

## Considerations for Collecting Racial Demographics Data in Physics Education Research

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This paper responds to recent calls in PER to expand demographic data collection, by providing a synthesis of some recommendations from leaders inside and outside of the field. Questioning objectivity in quantitative data, mitigating systemic erasure, and subverting deficit narratives are vital to conducting demographic research for liberatory purposes.

## I. INTRODUCTION

In 2020, Kanim and Cid [1] sought to answer the question, “Whom have we been studying when we say we are studying physics students?” Their analysis of the sample of physics education research (PER) subjects suggests that, among other things, PER has oversampled from white, wealthy student populations, limiting the generalizability of research findings and constructing a skewed, racialized and classed “norm” against which all physics students are measured. Further, they report that explicit demographic descriptions of research subjects in PER papers is rare. They call on researchers to characterize the student populations they are studying, in order to (1) understand the limits of the generalizability of results and (2) work toward diversifying samples such that more students are represented in characterizations of “physics students.”

A number of physics education researchers have heeded Kanim and Cid’s call to make explicit the demographics of their sample. For example, some have connected racism to reported differences in performance and attitudes (e.g., [2,3]). In this paper, we build from Kanim and Cid’s work to problematize the very categories we use to characterize race in demographic data collection, and synthesize research from PER, Critical Race Theory, and public health into a series of recommendations that respond to the problematics of these categories.

The consequences of failing to question demographic categories cannot be understated [4–6]. For example, Dockendorff states that when institutions do not build forms and surveys that capture diverse gender identities, instead collecting “sex-assigned-at-birth,” this practice erases trans students’ existence in that university [7]. Though in this paper we focus on race, we occasionally point to research that problematizes demographic categories along axes of gender, sexuality, and disability (e.g., [8–11]), noting the importance of intersectionality in our considerations of research that seeks to understand the impact of oppression [12–14].

We anchor our critique of racial and ethnic demographic categories, and their use in statistical analyses, in the white supremacist and eugenicist origins of racial statistics [15–18]. Early statistical logic was motivated by an ongoing need to justify racial stratification—or differential social outcomes by race—in a post-emancipation United States. This shifting social context required new tools that would support the continuation of structural oppression, and statistical methods, which seek to measure and characterize difference, were just such tools. For example, Goar recounts a series of interpretations of descriptive statistics by Ferguson, who used measurements of IQ and performance in school, differentiated by racial categories, to argue that “the color of the skin and the crookedness of the hair are only outward signs of many far deeper differences,

including...temperament, disposition, character, instincts, customs, emotional traits” [16].

Our point in briefly recounting this history is to make apparent that not only has racism shaped our *use* of statistics and the kinds of inferences we have made, but also that racism has shaped the *tools* we use for analyzing and understanding the social world. Conventional present-day racial classifications reflect essentialist interpretations of race as “unalterable characteristics of individuals” [17]—race as a biological *reality*—rather than a conceptualization of race as a social construct mediated by white supremacy. These categories bear the marks of early classification schemes, which sought to subdivide humans according to morphological traits and then to rank those subdivisions hierarchically, as part of the ongoing legacy of colonization-era justifications for the enslavement of Africans and Indigenous genocide and dispossession of land [19]. Not only do such categories “naturaliz[e] particular [biological and essentialist] understandings of race” [18] but they also bolster inappropriate causal inferences that treat *race*—rather than *racism*—as a cause of disparate educational and societal outcomes [17]. This interpretation of statistical results is reflected in much present-day research on educational “gaps,” especially in STEM education. For example, discussions of the achievement gap, school “dropouts,” and failing schools often leverage statistics to “prove” a culture of poverty among Students of Color and their families [20–23].

In spite of its origins, critical scholars have argued that researchers can reject the “white logic and white methods” [24] of social statistics and instead use statistics toward liberatory ends. This possibility is illustrated in the pioneering sociological research of Du Bois, who demonstrated that statistical analyses could disrupt racist data narratives to center a more critical narrative of Black life in the U.S. [17]. In particular, Du Bois used statistical and comparative data to challenge deficit analyses of Black Americans, offering imagery of a vibrant Black community and a sociological analysis that pointed to structural racism, not biological differences, as the source of poverty, crime, and illiteracy.

