# The Elephant in the (Physics Class)Room: Discussing Gender Inequality in Our Class

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## The Elephant in the (Physics Class)Room: Discussing Gender Inequality in Our Class



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iversity strengthens science,<sup>1</sup> but in most physics classrooms female students are disadvantaged both directly and indirectly: extensive research shows that they are undermined,<sup>2</sup> viewed as less capable,<sup>3,4</sup> and have less successful experiences both in terms of learning and identity formation.<sup>5</sup> The following article was written in partnership between a male high school physics teacher (Rifkin) and a female student from his 2018-2019 12th-grade physics class (Eickerman). In this article, which we wrote by reflecting separately and then combining our writings, we describe a twoweek period in which we worked together to try to change the culture of our physics class.

#### Student:

I've always been interested in science. The books that were read to me when I was younger included dinosaur encyclopedias and Bill Bryson's *A Short History of Nearly Everything*. These things make you wonder about how the world works. Questions of how the world works apply to everyone—no matter your gender, class, race, or sexual orientation.

Growing up and coming into middle and high school, I was told many cautionary tales of how science inevitably becomes male dominated. But it was easy for me to assume that those problems are gone—anybody can do anything. However, as experience went on, I realized there are caveats.

#### Teacher:

The ways in which physics education has been ineffective, unwelcoming, or toxic for many female students is deeply troubling to me. As a physics teacher, I know I have a significant role to play in upholding or undoing this; as a male teacher, I know I simultaneously have a great deal to learn and as much of a need to act. As a result, I chose to focus on how gender impacts my class and my students as part of a three-year selfstudy required by my school.

#### Student:

In my physics class, I experienced firsthand how being female can present a lot of small and large obstacles that add up quickly. These small obstacles are just annoying at first, but when you zoom out and look at the big picture, they lead to larger trends in science that are worrisome.

There are two things in particular that stick out to me from my experience. One prevalent experience was different confidence levels based on gender: "I'm not good at math" is thrown around often and, when I think about who has said that most, I have overwhelmingly heard it come from other females. It feels like males have more expertise somehow—it's just assumed. Their voices are louder, it feels like they are more likely to communicate their intentions to go into STEM fields, and they overall present an image of confidence. In contrast, among my female classmates, I know so many extremely intelligent people who love STEM but don't project it in the same way.

When it feels like you're surrounded by males who are confident in their success in math and females who are just as smart but not always as confident—even if these images aren't true—it can start to reinforce implicit biases.<sup>6</sup> When learning anything, a good mix of confidence and humility is a must. Because of the aforementioned implicit bias that males are good at math and females are not, and the ways that it is reinforced, male students tend to start out a little ahead on the confidence side and female students tend to be somewhere in between confident and doubting. Many female students are just as successful as their male counterparts, but when you're struggling in a class that can feel male dominated, it can be an uphill battle to feel as confident as you need to be.

The second experience was feeling discounted for being female—feeling like it took much more work for my female classmates and me to prove that we were not only OK at math and physics but good at it. In group work, there would often be times where the group would move at different paces, typically, it felt, with the males going through the questions more quickly. My male partners rarely asked me what I thought, and when I would make a mistake or have a question, it seemed like that only increased their assumption that they were the leaders in the group. Added to my own nervousness, this subtle exclusion kept me only doing the things I felt confident in, which is not how learning should go.

These issues can apply to anyone, regardless of gender any male student can feel hesitant and unconfident in math and physics classrooms or have their good work ignored. However, because we live in a culture where the larger prevailing message sets us up to hold a bias of surprise at females in science, this process penalizes female students all too often. These two things make it harder to learn in a classroom, which can discourage female students in physics quickly and easily.

#### Teacher:

As a male, I inevitably have blind spots when it comes to gender.<sup>7,8</sup> For example, I knew that the experiences of my male and female students were inevitably different, but knew that there were elements of those differences that I couldn't see. To learn more, I devised a survey I would administer to students at the middle and end of the year, that asked students yes/no questions (Fig. 1) about whether gender had impacted their experience in my class and then offered a chance to explain further with a narrative response. The survey was anonymous, but by asking students to identify their gender (including non-binary options), I could see whether students of different genders were having different experiences.

