

Encouraging Equitable Participation in Ethical Data Science Discussions

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As a teacher of diverse students, I have often struggled to define and implement equitable learning and instruction. Like many educators today, I have pondered over the definition of the term “equity” and what that means for my students and I, knowing that the idea of “*giving students what they need*” in inquiry and discourse-based mathematics classrooms is not all that straightforward. However, when initiatives to implement culturally responsive and social justice teaching reached my attention, I was awestruck at the possibilities for learning, but also by my fears as a relatively privileged, White, female teacher. I wondered, how do I create equitable learning opportunities for the students in my diversely populated classroom while also exploring and discussing potentially uncomfortable and controversial issues? My classroom had never looked like the learning contexts written about by the scholars who were successful with this work (e.g. more homogenous in terms of race, socioeconomic status, etc.) (e.g. Gutstein, 2005; Rubel et al., 2016; Berry, 2004). Rather, my students identified differently according to their race, gender identification, sexual orientation, socioeconomic status, educational experiences, etc. creating a tension for me regarding how I might facilitate classroom discussions related to sociopolitical topics. Given that some of my students were considered relatively privileged while others were marginalized by definition, my fears translated into the following actionable questions:

1. How might I provide equitable learning opportunities for students who are situated differently in both society and the classroom?
2. How might I guarantee that all students are given the same access to class discussions, knowing that they likely have different emotions and motivations related to participating in them?
3. How might I facilitate sociopolitical/ethical discussions in the data science classroom while not creating a polarizing environment between relatively privileged and marginalized students?

This article will discuss my experiences in teaching an introductory ethical data science (EDS) course for high school students, where I attempted to encourage *equitable participation* in classroom discussions among students from different racial, cultural, and gendered identities. Here *equitable participation* refers to variation in the students who speak up in class discussions, and that those students participate in ways that honor their gendered, cultural, and mathematics (or data science) identities, resulting in their sense of belonging in that space (Register, 2023; Register & Stephan, 2023). Specifically, I will discuss three key *discursive moves* (moves that

promote desired ways of talking and participating) (Sandoval, 2014) that I made throughout this process which seemed to bolster my students' belief in the importance of *equitable participation* and their commitment to encouraging it in our classroom discussions (Register, 2023, Register & Stephan, 2023).

These strategies help to foster critical statistics education in that they explicitly address issues of power, race, and identity in diverse classrooms (Larnell, 2013) for the purposes of promoting nondominant representation in the data science industry, and to promote justice in the global economy. At the same time, these strategies are also useful in contexts beyond data science and high school, offering tangible ideas and practices for promoting equitable participation in technical classroom contexts.

Context

The context of this article is situated in a larger classroom Design-Based Research project whose purpose is to characterize students' ethical reasoning in mathematics and data science in order to develop instructional resources. The project was initiated in 2019 and up to this point, includes the following yields, which are beyond the scope of this paper:

- Critical Mathematics Consciousness (CMC) analytic framework for characterizing students' ethical/critical reasoning in data-based contexts (Andersson & Register, 2022; Reinke et al., 2022; Register et al., 2021; Stephan et al., 2021);
- Ethical Mathematics Consciousness (EMC) design framework for developing ethical mathematics instruction (Register, 2023);
- Ethical Data Science tasks (see: Andersson & Register, 2023; Register et al., 2021; Stephan et al., 2021; Register, 2023);
- Findings from Ethical Data Science task-based interviews (see: Andersson & Register, 2022; Register et al., 2021; Stephan et al., 2021; Register, 2023);
- Ethical Decision Making in Data Science Analytic Framework (Register, 2023).

The findings of our task-based interviews, relevant literature, design heuristics from Realistic Mathematics Education (Van den Heuvel-Panhuizen & Drijvers, 2014), and the EMC conceptual framework referenced above, guided both the course design and corresponding materials for the Ethical Data Science course.