Present-day scholars have built on the work of Du Bois to formulate frameworks for analyzing quantitative data toward liberatory ends, such as Quantitative Critical Race Theory (QuantCrit) [26–29]. QuantCrit draws from a number of tenets, among them the acknowledgment that (a) numbers are not neutral and should be interrogated for the ways in which they have promoted deficit analyses that serve white supremacy, and that (b) categories are neither natural nor given and so should be critically evaluated. QuantCrit seeks to advance the use of statistical analyses for social and racial justice, as the papers we cite above do, and as we seek to do in this paper. We draw on existing work in PER, our team’s expertise in Critical Race Theory, and the first author’s experience as a (former) epidemiologist at a

Tribal Epidemiology Center, during her time in the non-profit sector in public health. As part of that work, she was trained to use Indigenous frameworks of analysis [30,31] for large data sets including demographic variables, and she has since transitioned that knowledge to using grounded, strengths-based approaches in lived contexts for her current research as a medical student, and to her work on interdisciplinary teams.

## II. RECOMMENDATIONS

### A. Do not treat demographic research/datasets as objective truth

Zuberi [15], in recounting the historical development of social statistics (above), is careful to reiterate that race, as a category, was socially constructed to justify enslavement and genocide; it is not a biological reality. However, essentialist interpretations that treat race as a categorical fact are re-entrenched by positivist framings that underlie the scientific endeavor, where quantitative science (including social statistics) is treated as the most appropriate means by which to understand the “truths” of the (social) world [26].

Critical scholars and activists challenge essentialist interpretations of racial classification, arguing that the racial classification of Black, Latinx (sometimes labeled “Hispanic”), Asian, and Indigenous populations is political [32,33]. Not only do these categories essentialize race—through the use of pan-ethnic labels (e.g., Hispanic)—they also *support* racism through deficit-oriented narratives that treat race, rather than racism, as the prevailing cause of a variety of inequities. This strengthens causal arguments that attribute educational outcomes (e.g., test scores), for example, to “people” (e.g., Latinx physics students), rather than to structural conditions (e.g., biased testing). Research that uses, and fails to problematize, essentializing categories has served a variety of exclusionary actions. For example, Arab immigrants could seek racial classification as “white,” while immigrants from other regions were not permitted to do so and denied entry to the U.S. [34].

Because of their nature as a social construction, demographic categories do not represent “objective” information. We can design data categories that are more inclusive, but they are not free from bias. QuantCrit [26–29] argues for the importance of contextualizing quantitative findings in the experiential knowledge of racialized groups. The numbers do not “speak for themselves,” and, when decontextualized from the ongoing legacies of racism, “quantitative analysis will tend to remake and legitimate existing race inequalities” [26].

### B. Build data categories that avoid systematic data erasure for groups

QuantCrit challenges us to consider the ways in which data and statistical computations inadvertently contribute to

the erasure of minoritized groups in research. This can occur through collecting data without the appropriate ability to disaggregate large categories into more granular information, using survey tools without diverse options for response, or not attempting to collect demographic data at all [35]. Kanim and Cid [1] recommend reframing discussions about race and privilege, arguing that not reporting demographic data—and then treating the skewed PER sample as reflecting “normal” physics students—both erases the presence of non-white students and implies that such students are not normal. They recommend not only reporting the demographics of the data that we collect but also intentionally oversampling from minoritized racial groups, so as to construct a more representative sample that includes all students.

Research in the public health sector offers some insight and recommendations about the construction of racial demographic categories that can mitigate the tendency of mainstream statistical research to erase minoritized groups. Data on COVID-19 infection rates for American Indian/Alaskan Native (AIAN) populations in the pandemic is a potent example of systemic erasure: surveillance inconsistently recorded race/ethnicity, included categories like “other” and “multi-race” that do not allow for disaggregation, and sometimes asserted that numbers were too small for appropriate statistical analysis, contributing to “systemic and repeated attempts at elimination” [6]. Historically, when populations are deemed too small to meet the minimum criteria for statistical significance, instead of engaging with other forms of analysis and/or questioning the epistemologies that assign superiority to statistical methods as a primary way of knowing, researchers opt to collapse people into heterogenous categories (e.g., AAPI) or simply eliminate groups from the analysis all together [36,37]. The erasure of Indigenous peoples (including physics students) through data collection techniques such as these contributes to the settler colonial narrative of Indigenous peoples as “no longer here” [38], a narrative that directly contradicts the reality that Indigenous physicists “are alive, living, working and growing” [35].