Among my 12th-grade physics students, across three years of biannual surveys, I saw the following results (Fig. 1) ( $n_{\rm f} = 123$ ,  $n_{\rm m} = 123^9$ ).

	Female	Male
Do you feel your gender has impacted your learning in this class?	24%	7%
Do you ever feel like your gender has impacted your participation in this class?	20%	10%
Do you ever feel like your gender has impacted the type of work you are asked to do in this class?	20%	6%
Do you ever feel like your gender has impacted the amount of work you are asked to do in this class?	20%	3%
Do you think your gender impacts how I treat you in this class?	9%	7%
Do you think your gender impacts how others treat you in this class?	35%	15%
Have you ever experienced a gender-based microaggressin in this class?	19%	3%

Fig. 1. Percentage of respondents answering "yes."

My female students are significantly more likely to say that their gender is affecting their experience than my male students. Student narrative responses suggested this impact is nearly always negative for female students, and a mix of negative and positive for male students. I wasn't surprised that my male and female students were having different experiences, but I was surprised by the degree to which they were. I didn't know exactly what to do with that knowledge, but did my best to name and challenge microaggressions<sup>10</sup> and to highlight the valuable contributions of my female students.<sup>11</sup>

This past year, though, the mid-year survey results were different from previous years' results to a degree that left me

	Year 1 and 2		Year 3	
	Female	Male	Female	Male
Do you feel your gender has impacted your learning in this class?	18%	7%	45%	0%
Do you ever feel like your gender has impacted your participation in this class?	17%	10%	45%	0%
Do you ever feel like your gender has impacted the type of work you are asked to do in this class?	14%	5%	27%	8%
Do you ever feel like your gender has impacted the amount of work you are asked to do in this class?	17%	4%	36%	0%
Do you think your gender impacts how I treat you in this class?	4%	7%	0%	0%
Do you think your gender impacts how others treat you in this class?	29%	14%	91%	17%
Have you ever experienced a gender-based microaggres- sion in this class?	13%	4%	45%	0%

Fig. 2. Percentage of respondents answering "yes."

flabbergasted (Fig. 2).

Again, the narrative responses from female students showed clearly that those students were feeling undermined by their male peers:

- "I felt like I was expected to take the reins as I'm supposed to be the 'organized one' while other group members showed significantly less effort."
- "Some of the guys in this class treat the girls like they are completely stupid."
- "I think that being a female puts me at a disadvantage in science group projects because guys often assume they are more knowledgeable especially on quantitative problems. This can cause their behavior to seem very condescending."
- "In some group projects, it felt like my ideas were more quickly dismissed than my male counterparts'."
- "If I am in a group project with guys and I am not understanding something, I feel not as willing to ask questions because I am afraid they will think I am dumber than them and then will have evidence for their theory that girls are worse at math and science."
- "Sometimes male group mates don't listen to my opinions. I don't know if that is because I am female but I think a part of it has to do with that."
- "I have had so many things that I fully understand explained to me by some of the guys in the class . . . in ways that are incredibly condescending."

I don't know what caused this past year's results to be so different than previous ones', but frankly the reason didn't matter: regardless of the cause, I wanted to address and heal the contrasting problems of my female students feeling undermined and my male students remaining unaware. Research by Hazari et al.<sup>5,12</sup> gave me confidence that talking explicitly about inequality was a powerful way to undo it, and so I resolved to share this data with my students in our next class.

#### Student:

This data blew us away. The first numbers that jumped out to me were the 0% and 0% for "Do you think your gender impacts how I treat you in this class?" I had easy answers for why this was, the most prevalent being Moses grading our tests by assigned code numbers instead of our names, in order to remove possibilities of implicit bias.<sup>4</sup>

The next thing that I noticed was the difference between genders on the questions "Do you ever feel like your gender has impacted the type of work you are asked to do in this class?" and "Do you ever feel like your gender has impacted the amount of work you are asked to do in this class?" This was not surprising to When we discussed the Gender in our Class data, several folks wanted to learn more about microaggressions. I asked everyone to write any they'd experienced on the back of an index card. Answers are presented here.

