2022 PHYSICS EDUCATION RESEARCH CONFERENCE

Grand Rapids, Michigan    July 13-14, 2022

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2022 Physics Education Research Conference

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Preface

The 2022 Physics Education Research Conference (PERC) continued the community’s critical work that “breaks down social constructions and hierarchies to unpack normalized assumptions” with this year’s theme: **PERQ 2022: Queering Physics Education.** This theme was designed to encourage dialog and explorations of how various social constructions affect the lived experiences of those who engage with our discipline in a variety of ways.

This year, the PERC returned to an in-person format with virtual options for participants. In this late-pandemic stage, it is impossible to overstate the efforts of the organizing team, which included Madison Fitzgerald-Russell, Brianne Gutmann, Kelby T. Hahn, Alia Hamdan, Sara Mueller, Yasmeen Musthafa, Ben Pollard, Xandria Quichocho, and Mike Vignal, who worked to create a meaningful conference experience and a deliberate, inclusive environment for all participants. The committee was supported in their efforts by leadership from both the American Association of Physics Teachers (AAPT) and the PER Leadership and Organization Council (PERLOC).

Plenary speakers included Kari Dockendorff, Shanna Katz Kattari, Luis A. Leyva, Taylor McNeill, Nicolette D. Mitchell, and Gary D. White. The conference also hosted a variety of workshops, symposia, collaboration spaces, dine-n-discuss events, and a fundraiser for the LGBTQ+ community, in addition to the PERC poster sessions.

The 2022 PERC Proceedings process would not be possible without the ongoing support of Lyle Barbato, who works closely with the editors each year. The continued sponsorship of AAPT and open-access publishing through ComPADRE have allowed the PERC Proceedings to improve each year, including maintaining the double-confidential review process and continue the development of a robust and dedicated online platform for proceedings management.

However, it is the reviewers who volunteer their time and expertise each year who are critical to the PERC Proceedings success. The editors sincerely thank all of those who participated in the review process and strengthen our research community: Fatima Abdurrahman, Mark Akubo, Anne Alesandrini, Camila Amaral, Austin Anderson, Katherine Crimmins, Tim Atherton, Leslie A. Elliot, Ramon Barthelemy, Lauren Bauman, Ridge Bennett, Simon Bland, Victoria Borish, Jesus Botello, Theodore Bott, Andrew Boudreaux, Eric Brewe, Bill Bridges, Mary Brundage, Eric Burkholder, Danny Caballero, Jennifer Campbell, Bianca Cervantes, Sanjay Chandrasekharan, Aamir Sahil Chandroth, Jessica Changstrom, Jacquelyn Chini, Elaine Christman, Eleanor Close, Camille Coffie, Joel Corbo, Giaco Corsiglia, Colleen Countryman, Karen Cummings, Sonja Cwik, Robert Dalka, Ian Descamps, Matthew Dew, Lin Ding, Daniel Doucette, Helge Drange, Philip Eaton, Shams El-Adawy, Andrew Elby, Paul Emigh, Tatiana Erulkhimova, Elias Euler, Forouzan Faridian, Thomas Fitts, Mark Flores, Shanize Forte, Michael Fox, Claudia Fracchiolla, Maxwell Franklin, Andy Fung, Rebeckah Fussell, Terrie Galanti, Tyler Garcia, Jon Geiger, Isabella Gennuso, Vegard Gjerde, Anthony Gobernatz, Lisa Goodhew, Ezra Gouvea, Brian Gravel, Kara Gray, Tone Gregers, Molly Griston, Matthew Guthrie, Brianne Gutmann,
By continuing to honor the PERC Proceedings tradition of welcoming new members in the field to publish their research alongside known scholars, it is our hope that the Proceedings can contribute in some small way to the goal of inclusivity and the value in hearing the voices of all stakeholders that are so clearly laid out in this year’s theme.

Dyan L. Jones
The theme and goal of PERC 2022 (affectionately also called PERQ) was "queering physics education" through engaging in queer learning practices using an intersectional lens. By "queering," we are centering queer theory, which breaks down social constructions and hierarchies in order to challenge normalized societal assumptions and existing cultural systems. Queer theory is a branch of critical theory that seeks to understand and deconstruct hierarchies and systems of oppression, especially those regarding traditional norms regarding gender and sexual orientation.¹

In the context of physics education, we want to apply critical queer educational theory to unpack who holds the power in physics to not only train future physicists, but also teach them about the historically toxic and oppressive culture of physics. We want to acknowledge that although PER often aims to deviate away from these structures, the field also embeds binaries in both its content and sociological research. During this conference we aimed to engage with these statements as a critique of the field and a way forward towards imaging a queer future for PER.

To us, queering physics education means doing the work of deconstructing traditional notions of what it means to study, learn, teach, and do physics. Many of us, as organizers, are physics education researchers who have found queer theory to be particularly useful in our own work, both from an academic standpoint and from a more human, empathy-centered place. We aimed to center social constructions that have been historically marginalized in the field—race, (dis)ability, gender, sexuality—and how these interact and impact the lived experiences of everyone who comes through a classroom door. For us, queer theory is not only understanding LGBTQ+ history, culture, and identity from a theoretical standpoint, but a reminder to stay connected to the communities and people that we do this work for.