Hyper-aggregation of data can also contribute to erasure, such as when Asian, Pacific Islander, and Native Hawaiian communities are grouped into a single “Asian” category, creating a false monolith and erasing individual communities’ experiences [39,40]. In homogenizing across groups with very different immigration experiences and access to wealth, and thus smoothing over differences in educational access and attainment, this overgeneralization contributes to the *model minority myth*, which positions Asian(American) students as “model minorities” who “have succeeded academically and economically, despite obstacles, because of individual and cultural determinants” [41]. The model minority myth directly serves white supremacy by erasing Asian (American) experiences with racism; denying access to resources on the basis of the appearance of “success”; and recusing the system from

responsibility in addressing racism [41–45]. In particular, aggregating data into a single “Asian” category often erases the experiences of (1) South East Asian refugees who are escaping war, genocide, and economic disaster and (2) Native Hawaiian and Pacific Islander students who have very different historical (and settler colonial) relationships to the U.S. than Asian immigrants [46–50].

Steps that can be taken to eliminate erasure like this in demographic questions include [51]:

*1. Use “select all that apply” instead of limiting participants to one option*

This allows people who identify with more than one category to be counted in each category instead of being forced to choose between multiple identities that they hold.

*2. Build in the ability to disaggregate categories in the raw data [35,40]*

For example, under the “Asian” subcategory, include drop-down options to include greater granularity of identities of “Chinese,” “Vietnamese,” etc. If categories are too small to analyze due to privacy concerns (i.e., to protect the anonymity of research subjects), these categories can always be re-aggregated. This mitigates the effects of creating a false monolith, when in reality each category encompasses vastly different lived circumstances, cultures, challenges, and potential avenues for success in education spaces.

*3. Include as many options as possible for each response, utilizing drop-down options under large categories*

For example, gender non-conforming individuals are often left out of analyses when categories for gender response use a binary variable only including “male” and “female” response options as discussed previously [7].

*4. Do not include “multi” categories [35]*

A “multi” category cannot be disaggregated, which challenges its use for research reliant on demographic analysis. For example, if a participant identifies as both Black and Indigenous and thus selects the multi-race category, that participant is now invisible in the “multi” category, and also lost from both the Black and Indigenous categories. This creates a double erasure and eliminates their presence in the population being studied.

*5. If using an “other” category, create a drop-down tab with a free response option to create opportunities for finer granularity in the data*

Sometimes we cannot include as many options in survey tools as we would like. Including a free response option can help avoid missing important contextual information, even if it might take more time to analyze your results.

*6. If your data was not collected under ideal circumstances (as many datasets are convenience samples), be intentional about reporting limitations of your dataset and limit the claims you make using the data*

Writing a powerful and accurate limitations section about data quality and capacity to analyze is vital for not propagating deficit narratives of students from minoritized groups. Figure 1 shows an example of a question about the race/ethnicity of a participant that follows the recommendations above.

FIG. 1. Example of a question asking about the joint race and ethnicity of survey participants [52,53]. When “Other” is selected as a main category, or under one of the subgroup headings, participants should have the chance to write-in their identity.

Even as we make these changes, it is important to advance ongoing critical applications in our data collection and analysis methods, including moves toward intersectionality in decisions about demographic categories [40,54,55]. Covarrubias [56], for example, argued for the importance of intersectional inquiry [12,13] that relies on cross-sectional demographic data to examine and display trends of “gender-based discrimination, patriarchy, class inequality, nativist racism and their interconnected effects” [56].

Further, Indigenous leaders are calling for more accountability in data collection and analysis about Indigenous people, asking researchers to honor Indigenous Data Sovereignty, or the “rights of Indigenous peoples, communities, and Nations to ‘govern the collection and application’ of datasets created with or about Indigenous communities, Indigenous Lands, and the community’s non-human relations” [57]. Honoring Indigenous Data Sovereignty would mean recognizing Indigenous peoples as sovereign “rights-holders, not stakeholders” [57], requiring a deepening of relationships with Indigenous communities to ensure that rights to governance are being recognized [58], using frameworks like that developed by Claw et al. [59].

### C. Center the experiential knowledge of minoritized communities in design and interpretation of quantitative studies.

Counterstorytelling is a methodological intervention of Critical Race Theory, which emerged in the context of legal scholarship and originally sought to make the case that law and policy in the U.S. are not race-neutral but instead are guided by efforts to maintain white supremacy [60–62]. Counterstorytelling challenges dominant narratives of minoritized groups and directs us to the ideological and structural underpinnings of racism in education, by highlighting the experiential knowledge of those at the margins [63–66]. Counterstories lean into Black feminist epistemologies [40,67] that locate truth-seeking and knowledge-building in lived experience and community dialogue, challenging the objectivity and superiority of purely quantitative methods.

