

TAKING RESPONSIBILITY FOR EQUITY IN PHYSICS THROUGH PHYSICS EDUCATION RESEARCH

BY LINDSAY MAINHOOD



Objective, experimental, and scientifically pure. These are words that conventionally define the field of physics as it aims to find answers to our questions about the natural world. In current conversations (though they have been used for many decades) different words are being used to describe physics as a field of study and work: unfriendly, inequitable, and homogenous, to name a few.

A PARADOX

It seems a most interesting paradox that a field upheld by principles of impartiality is itself a rather extreme example of partiality as a community. It begs the question: *why* does physics not represent equity, diversity, and inclusion (EDI)? This is a particularly intriguing question in light of other scientific fields, similarly characterized by homogenous communities in the past, which have become increasingly diverse.

In this paper, I assert that one of the responsibilities of the physics field is equity, just as it is the responsibility of the physics field to exercise rigorous scientific methods. I discuss whether and how physics ought to take responsibility for equity; however, I preface the discussion by offering a response to the question I posed above: why does physics not represent EDI?

Importantly, this opinion article is but one response to this question, aiming to stimulate critical thinking about equity amongst the physics community (physicists, physics educators, and students of all levels). It is perhaps especially

intended for those who have not yet decided how to think about their own responsibility for equity in physics. The article is inspired by recent conversations I have had with five international experts on gender equity in physics education research, who I interviewed as part of my PhD research, and from whom I have been grateful to learn.

WHY IS PHYSICS NOT REPRESENTED BY EDI?

From the experts on equity in physics, I gained insight on the early development of physics as a scientific field — a clue to why physics is currently failing to represent EDI. Experts spoke of the physics field as a social institution in the western context that is fundamentally non-inclusive and inequitable because it was developed by a very homogenous and exclusive group of people who were mostly white men. Using women's exclusion from the development of physics as an example, one of the experts explained: "Women were never part of defining the field, [or] what it means to be a physicist...all of those things are fundamentally inequitable and non-inclusive." They described the field of physics as one that became a "neutral, objective, rationalist kind of area, which were not the same traits people had been associating with women." The historical social dissociation of women from physics, or any person who represents an alternative to the traditional representation of a physicist, is a pattern that endures today and continues to exclude people. But why have these outdated norms continued in physics when other scientific disciplines have progressed?

The socio-historic aspects of the field of physics inform its attitudes, beliefs, and practices. These components make up its culture — the nature of which was exemplified to me when one of the experts said, "physics itself sometimes feels like an unfriendly place." This is an indication of the preservation of physics' socio-historic norms that reinforce a culture non-representative of EDI. What the experts on equity in physics observe to be sustaining this culture is a lack of care and motivation among the physics community for equity in physics: "A lot of people actually don't care, and they only care enough to make it seem like they care because, politically, you can't *not* care

SUMMARY

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now.” They also note the trend among the physics community to look for superficial solutions, for example: gender equity being addressed by physics educators hosting female guest speakers, discussing famous female physicists, or using more stereotypically female examples in problems.

I acknowledge that there are members of the physics community who make genuine efforts to be equitable and inclusive, who may have used such practices as part of that genuine effort. I also recognize that the physics community must be willing and must have access to practical and evidence-based recommendations for increasing EDI in teaching, supervision, and research. However, based on my conversations with the experts (and later with Canadian physics education researchers for another part of my PhD research), it seems both the physics community’s willingness and access to using evidence-based recommendations are minimal, and could be inhibiting EDI progress.

One contributing factor was explained to me by one of the experts and is related to the fact that recommendations typically come from physics education research (PER). PER is a relatively young field focused on physics teaching, issues of student understanding, and more recently, affective experiences students have in physics, including those related to EDI. The challenge is, as one expert said, “physics education is in a weird place where we [physics education researchers] are fighting to be seen as competent professionals by physicists.” Physics’ resistance toward PER may be hindering the physics community from taking responsibility for and ultimately becoming representative of EDI. Later, I discuss how the physics community can take responsibility for equity through PER. First, I present reasons why doing so is important.

WHY SHOULD PHYSICS TAKE RESPONSIBILITY FOR EQUITY?

In a recent American Association of Physics Teachers webinar panel on making physics inclusive and equitable, one of the panelists recommended people in the physics community do the following: “Find a reason for caring about EDI, otherwise it will not happen because you won’t do the work.” This statement struck me with its truth; unless a sense of care or responsibility is felt for the issues, it’s likely little or no investment will be made to address them. I suggest five reasons why those in the physics community ought to care about equity. I hope they encourage individual sense of care for EDI in physics in order to “do the work” that is necessary.