Course Goals and Design Considerations

Generally speaking, data science sits at the intersection of mathematics and statistics, computer science (programming), and domain knowledge (e.g., business or medical knowledge). Its purpose is to capitalize on computer science techniques (programming, data extraction,

Machine Learning, etc.) to perform advanced statistical, mathematical, and visual analysis on massive amounts of available data (Big Data) in order to propose solutions to commercial, economic, and societal issues. However, evidence has shown that these solutions typically benefit certain groups in society while they may disadvantage other, often marginalized, groups. Scholars typically attribute this phenomenon to the *privilege hazard* in data science which occurs when the demographic make-up of data scientists are overrepresented by dominant and/or privileged groups in society (i.e. White and Asian males) (D'Ignazio et. al, 2020).

With the broader aims of (1) diversifying the data science field to include non-dominant voices, ideals, and perspectives and (2) preparing students as ethical decision makers concerned with equity and justice, we designed the Ethical Data Science (EDS) course structures to support *equitable participation* among students with diverse and intersecting identities in ethical and sociopolitical data science discussions. The term *equitable participation* refers to variability in the students who contribute to class discussions (typical definition), but more so that these students participate in ways that affirm their identity and sense of belonging (Register, 2023).

In preparing for the EDS course, the goal to teach data science principles while considering their impact for ethical decision-making, made me question the feasibility of aligning classroom practices to my students' realities. Because the students came from different towns, it was difficult to design course activities that reflected their specific home communities. I recognized that any attempt to do so would likely be superficial (since I did not yet know my students) and/or draw on gendered, racial, or ethnic stereotypes. Instead, my colleagues and I chose to plan from the standpoint of developing rigorous data science activities using real-world and sociopolitical data sets. In choosing these contexts, we selected those that we felt would speak to sociopolitical and/or ethical issues that the majority of the students would be familiar with through their interactions with technology and the media (e.g. commercial and political targeting, facial recognition software, COVID vaccination rates, US Census data, civilian gun ownership, coal ash contamination in their home state, etc.). That is, we drew on their intersecting identities (Crenshaw, 1991) including those tied to location, youth culture, social media, and technology.

Course tools and materials included Python programming modules through [Datacamp.com](https://www.datacamp.com), data science content modules and labs grounded in sociopolitical contexts, sociopolitical readings (including: *Weapons of Math Destruction* by Cathy O'Neil, 2016, *Automating Inequality* by Virginia Eubanks, 2018) and explorations related to the positive and negative effects of data science on marginalized groups in society, and an ongoing research project where students chose a social injustice that was personally meaningful to them, to explore and develop ethical solutions. The majority of classroom activities included either small or whole group discussion and the students were expected to participate in classroom discussions either by individually contributing or by presenting in small group formats.

Importantly, the tools, materials, and task structures were designed to reflect processes used, and ethical considerations made, in the data science industry. Therefore, a majority of the

investigations were designed to leverage student discourse in the service of illuminating multiple (and often contradictory) rationales for making ethical data-based decisions. The task structures (Sandoval, 2014) for the course included:

- *Decision-making task structures*: position students as decision makers who must decide and justify their choices based on both their understanding of the topic and their personal experiences (BBC, n.d., Keefer & Ashley, 2001; Mastin, 2009; Matthews, 2019);
- *Pluralistic task structures*: students explore and justify their decisions by arguing pluralistically. By pluralism we mean that students are able to adopt and understand different subject and theoretical positions regarding the ethical issue, and consider both the pros and cons of their potential action for a multitude of different stakeholders (Noddings, 1988; Norlock 2019; Stanford University, n.d.);
- *Qualitative task structures*: students consider the quality or consequences of specific mathematical actions or processes in society or based upon their personal experiences (Matthews, 2019).