Building from Recommendation A, Recommendation C presses us to center the experiential knowledge of minoritized groups as we design and interpret quantitative studies. Counterstories and studies that illuminate the experiences of People of Color in physics (e.g., [68–70]) can not only direct the questions we ask for the purposes of advancing racial justice via QuantCrit, but also can help us contextualize quantitative findings in broader narratives of racism in physics education, directing us away from deficit-oriented analyses and toward strengths-based framings [68,71,72]. Counterstorytelling can also be used as part of a mixed methods approach to contextualize demographic data and to guide demographic data collection and analysis toward liberatory ends [73].

### III. CONCLUSIONS

Kanim and Cid’s landmark paper, “Demographics of physics education research,” drew attention to *who* has been historically included in the physics education research sample, naming that this sample has been from disproportionately white, wealthy, high-SAT-scoring university populations. Our paper builds from there, arguing that *how* we collect demographic data matters. We synthesize work from PER, QuantCrit, and public health to suggest that researchers collecting racial demographic data should not treat demographic categories as objective truth, but rather should build demographic data categories that avoid systematic erasure for People of Color, and should center the experiential knowledge of minoritized communities as they design and interpret quantitative data.

While we are well aware of other critical quantitative approaches (e.g. CritQuant, quantitative criticism), our alignment with the tenets of QuantCrit reflects an “epistemological genealogy rooted in Critical Race Theory” [74]. QuantCrit ties us explicitly to political commitments at the core of CRT, wherein “critical” signifies

an insistence to surface white supremacy as a structural and institutional condition shaping the daily experiences of Communities of Color. Our *analysis* of ethnic and racial quantitative data in the broader narrative of white supremacy acknowledges that numbers are not neutral and can be used to reify—or disrupt—racism at work. Importantly, this contextualization relies on connecting quantitative data to *story*, particularly the stories told by those who have been marginalized.

As we work to implement the suggestions made in this paper and elsewhere, we anticipate there being challenges that may require careful strategizing. For example, altering demographic categories may compromise our capacity to compare across years of student data, or to conduct cross-institution or aggregate analyses. This limitation can be mitigated by standardizing inclusive data practices across institutions over time, while advancing efforts to build critical literacies about data and quantitative methods among institutional research professionals in higher education.

It is also possible that an individual researcher does not have the power to affect the way their institution collects data, or need to use a dataset of convenience. Implementing tools such as supplementing data with qualitative methods like counterstorytelling, or analyzing quantitative data with a critical lens, can help bridge gaps in less-than-perfect datasets. Lastly, while we center race in our discussion, given our anchoring in QuantCrit, we argue that we must extend critical theories to other demographic variables, especially attending to intersectionalities in “the numbers.”

We recognize that the arguments and methodological recommendations put forth in this paper will be met with opposition from those that would claim that we are violating “objectivity” in a field that has traditionally prided itself on this characterization. QuantCrit scholars have exposed the flawed arguments in defense of these claims, but we view these critiques as an invitation to deepen our critical engagement with a range of statistical approaches. We humbly offer a step forward here, propelled by an unwavering commitment as scholars seeking social and racial justice in physics education research and beyond.

