</td>
</tr>
<tr>
<td>✓</td>
<td>Needs improvement in writing to be fully persuasive (improve grounding, clarity, organization)</td>
</tr>
<tr>
<td>✓</td>
<td>Clear argument and structure, professional presentation, grammar, and spelling,</td>
</tr>
</tbody>
</table>

The essence of a “B” grade for graduate courses is adequate participation in class and assignments. Achieving this level of participation includes attending most classes and accomplishing assignments with a mix of mostly check minus and checks on assignments. I consider this to be the minimum for graduate students.

The essence of an “A” grade for graduate courses is appropriate participation in class and in assignments. Achieving this level of participation includes active and thoughtful participation in the classroom, incorporating feedback from peers and me as instructor into revisions of papers, and achieving a mix of mostly checks and some check plusses, on assignments (the occasional check minus isn’t the end of the world). This is my expectation for graduate students.

Course Philosophy
Throughout the design and implementation of the course, I strived to show my commitment to these various ideas:

1. **Graduate students should do work in their courses that matters and is useful to them**: for example, I provide participants a choice between 5 different options to write for their final project, as described below, I give participants class time to reflect on how content is relevant or meaning for to them and their work; I value students’ reflections on readings as part of the course grade.

2. **Both students and instructors are social actors who are also part of an intellectual community from which we learn and to which we should give back**: for example, I shifted from posting PDFs of all required readings on Blackboard to working with the library to
list required readings on a website accessible through the Library website so they may track downloads and so that authors may receive download credit to better track their impact; regarding giving back, I ask participants to share their final project with their classmates through a presentation, and the presentation includes a structured classroom discussion as part of the grade.

3. *It is valuable for us all to figure out what we need to do to write better:* I tried to incorporate explicit discussion and assignments that recognize different phases of writing, different genres of impactful writing, and different writing-related tasks to engage in. For example, we spend time deconstructing how authors build their arguments in the primary and secondary sources we read, we hear from authors about how they go about writing (ex. Lamott, 1994), students engage in peer review of each others’ work; I assigned different types of writing over the term (including reflective writing, outlining and rough drafting, and reviewing); and I shared papers that I had authored or co-authored along with the backstory of how they came to be.

4. *We can find and should look for value in things with which we disagree:* this idea is to recognize the politicized nature of much of the theoretical content, and how there are students who find the theory politically or morally difficult. The goal is to help students learn how to engage analytically with the content, and be able to find some kind of value in papers with which they might otherwise disagree. (We did not engage with this idea as a class too much this term, for some reason.)

5. *Teaching and learning is a responsive endeavor.* I try to incorporate a recognition of the relationality of teaching and learning, that teaching is not just a matter of dispensing material, but about engaging with the prior knowledge and interests of learners in order to help them develop their own understanding. I designed in multiple features recognizing this constructivist standpoint; for example, I invited participants to decide on whether we kept listening to podcast episodes (depending on the value they found in them until that point); I did a mid-course correction soliciting feedback on the course so far, and then made some teaching decisions differently or more transparent as a result; and I limited grading to check plus, check, check minus that focused on engagement with the ideas to recognize that people are at different stages of their familiarity with the theory.

As an instructor, I claim a commitment to principles of feminist pedagogy, which problematize the relationship and power dynamics between the instructor (as the source of knowledge) and the students (as the recipients of knowledge). This has consequences for the structure of the classroom, the choice of material and learning objectives, assessment principles, the pedagogy of each class period, even the arrangement of where people sit in the room.

In the organization of class activities, I try to incorporate an awareness of tensions and paradoxes that Parker Palmer (2017) lists, namely:

1. The space should be bounded and open.
2. The space should be hospitable and “charged.”
3. The space should invite the voice of the individual and the voice of the group.
4. The space should honor the “little” stories of the students and the “big” stories of the disciplines and tradition.
5. The space should support solitude and surround it with the resources of the community.
6. The space should welcome both silence and speech.
As such, I have adopted such familiar feminist principles as putting the tables in a circle, finding opportunities for everyone to speak, staying aware of how much time and space I occupy with direct instruction versus the students having time to discuss and reflect together, and how we incorporate the offerings of students into our collective understanding that we develop together.