Together, these designs place the onus of responsibility on students to understand the technical aspects of the data science methodology, while considering the potential effects of their data science products in society. In addition, we conjectured that when working with students of privilege, positioning them as the recipient of the data science decision may help them to affirm the experiences of marginalized populations in sociopolitical contexts. Therefore, rather than jumping directly into problem types that discuss social justice issues with regard to oppressed groups in the United States, we began the course with activities that positioned the students themselves as the target population of the dataset (and potentially an oppressed group) in hopes to develop empathy and an open-mindedness to the impact of BDA on people situated differently in society (e.g. examining their own identities in data, including the US Census and NAEP data). In other words, by exploring their own identifying characteristics in the data (their digital traces), students may come to understand that Big Data Analytics has the potential to misrepresent the unique characteristics of individuals by categorizing them based on some identifying characteristic (race, gender, income, etc.). These categorizations may result in improved life situations for some (e.g. increased convenience through targeting practices and automating access to social programs), while damaging or restricting access to the same programs for others (e.g. discrimination through targeting practices and restricting access to social programs due to automation and lack of human contact).

Classroom Context

The Ethical Data Science course was implemented over a four-week period in summer of 2022 at a major Urban Research University in the Southeastern United States that serves urban intensive, urban emergent, and urban characteristic schools in both its city of residency and

surrounding counties (Milner, 2012). The course was offered through a state-funded summer program dedicated to offering authentic research opportunities and learning in STEM. Its intent was to introduce high school students to the data science methodology and its impact in society.

The high school students who participated in the course came from a range of urban intensive/emergent/characteristic communities across the state and held a variety of cultural and gendered backgrounds, although predominantly economically and academically privileged. Some of these students attended their home schools while others attended the state school of Mathematics and Science. Students were rising juniors and seniors and included one Black girl [BG], one Indian-American girl [IG], five White girls [WG], four White boys [WB], two Indian-American boys [IB], and two Asian-American boys [AB] (all self-identifying). They were all from the same state, but traveled from separate congressional districts to join the program. While all students were academically high performing, only four of these students had some experience programming, two had experience with some Machine Learning, and fewer had experience in inquiry, discourse-based, ethical, and social justice-oriented learning environments.

Motivation for this Article

Since the course was grounded in sociopolitical and ethical contexts, and the students did not know each other, I expected that many of the students would be uncomfortable engaging in class discussions. What I did not expect was that students would participate (or not) according to their designated gendered and cultural identities (Register & Stephan, 2023; Riegle-Crumb et al., 2020; Sfard & Prusak, 2005).

In the first few days of the course, we noticed that the females were less likely to participate in discussions that were heavily grounded in the technical and mathematical components of data science. At the same time, White males and Asian students were more likely to participate in the technical discussions and less so in the sociopolitical or ethical grounded discussions. As we progressed through the first two weeks, it was typical that the White males would dominate class discussions. Additionally, it was observed that Asian and Indian students (male or female) were more comfortable in technical rather than sociopolitical discussions, and that females' (of all ethnicities) participation was heavily influenced by their feelings of competence in relation to their peers (Register & Stephan, 2023; Ridgeway, 2001; Riegle-Crumb et al., 2020).

In an attempt to resolve these inequities, I (the instructor) began to encourage *the students themselves* to bring their community ways of knowing, learning, and participating in academic discussions to the classroom, creating what Hodge and Cobb (2019) refer to as a *hybridized learning environment*. That is, where the students get to discuss and collectively determine what it means to understand, explain, critique, agree, justify, etc. in our specific ethical data science course, with our specific group of individuals.

The goal of a *hybridized learning environment* is to create a space where students from different cultures can come together, identify and enact ways of participating that work for the individuals in that setting, but that may not translate outside of that space. Importantly, creating this learning environment *together* with high school students in the EDS course required that I guide students' expectations for participation and learning differently than I had in the past, to ensure that all students developed a sense of belonging in the classroom and in discussions. Therefore, I enacted several *discursive moves* to promote *equitable participation* among my students, as well as their belief in the need for equitable participation in society more generally. The following three moves (though not enacted in isolation) were key for the students in the EDS course to begin participating meaningfully and equitably, and can be adapted for any group of students in socio-politically grounded statistical, mathematical, and/or technical learning contexts.