To this end, the PERC 2022 organizers made it a point to reach out to local Grand Rapids queer groups, queer community organizers, and queer theory experts to allow conference attendees to engage in queering PER wherever they were at in their journey of understanding of queer theory. We explicitly built an interactive plenary activity that bridged AAPT and PERC by connecting physics educators with queer theorists to demonstrate how queer theory can inform a physics classroom.

Further, we believe that transparency and accountability are critical for queering PER and so we wrote and routinely updated a transparency document that outlined our thinking and decision making with invitations for feedback. And because building community was another priority of ours, we had a lot of fun organizing and participating in the conference, including producing a

¹ We also want to acknowledge that the term "queer" has had a long and complicated history and has only recently been reclaimed by the LGBTQ+ community, both as an identity and as a lens through which to understand a little more about the queer community.
zine and hosting a sober variety show with Joule’s Molly House—allowing many physicists their first experience at a drag show! At a physics conference!

During and after the conference, we heard participants appreciate our efforts to engage the local community and do things a little differently from as the first conference back in person since the COVID-19 pandemic began in 2020.

Organizers:
Madison Fitzgerald-Russell (she/they), Western Michigan University
Brianne Gutmann (she/her), San José State University
Kelby T. Hahn (they/she), Oregon State University
Alia Hamdan (she/her), University of Arizona
Sara Mueller (she/they), Brown University
Yasmeen Musthafa (they/them), TAE Technologies
Ben Pollard (he/him), Worcester Polytechnic Institute
Xandria Quichocho (they/he), Michigan State University
Mike Vignal (he/him), University of Colorado - Boulder

Acknowledgments

The PERC 2022 organizers deeply appreciate everyone who worked to make this conference successful, including:


Session Organizers and Moderators: Benjamin Pollard, Raymond Zich, Xandria Quichocho, the PER Early Career group (Katie Ansell, Rachel Henderson, and Kelby T. Hahn), Elias Euler, Timothy Atherton, Rebecca Lindell, Josephine Meyer, Tor Ole Odden, Sara Mueller, and Brianne Gutmann

Michigan queer groups:
Joule’s Molly House
OutFront Kalamazoo
Grand Rapids Pride Center

AAPT staff: Lyle Barbato, Cerena Cantrell, Tiffany Hayes, and Jamar Jennings

PERLOC Liaisons: Rebecca Rosenblatt and Raymond Zich

PERC Proceedings Editors and Staff: Dyan Jones, Qing Ryan, and Brian Frank

Financial support from PERLOC and AAPT
We’d also like to thank all of the PERC 2022 attendees who came (in-person or virtually) to the conference and engaged with a challenging subject with openness and grace.
# At-a-glance Schedule

**Wednesday, July 13th, 2022**

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<td><strong>Living within the Intersections</strong></td>
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- Navigating privilege & constraints in early career positions  
- Physics education research in the Nordic Countries  
- Benefits of Solo PER & strategies to encourage and support it: a roundtable discussion  
- Queering Computation |
| 9:30-11:00 am | Poster II | Presenters with odd-numbered posters will present during the first 40 minutes. Following a 5 minute transition period, presenters with even-numbered posters will present during the last 40 minutes. |
| 11:00-12:30 pm | Parallel III | - Mini Book Club  
- Machine learning methods in PER: intuition & methodological discussion  
- Queerness in STEM education: perspectives from early career scholars  
- Help! I'm at a Primarily Undergraduate Institution: how do I include undergraduate research students into my research?  
- Contributed Posters Focus: Learning Quantum |
| 12:30-1:15 pm | Plenary | Plenary III: Quarks are a bit queer: Rethinking known truths from a queer mindset |
| 1:15-1:45 pm | Lunch | Get a plate from the buffet in the Ambassador Ballroom, take it to eat wherever you are comfortable. Return the plate to the Ambassador Ballroom area. |
| 1:45-3:15 pm | Poster III | Presenters with odd-numbered posters will present during the first 40 minutes. Following a 5 minute transition period, presenters with even-numbered posters will present during the last 40 minutes. |
| 3:15-4:00 pm | Closing Plenary | Plenary IV: “We can’t just turn that off and then do some physics”: A counter-storytelling analysis of introductory physics as a white, cisgender/patriarchal space |
Introduction

Papers published in the 2022 Physics Education Research Conference Proceedings consists entirely of peer-reviewed papers, including two plenary papers.

The peer-reviewed papers are written products of any presentation including the juried talks, parallel sessions, and poster sessions. Each paper undergoes a rigorous peer review process in order to be published in the Proceedings. This year saw 112 submitted manuscripts, of which 84 were accepted for final publication.

The readership of the Physics Education Research Conference Proceedings includes faculty, post-doctoral associates, and graduate and undergraduate students in physics education; scholars in other discipline-based science education or closely related fields, such as cognitive science; practitioners in physics or other sciences, such as teaching faculty at undergraduate and graduate levels, and high school physics teachers.