A course about diversity that articulates a commitment to feminist pedagogies should also be designed to welcome participants’ diverse lives and perspectives. Current syllabi commitments to classroom respect, accommodations for people with different physical or mental challenges, and well-being (including around food or housing insecurity) appear early on in the syllabus. In a revision made mid-semester, I have added a special section on supporting parents in the classroom, particularly nursing mothers, or parents struggling to find childcare on snow days when schools are closed (for example). I include a section about meeting deadlines that recognizes that university schedules are coordinated around major Christian holidays, and not other cultures’ or religious holidays, and that for those realities, or caregiving responsibilities, students (and instructors!) sometimes cannot meet deadlines. I committed to working with students to figure out an accommodation when these conditions arise.

Method

This paper was drafted as part of, but independent of the grade of, the fall 2018 instantiation of ENE 69500/WGSS 681. The lead author initially proposed the paper as part of a class discussion. Authors collaboratively wrote the abstract. The instructor proposed an outline for the paper and began writing sections related to the course development. During lecture, the authors discussed proposing a presentation in lieu of a paper, but thought a paper would be more informative and would make a greater impact than a simple slide presentation. We strived to scope it to be reasonable to fit in the middle of other writing commitments at the end of the term, so not to burden student authors. Authors agreed upon using a modified version of their final journal reflection for this class as their primary entry for this paper. The entries presented next are each student’s reflection in their own voice, written for their journals, and modified to be sharable with the public.

Student Reflections

Tikyna: I am a second-year doctoral student in engineering education. I identify as a black cisgendered woman with a working-class upbringing. I was raised in the Midwest and then relocated to the Southeast as a first-generation college student to attend a Historically Black College and University (HBCU) on an academic scholarship. After obtaining my bachelor’s in engineering technology, I moved back to the Midwest to pursue my graduate studies in mechanical engineering. In 2017, I chose to change my doctoral studies to engineering education after experiencing a pivot in research interests. My research focuses on teaching engineering to at-risk youth who reside in under-resourced communities.

I arrived in ENE/WGSS 69500 in a neutral position about race, class, and gender. I completed a significant amount of reading, but it was unsystematic and muddled without any structure and
discourse. I was also hesitant in taking a course where I would be the only domestic black student and feeling like I would have to serve as a voice for the black experience. Before this course, my academic mentors encouraged me to study race and gender issues in STEM, so I followed suit, even though I felt untrained. I spent an entire semester developing an identity development framework that only theorized race. I did not account for gender, class, (dis)ability, or any other axis that could potentially influence identity formation.

In this course, I learned that my identity was not binary, and did not have to choose between my gender, race, or abilities when we read *Intersectionality* by Hill Collins and Bilge. I learned that racial formation was not only a social construct and people of color in the United States did not all share the same needs, wants or agendas and there were critical race theories to help prove it (Delgado & Stefancic, 2017; Omi & Winant, 2015). I learned that just as there are disadvantages in being feminine in STEM education there are also advantages, Angela Calabrese Barton (1998) expounds that “women’s ways of knowing” can be practiced in STEM in a myriad of ways. Connell and Messerschmidt (2005) outlined that just as there are benefits of being masculine in STEM, there are also drawbacks when we police those masculinities in the gendering of individuals. My knowledge of these theories helps me look inwardly at myself, and become much more careful and meticulous my research, as I have the responsibility to amplifying the voices of my participants.

Now that I have completed this course, I have the language, theories, and understanding to competently argue that youth of color are not a monolith and should not be treated as such when being taught STEM. There are also skills, ways of knowing, being, representing, and living that these youth bring with them into the classroom, and educators should be sure not to overlook or dismiss these jewels of knowledge but celebrate them. Their current lived circumstances should not dictate the education they receive or who they are to become in life, nor should a STEM education fit them into a narrow pathway that was not designed with their lives in mind. I learned that the engineering content that I teach youth should align with their lived experiences and my research approaches should not highlight deficiencies. I reflect on my own childhood and cry at the young girl who abandoned parts of herself to assimilate into STEM education. I leave this course also extremely aware of my privileges, although they may have not always been seen as such.