Key Move #1: Co-Develop and Model Desired Behaviors for Discourse

For the EDS course, the behaviors that I sought to encourage in classroom discussions included that the students explain their reasoning, ask questions when they don't understand, challenge others' perspectives, and indicate agreement or disagreement when applicable (Yackel & Cobb, 1996). While I modeled and encouraged students to engage in these behaviors by asking clarifying and extending questions, this did not result in equitable participation in classroom discussions because I had not yet facilitated a classroom community that valued it. By the third week of the course, I noticed that despite having discussed the desired behaviors, not all students were participating accordingly. That is, some students felt obligated to have their voices heard while others were either hesitant to speak out or were not given the space to express their thinking. As a result of these observations, I hypothesized that because the students were not a part of the process when I dictated those expected behaviors, some of their cultured and/or gendered ways of participating may not be reflected in our classroom practices. This begged the question: how do I facilitate class discussions in a meaningful way that also honors each of their diverse perspectives and ways of participating?

Timed Writing Activity

On day 12 of the course, I developed the following Timed Writing Activity as a means to accept feedback from students related to the classroom environment, and to provide a space for the students and I to negotiate expectations for participation in classroom discussions moving forward. The students were to open a Google Doc, and write continuously for two minutes for each of eight prompts. After responding to all eight prompts in writing, I then asked the students to respond to the first six prompts verbally as a class. Prompts 7 and 8 are personal in nature, so I did not require that they speak to them publicly but hoped that they would influence their response to prompt 6. I then recorded their verbal responses to each prompt on the board in order to provide a collective visual representation of the class expectations for discourse and participation. Prompts and students' collective responses can be seen in Table 2.

Table 2. Timed Writing Prompts and Collective Responses

Prompt	Collective Responses
<p>1. What is your purpose for being in this course? What are your goals? What can you do to accomplish these goals? What can your classmates do to help you accomplish these goals?</p>	<ul style="list-style-type: none"> ● To learn! ● Ask questions, engage in ongoing learning, seek additional information ● Classmates can challenge, push our thinking, etc. ● Facilitate an environment where you're free to be wrong.
<p>2. What does it mean to be an academic? What behaviors does this entail?</p>	<ul style="list-style-type: none"> ● Behave professionally in an academic setting: ● Be a professional learner ● Be a lifelong learner
<p>3. What does it mean to engage in academic discourse with your peers? What behaviors from you and your peers may support academic discourse?</p>	<ul style="list-style-type: none"> ● Evidence-based claims/warrants ● Push others' understanding/reasoning, etc. ● Be productive! Engage to get something out of it: to better understand, propose a solution, critique, etc.
<p>4. What counts as a “good” question in an ethical data science course?</p>	<ul style="list-style-type: none"> ● A question the speaker can answer or speak to and that serves an academic purpose ● Brings up something that others may not have thought of/or may not understand ● Respects past, present, future impact of the question or topic being discussed
<p>5. What counts as a “good” explanation in an ethical data science course?</p>	<ul style="list-style-type: none"> ● Thorough ● Debatable ● Answers the whole question ● Audience appropriate ● Evidence-based
<p>6. What counts as meaningful and equitable participation in class discussions and tasks? Why is this important?</p>	<ul style="list-style-type: none"> ● Meaningful → active engagement, focused on the topic, thinking deeply about the topic, adding meaning by tying back to experiences, giving constructive input

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- Equitable → Considering other viewpoints, participate for a reason (not just to hear yourself talk or show how smart you are, not to bring others down)

7. Do you feel that you meaningfully participate in every discussion/activity? Why or why not? If you hesitate to meaningfully participate in every discussion, why do you think this is the case? What changes could be made to encourage your meaningful participation?

8. Do you feel that your participation allows for other voices to be heard? Explain. What could you do differently to encourage and value the voices of your diverse peers?