#### As you read, ask yourself: Have I ever been a part of any of these? How did I feel in the moment? How might the other person have felt? What could I have done to make our class a more inclusive place?

- Male classsmates felt I was less capable of doing math problems.
- Suggestions for me to do the easy work.
- Not explicitly but I am aware of trying not to seem too "bossy" or threatening in group projects.
- Being told: "Your sarcasm and big personality are emasculating."
- Small things like ignoring my contributions or answering a small question as if I don't understand anything at all.
- My male partner didn't ask me a question when he had a question but rather found multiple other males in other groups to ask the question to.
- During a group project one of my male peers re-wrote my exact calculations.
- Being told: "Smile."

Fig. 3. Activity #1.

me at all. After physics classes, in the hall on the way to our next class, my female peers and I would talk all the time about how we were asked to write out the poster titles or write the discussion wrap-ups. The group work common in our class is something that all of us benefit from, but it allows these imbalances to happen so easily that it ends up feeling rare to have a great, evenly split, not-at-all-frustrating experience. These imbalances are so common you become used to them. The differences in "Do you think your gender impacts how others treat you in this class?" fits this trend as well-the number that should be shocking feels expected.

The last data point that really got me thinking was "Do you feel your gender has impacted your learning in this class?" This was one that highlighted just how many instances of 0% there were on the male side of the survey. Even reading this data again now, this is something that makes me feel so frustrated. 0% is what all of these columns should say, but it seems like in this data, in the year where the females are saying yes more often, the males are saying yes less often. How can the two sides be so divided? There had to be a way to reduce these percentages.

#### Teacher:

Sharing the data took about 10 minutes of class time. It was clear that it got their attention, and I remember discomfort from some of my male students. I asked my students to reflect through anonymous writing (like the survey, I asked for their gender)—What surprised you? What do you want to know more about?---and for students who wanted to help me plan next steps to stay after class.

- Being ignored in a project.
- When I ask the same question as boys and get the feeling that I'm reinforcing the stereotype of females being bad at science.
- Being told: "guys are better at this so you should do this (other thing)".
- Mansplaining.
- Ignoring female group members.
- Once it was a group of four people, two males and two females (me being one of the females). One of the guys said to the other male, "I guess we're going to have to do all the work by ourselves." I never talked to either of the students before we were assigned the work. I don't know if it was because of our gender or who they thought we were, but they basically pointed out that they thought we were stupid.

#### Student:

In the post-class meeting there were four of us, all girls, who all just felt like the conversation could go on forever. We were all frustrated, and all passionate about using this data to its full extent. I remember just wanting people to understand. We all wanted to take advantage of people's desires to learn more about this topic, seeing as it was something that the four of us had been talking about outside of class. After talking about what the data meant to us, we brainstormed how these various issues could be made relatable to our class.

#### **Teacher:**

When I looked at their anonymous writing, the boys were full of questions. "What are some examples of microaggressions?" "What's it like to be female in physics?" "Am I part of the problem?" I had feared that they'd withdraw or be resistant, but I was excited to see this engagement. I shared this with the four female students, and we brainstormed different ideas for what we could do next. Their commitment to creating open dialogue and helping others to learn was inspiring. Collectively we designed two activities to continue building on this beginning.

In the first, I simply projected the anonymous responses from students to the narrative survey prompt "Describe a gender microaggression you have experienced in this class" (Fig. 3), and gave students a chance to reflect quietly. It took approximately five minutes of class time.

To support my male students, I shared with them some things I'd learned from Robin DiAngelo's writing about whiteness<sup>13</sup>: that we are not to blame for having blind spots, that gender socialization hurts us all, that not being aware

### **Spectrum Activity**

A way to learn about the experiences of people who are different from you

With thanks to the students who stuck around after class to help plan this

#### Fig. 4. Activity #2 Introduction.

Have you ever felt disrespected?	
Have you ever felt excluded?	
Have you ever felt excluded because of assumptions someone made about you?	
Have you ever felt excluded in this class?	
Have you ever felt excluded in this class because of your gende	er?

Instructions

A question will appear on the screen.

answer questions from the No side.

Move to the back of the room if your answer is "Yes."

Move to the front of the room if your answer is "No."