**Hassan:** I am a second-year doctoral student in Engineering Education. I identify as middle eastern, upper-middle class, straight male. I was born and raised among a middle-class family in Saudi Arabia. The general nationalist views, the nature of the composition of the students, and the gender segregation have shielded me from recognizing the influence of power dynamics within any society. I started to understand and differentiate those experiences during my eight years presence in the United States as part of my academic pursuit. Back home and especially in my family, STEM and especially engineering is more of an expectation rather than a choice to any high performing student unless they choose to pursue a medical degree. Accompanying my father at his work during school recess since and the regular dialogues we had about his work as a civil engineer had been one of the influences that led me to pursue engineering as a major. Prior to my enrollment in the doctoral program, I completed my bachelor’s and master’s degrees in mechanical engineering where I ended up working as an engineer and for five years at an industrial corporation. In my research, I am focusing on engineering from the lens of cultural
assimilation from both student and professional standpoints. My current research direction looks into both engineers’ assimilation in corporate culture as part of a rotational program and into transfer students’ assimilation into an academic setting from the lens of cultural capital. What motivated me to explore this research is the influence of how being a minority and the only international among a class led me to transfer to another school as I felt ill-equipped to pursue an engineering degree without a peer support group. As the majority of the students, I connected with, opted to either change majors or transfer to another school.

I would say the thing that makes me most different since taking the class is awareness. I became aware of the power dynamics the U.S. society and worked on related them to some of the experiences from back home. I grew aware of how strong my quantitative, positivist and functionalist views influence how I make decisions, judge and solve problems and how those views limit me from seeing the whole picture. I started to note how I now have a duality in my approaches. One that is based on my instinct, identity, and what I have been indoctrinated in, and another that requires some reflection but encompasses views and knowledge of experiences that I haven’t lived. The class helped me through the intersectional lens tackle this duality and be able to realize the paradox of someone who can be privileged yet curbed. This helped me revise my research viewpoint to not only navigate students transitions but how different factors that are dependent on engineers or engineering student’s intersection within the race, gender and class may influence their transition within an organization. This led me to decide to reflect on my research methodologies and approaches to minimize research biases and errors by not providing enough representation to those who are intersectionality marginalized. I believe the most important aspect of this course, is that it questioned who I am, and led me to realize the areas I need to develop not only as a researcher but as an individual.

**Sharlene:** I am a first-year doctoral student in Technology. I identify as a black, straight, female, middle class, an International student with Caribbean cultural roots. Since I was born and raised in The Bahamas, my Bahamian culture is a cherished slice of my identity. I was extremely fortunate to have been afforded many opportunities to obtain my tertiary education in the United States. I received a Bachelor of Science in Computer Information Systems, then a Master of Science in Technology Leadership and Innovation, and currently pursuing a doctoral degree in Technology. Studying in the United States has also enabled me to broaden my social understanding of diversity, especially since I now find myself in the minority group. My matriculation experiences as a black woman in STEM at Historically White Institutions are what fueled my research interest to better understand and enhance the lived experiences of others like me. I seek to understand what factors motivate or impede black female’s persistence or attrition in STEM at Historically White Institutions. The ultimate goal of my research is to broaden STEM participation among underrepresented minorities.

Prior to taking this course, I had very little theoretical knowledge about class and gender theories. However, I did have some understanding of race theories such as Critical Race Theory, Critical Race Feminism, and Black Feminist Thought. I employed Critical Race Feminism and Black Feminist Thought in my master’s thesis work, but only at a surface level. Therefore, I took this course to gain a fundamental understanding of race, class and gender theories, to appropriately and extensively apply each to my dissertation work. I must say that this learning experience has really transformed my critical consciousness from surface level thinking about
race, class, and gender, to what I now describe as “oceanic deep” level. For instance, this course challenged my preconceived colorblind ideology about race, gender, and class, and enabled me to understand how elements of each are used to maintain power dissonance, which privileges some but marginalizes others. Although many of the core concepts seemingly overlapped, the section on Intersectionality was most profound. I am now able to see how it can be applied to my research as an analytical tool far beyond a surface discussion about meshed identities. Intersectionality theoretical framework is conducive in gaining a macro understanding of how socially constructed markers such as race, gender, and a class act in unison to create challenging environments for Black women in STEM environments at Historically White Institutions.