As evidenced by the students' collective responses, this discussion served to reframe our purposes for being in the course and engaging in academic discussions. That is, the students themselves characterized our time together as a means to learn about data science and its influence on society, while identifying explicit behaviors that would promote meaningful discourse related to those topics. Namely, they focused on participating *not* to hear themselves talk or showcase their competence, but rather to develop whole-group (collective) understanding by pushing each other, asking questions, critiquing claims, making space for other perspectives, asking meaningful questions, and providing acceptable explanations. When it came to prompt 6, I realized that to effectively characterize meaningful and equitable participation in our classroom setting, it was necessary to collectively and publicly define it. Specifically, what does equitable participation mean in the context of our classroom environment, for society in general, and why is it important in each of these spaces?

Key Move #2: Defining Equitable Participation

For the EDS students and I, prompts 6-8 were the meat of the discussion and thus required a bit of extra attention. When asking students to discuss their responses to prompt 6 publicly, I asked them to first define meaningful participation and then equitable participation. The students initially defined equitable participation as “considering different viewpoints and not being biased.” Critically, the concept of bias jump-started a discussion regarding whether or not it is possible to be completely unbiased in ethical data science discussions. The following excerpt illustrates the discussion that ensued, where student names are given as pseudonyms:

Instructor *What about equitable participation? What do we mean by that?*

Faye [WG] *Um, taking into consideration different viewpoints and not being biased [...]*

Sam [WB] *I was just gonna build on the, um, biased part--I was just gonna simply say that perfection is the enemy of good--trying to remove all biases is gonna make it impossible to remove any bias.*

Instructor *[...] Good point, but what we can do is recognize our own biases and try to control for that in situations[...] Because when we say "just don't be biased" it gives us the idea that we can be, and that's false. No offense. I mean, let's think about it: You have belief systems that make up who you are. You can't just throw those away because you're looking at something mathematically or you're having a discussion--Those are a part of you.--So we have to make room for other opinions or other experiences, and be very transparent about what our biases are.*

Beyond discussing the need to identify and control our biases, I realized that equitable participation was not yet defined in terms of student behaviors, meaning that we had not yet established guidelines for how to promote equitable participation in our learning environment. Therefore, I felt that it was necessary for the students to define the term equity in order to help them conceptualize why equitable participation may be important both in the classroom and in society. By doing this, I also anticipated that the students may be better able to reflect on how their own ways of participating may affect their peers, which I will discuss in the following section. The following excerpt, which occurred directly after the one above, shows how we collaboratively defined equity, and then equitable participation in the EDS course:

Instructor *What is the difference between the word equitable and the word equal?*

Sam [WB] *Equitable is just getting what they need, uh, equal is everyone gets the same thing.*

Instructor *[...] So when we are having equitable participation, what do you think that means?*

Moksh [IB] *When people who speak most speak a little bit less and people who don't speak much, speak more.*

Instructor *Right? And it just means giving that space. And it's not saying that people who speak up need to be quiet and not talk the entire time, but it's waiting, encouraging others maybe to speak up that don't necessarily speak up more often.[...] it's being aware of how your position in the classroom or in whatever room you're in, can affect how others communicate, and then being someone who can encourage those others to communicate, or vice versa. It's if you are not necessarily someone who likes to speak up, challenging yourself to get out there and speak up and ask those questions and share your opinion because it's*

a valid and valuable opinion that people should hear.

- Richard [WB] *[...] So I was kind of thinking like, equitable is like, you give your participation and you receive like output from other people,*
- Instructor *Knowledge from others, right?[...] Why is it important to have diverse people in different institutions or in different classrooms or in different jobs or as data scientists?*
- Moksh [IB] *So that represents the population. So that our values and stuff are represented.*
- Instructor *Yeah. Why?*
- Monica [BG] *Because like, people from different backgrounds carry like different experiences with them. So if you don't have one person's experience that may be representative of that person's group, then you're missing that kinda nuance and those kinds of things that could help your product or whatever you're doing, be more fair and equal for everybody else.*
- Sam [WB] *So, if your company or whatever is just made up of non-diverse people who all come from the same background then you're going to much easier fall into, perhaps, like group things. And just like not thinking critically about problems and stuff.*
- Instructor *Absolutely. And when we're in here--I mean, this is a space where we have a diverse group of individuals where we can learn a lot about each other and each other's cultures and each other's experiences [...] We all have different strengths. We are each other's human resources. I have a niche that I know and understand. You have a niche that you know and understand. Every single person does. And so we can capitalize on each other's knowledge to help make a better world, or make better products or whatever it is.*