Students who said Yes will have a chance to share and

Fig. 5. Activity #2 Questions.

is one way those of us who "benefit" from gender privilege get harmed, that we can learn about the things we do not yet know, and that we must do so. I write "we" and "us" here because, as a male teacher, I am both speaking from my own experience learning about my impact on people around me and simultaneously trying to model for my students with privileged identities an orientation of humility and eagerness. I also reminded them of the curiosity and openness they had expressed earlier in their post-data reflections.

Knowledge and awareness are powerful, but I also wanted my students to have opportunities not only to reflect but to take collective action. Several days later, we engaged in an activity designed to help students share their experiences, learn from those whose experiences were different from theirs, and create a more inclusive classroom culture.

#### Student:

For the second activity the idea we ended up liking most came from Moses. By doing a spectrum activity, we could visually show how different students had different experiences. By starting with questions that everyone could relate to, everyone would be involved from the start and the male students would feel included and heard. As we went on, though, we female students would have a chance to inform the male students about how things are different for us, and how those feelings come from simply being female. We were all excited for that next class to reflect our ideas to make it most effective for our classmates.

#### Teacher:

Building on the spectrum activity described in Daane et al.,<sup>14</sup> our second activity asked students to position themselves in the room based on whether they had experienced what was on the screen or not (Fig. 4). I introduced the activity by reminding students of a theme in my physics class—that listening to how other people understand something can help you understand it better yourself—and we began, with students moving

left or right as a series of statements appeared on the screen (Fig. 5).

As my coauthor described, this series was meant to help my male students better understand the experience of my female students. Starting with statements that were universal allowed every student to see how exclusion touches them all, and to remember how bad that exclusion can feel. As all students shared and listened, there was a sense of shared experience.

As we transitioned towards questions that highlighted gender exclusion in our class, though, the shift was unmistakable: increasingly, female students were answering "yes" and male students were not. Sharing personal stories about exclusion and seeing oneself as the agent of that exclusion both take courage and vulnerability, and one of this activity's strengths is how it shows all students that they are not alone. By the end of the activity, my female students were speaking powerfully about their experiences and my male students were listening intently and asking questions to learn more. This experience took approximately 15 minutes of class time but accomplished (I felt) my goal of giving female students a venue to talk about gender bias in my class, male students a chance to learn about their role in this, and for everyone to talk about how to make the classroom culture a better one.

#### Student:

This activity lent itself well to this topic. On the whole, everybody was very receptive. I think the bluntness of the data presented about our class previously had really shocked people into believing this was important. Everybody shared experiences willingly and respectfully. I was able to think more about what it would be like to be male in science and how that would change the experience of learning—feeling a pressure to do harder things and not feeling as able to express confusion. I also felt very able to share, along with my female classmates, what our experiences were like. Everyone was curious, and this activity opened up conversations after class that continued to be engaging and enlightening.

After these classes, I would say that there was a change. Big changes happen over time, so of course nothing became perfect, but people seemed to be more aware of their actions and there was less tension, because we had all talked about what we were experiencing.

#### **Teacher:**

In just 30 minutes over three class periods, my students had a sustained conversation about gender bias in our class. I believe this benefited my female students by naming their exclusion and supporting steps to reduce it, and I believe it benefited my male students by helping them to see the ways in which they were inadvertently contributing to a culture of inequality and motivating them to want to make change. Resources exist to help students talk about bias in physics culture as a whole,<sup>15,16</sup> but talking about it as it exists in our own classes is an even more powerful step towards removing it. At the very same time that I am trying to introduce these students to physics content, I am trying to help them learn how to create equitable communities. To not talk about systemic injustice is to tacitly endorse it,<sup>17</sup> but explicitly addressing bias and inequality in our own classes is one step that teachers can take to transform the experience of our students and, ultimately, the culture of physics. Olivia and I present our experiences as one way to do this—starting with a simple survey to better understand students' experiences, sharing the data to launch a discussion, centering the experiences of marginalized students, and asking students to find next steps to take to improve our classroom culture—and we encourage readers to find solutions that work for them. Readers interested in starting as we did can find a copy of the survey we used at https://tinyurl.com/EickermanRifkin.

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