Additionally, the Whiteness podcast was a weekly treat. I gained so many fundamental historical insights from engaging with each episode that I am now inspired to become actively involved in anti-racist efforts. Chenjerai Kumanyika made a very profound statement that still resonates with me, “Not everything that is faced can be changed, but nothing can be changed until it is faced.” Hence, apart from the theoretical knowledge obtained, this class provided a therapeutic, confidential forum with which to comfortably vent about any type of issues faced. I sincerely appreciated the friendly, warm and welcoming academic environment that this course fostered, one in which the professor and peers alike, were all willing to extend themselves beyond the required academic scope to ensure that everyone had a meaningful and successful learning experience. Overall, I feel that this entire class experience was socially enlightening, intellectually stimulating, and academically rewarding.

Justin: I am a second-year doctoral student in Engineering Education. I identify as white, male, and upper-middle class, though only recently have I had an opportunity to explore what it means to be “upper-class” in relation to socioeconomic status. It was not always this way though. I was born and raised in a low-socioeconomic area of the southwestern United States; Las Vegas, Nevada, and remember how lack of access to social, economic, and educational opportunities was always a salient part of my identity. I consider myself lucky to have had exposure to engineering, for without that I would not be where I am. During my undergraduate career, while I was completing dual degrees in Mechanical Engineering and Secondary Education in Mathematics, I mentored low-income youth who I identified as “like me” and began to see the deeper way socioeconomic inequality perpetuates inequitable opportunity to experience STEM education. As I became more socioeconomically mobile when I came to graduate school, I focused my research interests to understanding the pathways low-socioeconomic students take into, and through, engineering, and what effect race and gender play in socioeconomic inequality. In essence, I wanted to know how do kids “like me” or in more stratified positions “make it?”

Before taking the course, I have had some exposure to race, class, and gender literature and research. I wanted more though, and my purpose taking the course was not only to know more, but to also critically challenge, and let others challenge, the white male privilege I have come to benefit from. I always wonder what my position would have looked like if I was non-binary gender or from an underrepresented racial group in engineering. At the start of the course, my research interests considered race and gender, but neither was an explicit part of my work; nor was the idea really flushed out because I had not spent enough time engaging with the content. I did not originally know how much race and gender were going to be intertwined in the work I
wanted to do. That immediately changed when I was introduced to Intersectionality Theory and I asked myself “how could my study of socioeconomic inequality be treated as a deliberate study of an intersection in engineering education, and how could I format my work to be a deliberate discussion of social justice?” Throughout the course, I have committed to this idea as I have focused on my class project of building a conceptual framework for understanding quantitative measurement of socioeconomic status outlined in Intersectionality Theory. In the end, I have framed my research ideas in Intersectionality Theory with a specific class-based theory of gender and race I have adapted from Connell (2014) and Omi & Winant (2014) as “human bodies as places for discrimination to occur.” The final idea is an Intersectionality–focused, quantitative approach, for understanding and measuring socioeconomic inequality with consideration of the history of racist and sexist practices in the workplace, education, home-buying, and social programs.

I believe the course was beneficial to me for two reasons. The first reason was that it really did challenge my privilege. I promised myself before the course started that if I felt uncomfortable, expecting and hoping I would, I would sit in that discomfort and learn from it as Parker Palmer challenged. I was left uncomfortable every week and made sure I journaled that because I knew it would make me become a better person. The second reason was that the course challenged, and prepared, me to take a personal role in dismantling institutional structures by giving me the language and practice to frame my own future work in explicit theories of race and gender formation that goes beyond brief descriptives that are common in engineering education. Now that I have practiced challenging my own privilege in the classroom and within the constraints of my research, I hope to continue engaging with critical research and to continue to challenge systems of privilege.