The excerpt above shows that, as intended, the students themselves conceptualized the meaning of equitable and applied this understanding to the classroom learning environment by describing what it means in terms of student behaviors (e.g. Moksh explains that equitable participation translates to dominant students stepping back to let others have a voice). Their definition was consistent with my thinking and helped to establish that our diverse ways of participating often position some students on the outskirts of classroom discussions, requiring that space be made for those students to have their voices heard. I then used this as an opportunity for students to make arguments about why equitable participation is important, drawing on previous statements made by Richard and Monica about the importance of diverse perspectives in professional settings. This discussion served to redefine students' expectations for meaningful participation as evidenced by shifts in the ways that they talked about participating in classroom discussions and their ways of actually participating. That is, rather than place the responsibility to engage in

discussions on individual students as a means to evidence their intelligence or work ethic (typical of traditional classrooms), equitable participation can be argued as essential for the promotion of authentic and whole-group understanding from the standpoint that diverse perspectives give us a more well-rounded understanding of the topic at hand.

As anticipated, defining equitable participation also supported students in their ability to reflect on their own ways of participating and making space for others to participate in class discussions. In addition, it allowed them to identify classroom practices that they felt supported their ability to participate equitably. While the students identified several desired supports that included keeping the conversation friendly, allowing small group talk before having to speak out publicly in whole class discussions, and giving more wait time after prompts, the most salient of these for the quieter students (namely girls) was for the teacher to be explicit that there are *no experts* on the course content in the classroom.

Key Move #3: Decentering Expertise by Explicitizing “No Experts”

In the first few days of the course, I noticed that many of the girls hesitated to participate in class discussions, especially those that were heavily technical (e.g. Machine Learning labs) or that were centered around sociopolitical topics (White and Indian girls). When asked about their hesitations, the girls expressed that they (1) felt others knew more about the subject and thus preferred to listen, and (2) were fearful of being wrong in front of classmates and/or the teacher. As a result, I began to express some version of the following statements during our daily class discussions:

- *Data science is a relatively new and not yet well-defined field. Therefore no one, (including myself) is an expert on ethical data science.*
- *The purposes of our discussion are not to show how much we know, but to share our diversely educated opinions and experiences related to the effects of data science, so that we all can gain a more well-rounded understanding of the field and its potential impact.*

From the girls’ perspectives in the EDS course, this translated into a third key move: to make explicit that *no one in the class (including the teacher) is an expert about the subject of ethical data science*, which was expressed by Monica, the sole Black female student, during the Timed Writing activity:

Sometimes I think it's important to bring up in our conversations [...] that you don't always need to know about it [...] I think it would be beneficial for that reminder to be there that it's okay not to know, but also you can talk about it.

Monica’s comment seemed to resonate with the majority of the students in the course, especially

those who were hesitant to participate early on. Due to the observed power of this move, I continued to be explicit about the fact that no one in this class (including myself) is an expert in this field. The result of using this language seemed to have a significant impact on the quieter students' feelings of self-efficacy. That is, once I began to consistently highlight that there are no experts in the classroom, feelings of inferiority seemed to become less prominent for the girls in that they began to participate more often and more meaningfully. At the end of the course, Monica spoke to the impact of this move on her participation, stating that:

I participated a lot more in the EDS course than my typical math courses because it was a lot more open, welcoming, and fun to me because the students were part of the authority so it wasn't like a typical math class where everything that everyone did was only to seek validation from the teacher, but instead to actually learn, ask questions, and further our own understandings [...] The phrase we repeated so often, "no one is an expert in this field" helped me a lot because it meant that we were going to mess up and be incorrect but that was okay because it's not something we're supposed to come in knowing. I felt that I could contribute whatever idea that came to mind, no matter how foolish it seemed.