1. EDI in physics can be no one else’s responsibility but the physics community’s. Physicists play a critical role in the prioritization of EDI because they are at the top of the hierarchy of power and influence in their field. They affect: (a) the field’s cultural norms, which permeate wider societal representations of the field; (b) the field’s pursuits and outcomes in terms of research and knowledge production; and (c) activities of the field such as physics education and community outreach.

2. EDI commitment allows for the possibility of redefining the physics field by attracting a new, diverse generation of physicists who can (a) be prepared in light of what current physicists see as important, and (b) define what is valuable to the physics community in new ways. The field has an opportunity to reimagine what physics is, who physicists are, and what pathways are available to and from physics — all in service of preparing future physicists to achieve various purposes.

3. EDI in physics is a matter of social justice. One expert on equity in physics explained that equity is about giving people equal access to the discipline. It is “a social justice issue... allowing more people to enter this discipline both in terms of them getting access to high-status knowledge and high-status professions.”

4. Neglecting EDI thwarts physics’ and individual people’s capacities for being global leaders. Contrary to the belief that focusing efforts on EDI would come at the expense of disciplinary excellence, the inclusion of diverse perspectives can enhance excellence by broadening horizons in the field and increasing the capacity for innovation.

5. “The fact that harassment is pervasive, persistent, and pernicious.” One expert explained that physics epitomizes inequity when people experience harassment. Eliminating harm done to people in physics and associated negative environments is an obvious and compelling reason for the physics community to take responsibility for EDI.

HOW SHOULD PHYSICS TAKE RESPONSIBILITY FOR EQUITY?

These suggestions represent current conversations happening around equity in physics as they are based on my discussions with international experts. Most of the experts position themselves in the PER field, where much of the physics-specific EDI work is occurring. Therefore, the suggestions describe how the physics community ought to take responsibility for equity through PER.

1. Physicists: Engage with PER. Because of physicists’ influence and positions of power in physics, including defining physics education, the first way that the physics community can take responsibility for equity in physics is by engaging in PER. Experts reported the need to engage physicists in PER because they play an important role in improving physics education, which is the vehicle for people entering the physics community. PER is the bridge connecting physicists and education researchers, which is useful for helping each understand and fully benefit from one another’s expertise.

2. Focus PER-based EDI efforts on all levels of physics education. PER should not only be conducted at the post-secondary level of education, where physicists work, but simultaneously at all levels of physics education from university to elementary grades. The experts say this is crucial for

creating systemic change because the issues of EDI in physics education do not begin in university; rather, they begin at the earliest levels of schooling and include socialization mechanisms outside of school.

3. **Mobilize students as drivers of change.** Experts said a key part of taking responsibility for equity in physics involves enabling physics students to help drive the changes necessary for the field to represent EDI. One expert explained that students are the least enculturated members of the physics community and therefore they see issues that faculty and even researchers may not. “Traditionally speaking, the culture is set by the people at the top, but I think the disruption will come from the bottom,” the expert said. Illustrating the power students have in numbers rather than influence, the expert believes change “is going to be driven from the bottom because [students] outnumber the top, thousands to one.” Mobilizing students enables them to change what is not working for them and what they can clearly see does not align with their wider world that demands EDI. The physics community can mobilize students by providing them with physics education experiences that turn the traditional power structures upside-down: learning with their peers in an active, communal environment that is less individualistic, less competitive, and not lecture-based. The physics community can also engage students in PER, which is beneficial for both their engagement in current issues in physics education and PER’s further development from students’ novel insights.

CONCLUSION

International experts on equity in physics say that EDI is a matter of social justice, and the continued neglect of EDI only thwarts the physics field’s and individuals’ capacities, and fails to mitigate negative environments in which harassment occurs. Commitment to EDI allows for the possibility of redefining the field of physics to not only be more equitable, inclusive, and diverse, but also more globally innovative and successful. Physicists play a crucial role in defining EDI standards in the field. Three ways that physicists and other members of the physics community can take responsibility for equity include: engaging with PER, focusing PER-based EDI efforts on all levels of physics education, and mobilizing students to help drive the change toward greater EDI in physics. I encourage readers to consider how each of us has a personal responsibility for EDI, and find a reason to care about EDI in physics — this is the first step in doing the necessary work to achieve an equitable, diverse, and inclusive physics field.

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