Shalin: I am a third-year doctoral student in the field of education and Curriculum Studies, returning to my education after having taught in higher education for the past 18 years. I have designed curriculum, as well as courses on gender, sexuality, media, women’s studies, cultural studies, literature, and composition. I currently teach multiculturalism and education for primarily white, middle-class, female pre-service teachers, so I was interested in how this course, billed as a cross-listed course between Women’s Studies and Engineering Education, took up education for engineering education students on the issues of race, class, and gender. As a student in the field of curriculum studies, I have been trained to examine the ways in which curriculum and the pedagogy explicitly or implicitly center dominant discourses and knowledge. This course is my first course in engineering education, so a good deal of what I learned this semester in this course was about my own assumptions and biases of the ways issues of social justice would be taken up within the field of engineering.

I entered the course with equal amounts of curiosity and hesitation, which was (un)informed by my underlying assumptions about the ways in which the field would be taking up “social justice” as a mechanism to appropriate discourses of equity, difference, and power to maintain an emphasis on economic and market-based ideology. My primary takeaway from this course is that my own biases as an educator and a student are heavily influenced by my race. I also learned that my own intersectional positionality— as a queer, white, middle class, non-traditionally aged graduate student, cisgendered woman, as well as a single mother and a seasoned educator— means I intentionally and unintentionally filter my educative process through many dominant lenses,
but especially through my own whiteness. My various dominant positions offer me multiple spaces of privilege, which means I am comfortable in most public and academic spaces. I tend to avoid facing and naming my own complicity in maintaining dominant ideology, mostly as a mechanism of my whiteness. Through the course, I found that I have discursive mechanisms of whiteness that mask my complicity in maintaining dominant forms of knowledge that circulate within academic spaces. I realized that these discourses mechanisms help alleviate some of the discomforts I feel while learning more about the historical, social, political, and economic systems of power that I, through my whiteness, help to maintain. This was not something I had expected going into this course, but it is certainly something I am aware of now. An example that stands out to me is a pedagogical practice that the instructor used, which is common to decolonial approaches to teaching. I was regularly -and appropriately- interrupted by the instructor when I would phrase discourses of race and power using passive constructions during discussions. I often use challenges like this with my own students in Multicultural Education, and I was surprised to see how often I phrase discussion of power like this. Using passive constructions in conversations about race and power is an evasive rhetorical device that does not name power as the subject and actor for the resulting action. It is a result of my own whiteness to evasively and passively engage in conversations about race in this way as if my own dominant ideology isn’t complicit in this very hegemonic process of not directly identifying power.

My own biases as I was entering into this course are based on the premise that engineering education is only now, in the past 5 years or so, beginning to turn a critical eye on the field for how dominant ideologies structure much of the curriculum and pedagogy within higher education spaces. Because these critical discourses are new to engineering education, my assumption was, they would not be as theoretically informed as they are in humanities-based or education-based fields. Not only is the pedagogy used within the course theoretically informed, but the ways in which the instructor selected reading materials, listened to how students were taking up the materials, and facilitated discussions are informed with feminist, decolonial, and cultural studies-based curricular and pedagogical practices.

This class has helped make my own biases visible about my own assumptions about what is possible in engineering education, but it has also caused me to reflect on how my own approaches to teaching multicultural education has changed over the years from teaching in a liberal arts university to teaching in a university that defines itself as an “engineering school.” There is a tension here I cannot quite articulate, though I am starting to reflect on how this shift in my pedagogy and in my own language toward these passive constructions is likely a result of the neoliberal pressures to not challenge power directly within this climate so that my white, middle-class, female students to help them feel more “safe” and less complicit as carriers of harmful dominant ideologies that lead to social inequity regarding issues of race, class, gender, religion, and sexuality. Moving forward, I am now far more aware of my own intentionality in my teaching practices and how I speak about race and power in my own classrooms, and also a researcher, and how I will carry this intentionality into my own work, and how I will be mindful of my own biases and assumptions that frame my research practices.