In sum, consistent use of the language that "no one in the classroom is an expert in this field" served to dismantle notions of others as more or less knowledgeable about the content and for the girls, was essential for reducing their feelings of vulnerability and to increase their feelings of belonging (Register & Stephan, 2023). In addition, it served to reduce pressure for students to showcase their competence in classroom discussions and instead, engage in meaningful academic discourse. As a result, we were able to treat classroom discussions as a brainstorming space as opposed to an intellectual showcase.

Effects of the Discursive Moves on Student Participation

The effects of the Timed Writing activity were observable in the days that followed. For instance, students who typically dominated classroom discussions stepped back for others to speak, and those who were often quiet, began to take up that space by offering their perspectives in class discussions. A notable example occurred in a Machine Learning lab on the following day. In this activity, we explored real world data on civilian gun ownership across the globe. Students were expected to develop statistically investigative questions that could be answered using the available data, then apply descriptive and predictive Machine Learning algorithms to answer those questions. Within this lab, I noticed that there was increased diversity in the number of students who contributed to the class discussion and that the students who were typically quiet in Machine Learning contexts (girls), noticeably stepped forward to have their voices heard. This was something that I had not observed in previous Machine Learning labs and other technical activities. In addition, sociopolitical discussions were much less dominated by a subgroup of students, as they were in the beginning of the course. Instead, the students seemed to

internalize the notion that our discussions were a brainstorming space as opposed to a stage to showcase knowledge.

A Note on Timing

I stated previously that the Timed Writing activity was designed and implemented on the spot to combat the inequitable participation patterns that I observed in class discussions, however, this was not the first time that we had discussed social norms for discourse. On day 1, I communicated my expectations for students' participation in class discussions but because the students were not a part of this conversation, their gendered and cultural ways of participating were not reflected in those expectations. In hindsight, I would have included the students as contributors and stakeholders of this discussion. With that being said, in our context, students were engaging with new ways of participating and learning, and thus, may not have been able to identify supports and constraints for equitable participation on the first day of class. So, while I would have facilitated the discussion on day 1 differently, the Timed Writing activity seemed to be effective on the third week because the students could speak to their needs and desired ways of participating now having experience with our specific classroom context (i.e. learning goals, teacher expectations, personalities, etc.). Therefore, it may be prudent for students to engage in this type of activity regularly throughout a course so that they can adapt their expectations according to their ever-changing needs and newfound ways of interacting with their peers.

Concluding Remarks

For many teachers, establishing an environment where students feel comfortable participating without prompting, and where they do so meaningfully and equitably, is difficult to enact in practice. For the learners in the EDS course, facilitating an environment where my students with diverse and intersecting identities were expected to participate according to their ways of knowing and learning (while also drawing on their personal experience and emotions), allowed them to develop a sense of belonging in that space. This required that we (1) co-establish the desired social norms for discourse, (2) collaboratively define equitable participation and why it is important, and (3) make explicit that there are no present experts on ethical data science in the EDS classroom environment.

Significantly, our collaborative framing of *equitable participation as a means to develop whole-group and authentic understanding* while promoting the fact that *no one in the class is an expert at ethical data science*, allowed us to develop a mutual understanding that their contributions, whether fully conceptualized or not, provide a unique perspective that can help us gain a more well-rounded understanding of the content. This helped to reduce nondominant students' feelings of vulnerability in class discussions. As an example, Aashvi [IF] expressed that our class emphasis on equitable participation and discourse, coupled with her perceptions that "*the teacher greatly valued the opinions of the students and encouraged them to express their feelings*," made

her feel that she was “*more responsible for learning things in depth and looking at different perspectives.*” This motivated her to participate more than in her typical math courses and “*would help [her] a lot in [her] future endeavors.*”

In sum, by facilitating a *hybridized learning environment*, my students' commitment to meaningfully and equitably participating in class discussions improved because it became tied to the benefits of understanding diverse perspectives. Importantly, these recommendations are not restricted to ethical data science settings. Rather, the described teacher moves can be adapted for a range of classroom contexts and are fruitful for encouraging equitable participation in classroom discussions.

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