Casey: I am a third-year graduate student in Chemical Education. I identify as a white, middle-class, bisexual cisgender woman. I would like to recognize that the positions afforded to me through my identification as white and middle class have afforded me power as well as
insulation from dialogues of oppression centered around race and class. Prior to participating in this course, I had come to graduate school to do social justice-oriented work in STEM education. While this motivation still rings true to me, I think that many of the reasons why I was pursuing this path were largely unexamined. The project I currently work on is in an informal STEM learning setting with resettled Burmese refugee youth. When I started graduate school and began this project, I was unequipped to reckon with how to interact with the youth in the research setting, let alone the ethical issues of my working with them. I realized that I needed to get the language to do this work in a way that did not shortchange participants and aligned with my values. Taking this course was motivated by my experiences in a course on decolonizing methodologies in education. This course shook me in a way that made it clear that colonialism and white-centered ideologies were at work in educational settings. There I had the space to question for whom science has been created, and why issues of representation dig much deeper than getting minority individuals into science disciplines. Moreover, I got to be in space where I was truly uncomfortable because of my whiteness. Coming into this course, I hoped to find more spaces to be uncomfortable and vulnerable. Furthermore, I wanted to learn how to take theory around race, class, and gender into STEM education.

Personally, this course has helped me to further interrogate my positionality as a white, middle-class woman. From our discussions and readings, I have a better appreciation for how the social positions produced at the intersections of white, woman, and middle-class are unique to the intersections of those categories. Furthermore, I can now articulate how each of those categories has been constructed as a social and historical project and how they are (re)constructed through shifting distributions of power. Academically, this course has pushed me to fully interrogate my position within my current research project and to think of ways to do so as I move forward in my career. The culminating project I created for this course is an autoethnography that looks more closely at some moments I experienced while I was collecting data from the informal learning setting in which my research takes place and critiques them using an intersectional lens (Collins & Bilge, 2016). This course has created the space for me to be reflexive about my power and position as a researcher and helped me to begin to articulate how power and structural forces are what underlies issues of inequality within STEM education.

Instructor reflection

Alice: I am an associate professor in the School of Engineering Education and affiliate faculty with the Women’s, Gender, and Sexuality Studies program at Purdue. I am White, in my early 40s, and a native-born, able-bodied, cis-gendered heterosexual woman with class privilege, partnered with a man, with two children. I recognize that I take on little risk by sharing this personal information as I inhabit a position of many dominant identities, affording me countless
uneamed privileges, particularly when compared to my students or compared to others with whom I interact in my community. I defined my early faculty career around doing research on gender and using feminist theories in engineering education research (EER); however, during my first sabbatical, I had what I now think of as an embarrassingly late transformative experience learning more about Critical Race Theory, and confronting once again how much I as a White academic had been trading on my White privilege for my career success so far. In addition, I had a concurrent existential crisis, when it suddenly struck me how I had been writing papers for years, and that likely most of them were not having a direct impact on how people - mainly academics - went about their day-to-day work in engineering. I wanted to change that.

I participated in some professional development programs that really helped me move in a new direction. The “Pillars of Genius Program” (https://unleashyourgeniusbootcamp.com/program) helped me articulate some of my core principles, and what I hope to achieve in my career, to help me make better choices day to day about how to spend my time. I now try to point my vectors in the direction of creating engineering as a means to produce more engaged citizens and to help people have a more inclusive, engaged, and socially just vision of engineering education. The Playing Big Program and book, by Tara Mohr (2015), and associated facilitators’ training (https://www.taramohr.com/courses/) helps me figure out how to have more impact in the work I do every day by overcoming a fear of criticism, by listening to my own supportive inner mentor about how to move forward and to support others in doing similarly. From this course, I particularly appreciated learning how much impact you can have through online conversations and with reduced readings that are designed to have a big influence. Both of those courses helped prompt me to redesign this course to have more influence on participants and matter more to participants than the previous instantiation.

As we approach the end of the semester, I have a few reflective thoughts to share about my experience teaching this course this time. I recognize that I struggled throughout the term between my desire to provide a substantial and fair assessment of the field of engineering education equity research, and my commitment to providing readings that would have high impact. Sometimes the EER reading I chose served as an exemplar, sometimes it was evidence of how much further we all needed to come. I am not sure how people read the cultural studies contexts for much of the theories we read - the tension between utilitarian “but what does this mean for EER” and the need to get out of the limited theoretical space of EER, important to read primary research on social theory too. This is a tension I will need to continue to manage.

In addition, I also struggled with how much of my own work to include. I have tended to not include any of my work in the courses I teach, and yet I do significantly contribute to a scholarly conversation around social theory in engineering education research. However, I am not the only one in this space by any means, and I need to better amplify the work of other scholars, particularly scholars of color doing this important work in the field. My EER list of references overwhelmingly highlights the work of other White scholars, so I need to decolonize my reading lists. I commit here to looking at the research of more colleagues of color, particularly junior colleagues, to include in the next iteration of this course.

I also needed to be reminded late in the term about how different topics affect participants differently and to make space for those different experiences. Participants have different
embodied expertise with and realities regarding racial and sexual harassment and assault, discrimination, oppression and privilege, and different awarenesses about how those experiences influence engineering. I need to acknowledge this earlier on in the term (perhaps also in the syllabus) and better set up a classroom culture that supported people in approaching the content in recognition of those sometimes traumatic realities. Given the reality of potentially emotionally weighty topics, I need to preserve more time in class for participants to process and reflect on what our discussions meant for their own positionality and work. I hoped that would appear in the reflective journals, but we needed more of it in class too.

I know participants are anxious about how I will actually grade them at the end of this course. I find myself strongly experiencing the pressure of the overarching culture of meritocracy to judge students relative to each other, and to some falsely objectivized bar of accomplishment, and also simultaneously wanting to resist this pressure, to reassure students about their worthiness and ability to contribute to our field. The open assessment framework I have described above and used in other courses helps me commit at the start of the term to a more resistant stance, but I know students have a hard time trusting that in ambiguity they will still receive a valuable commodity in the form of a high grade. I need to think more about how to better embody this commitment and resistance through assessments.

I also want to acknowledge my own privilege in producing blind spots in my course design. For example, I found the podcast provided insightful, grounded information in a different medium than reading that was refreshing. The first time I listened to it, the podcast editors presented much of the information in a way that sparked many insights for me. It sounds like some students also resonated with the alternative format and the explicit discussion of Whiteness. But by assigning the podcast, did I also recenter Whiteness as our focus, only explicitly this time? Have I again displaced the voices and contributions of people of color to discussions in engineering education? Did I refocus on the revelatory experiences of some White students, to the detriment of some students of color who already knew the material? Did I enable a form of White fragility by meeting the White students where they were (DiAngelo, 2018), but maybe not the students of color? It may be that this is yet another tension to manage as per Palmer’s paradoxes, and at least explicitly acknowledging the tension can be an important step in my own journey as a White instructor doing diversity work while striving to unlearn White supremacy.

Finally, I acknowledge how much I have yet to learn about Disability Studies and ableism, and how to incorporate a recognition of ableism/disablism in my pedagogy, content design, and theoretical frameworks for looking at engineering education research. This is a work in progress for me.

**Conclusion**

Collectively, the student authors conclude that our positions within our individual research directions have undergone various forms of change through our engagement with the discussions and source material in this course. Some of us arrived knowing about some of our individual privileges but became more aware of other forms that may have laid more hidden to us within our identities. For some of us, our awareness of power and its discursive mechanisms that maintain dominant systems of oppression led us to really challenge our own social locations in
our research. However, whether we sat at the intersection of many marginalized identities, or the
intersection of more dominant identities, we all engaged in responding to theoretical and
personal tensions that challenged us to grow in our scholarship. From the instructor’s
perspective, we have shared various course design decisions and reflections about how the
design and material actually landed through this implementation of the course, in hopes that
others might be interested in riffing on them in their own course design focused on similar
content. As the next generation of scholars, the student authors emphasize the importance of
thoughtful theorizing of race, class, and gender in all research across STEM education
disciplines, and beyond, and encourage others to find meaningful opportunities to do the same.

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