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- [1] S. Kanim and X. C. Cid, *Demographics of Physics Education Research*, Phys. Rev. Phys. Educ. Res. **16**, 020106 (2020).
- [2] J. M. Nissen, I. Her Many Horses, and B. Van Dusen, *Investigating Society's Educational Debts Due to Racism and Sexism in Student Attitudes about Physics Using Quantitative Critical Race Theory*, Phys. Rev. Phys. Educ. Res. **17**, 010116 (2021).
- [3] D. J. Webb and C. A. Paul, *Attributing Equity Gaps to Course Structure in Introductory Physics*, Phys. Rev. Phys. Educ. Res. **19**, 020126 (2023).
- [4] K. Strong, Student Learning, Student Demographics, or Something Else? A QuantCrit Analysis of How School Accountability Reflects Student Labels but Not Student Needs, University of Colorado, 2022.
- [5] R. A. Campbell-Montalvo, *Being QuantCritical of U.S. K-12 Demographic Data: Using and Reporting Race/Ethnicity in Florida Heartland Schools*, Race Ethn. Educ. (2019).
- [6] Urban Indian Health Institute, Data Genocide of American Indians and Alaska Natives in COVID-19 Data, Urban Indian Health Institute, 2021.
- [7] K. J. Dockendorff, *Queering Data Collection: Strategies for Reimagining Survey Instruments in Student Affairs*, J. Stud. Aff. Colo. State Univ. **29**, 16 (2020).
- [8] T. Fernandez, A. Godwin, J. Doyle, D. Verdin, H. Boone, A. Kim, L. Benson, and G. Potvin, *More Comprehensive and Inclusive Approaches to Demographic Data Collection*, in (2016).
- [9] J. C. Garvey, *Queer Quantitative Query: Sexual Orientation in Higher Education Surveys*, J. Coll. Stud. Dev. **60**, 495 (2019).
- [10] J. C. Garvey, *Considerations for Queer as a Sexual Identity Classification in Education Survey Research*, J. Coll. Stud. Dev. **58**, 1113 (2017).
- [11] G. Parekh, *Applied Quantitative Inquiry Through a Critical Disability Studies Lens*, in *Handbook of Critical Education Research* (Routledge, 2023).
- [12] P. H. Collins, *Learning from the Outsider Within: The Sociological Significance of Black Feminist Thought*, Soc. Probl. **33**, S14 (1986).
- [13] K. Crenshaw, *Mapping the Margins: Intersectionality, Identity Politics, and Violence against Women of Color*, Stanford Law Rev. **43**, 1241 (1991).
- [14] G. L. Cochran, M. Boveda, and C. Prescod-Weinstein, *Intersectionality in STEM Education Research*, in *Handbook of Research on STEM Education* (Routledge, 2020).
- [15] T. Zuberi, *Thicker Than Blood: How Racial Statistics Lie*, First Edition (Univ Of Minnesota Press, Minneapolis, 2003).
- [16] C. Goar, *Experiments in Black and White: Power and Privilege in Experimental Methodology*, in *White Logic, White Methods: Racism and Methodology*, edited by T. Zuberi and E. Bonilla-Silva (Rowman & Littlefield Publishers, Lanham, 2008), pp. 153–162.
- [17] T. Zuberi, *Deracializing Social Statistics: Problems in the Quantification of Race*, in *White Logic, White Methods: Racism and Methodology*, edited by T. Zuberi and E. Bonilla-Silva (Rowman & Littlefield Publishers, Lanham, 2008), pp. 127–134.
- [18] A. James, *Making Sense of Racial Classification*, in *White Logic, White Methods: Racism and Methodology*, edited by T. Zuberi and E. Bonilla-Silva (Rowman & Littlefield Publishers, Lanham, 2008), pp. 31–45.
- [19] R. Grosfoguel, *The Structure of Knowledge in Westernized Universities: Epistemic Racism/Sexism and the Four Genocides/Epistemicides of the Long 16th Century*, Hum. Archit. J. Sociol. Self-Knowl. **11**, (2013).
- [20] R. R. Valencia, *Students of Color and the Achievement Gap: Systematic Challenges, Systematic Transformations* (Routledge, New York, NY, 2015).
- [21] G. Ladson-Billings, “Makes Me Wanna Holler”: Refuting the “Culture of Poverty” Discourse in Urban Schooling, Ann. Am. Acad. Pol. Soc. Sci. **673**, 80 (2017).
- [22] M. I. Pearson, S. D. Castle, R. L. Matz, B. P. Koester, and W. C. Byrd, *Integrating Critical Approaches into Quantitative STEM Equity Work*, CBE Life Sci. Educ. **21**, es1 (2022).
- [23] R. Gutierrez and E. Dixon-Roman, *Beyond Gap Gazing: How Can Thinking About Education Comprehensively Help Us (Re)Envision Mathematics Education?*, in (2011), pp. 21–34.
- [24] T. Zuberi and E. Bonilla-Silva, *White Logic, White Methods: Racism and Methodology* (Rowman & Littlefield Publishers, Lanham, 2008).
- [25] W. E. B. Du Bois, I. Eaton, and E. Anderson, *The Philadelphia Negro: A Social Study*, Reprint edition (University of Pennsylvania Press, Philadelphia, 1995).
- [26] D. Gillborn, P. Warmington, and S. Demack, *QuantCrit: Education, Policy, ‘Big Data’ and Principles for a Critical Race Theory of Statistics*, Race Ethn. Educ. **21**, 158 (2018).
- [27] C. E. Crawford, S. Demack, D. Gillborn, and P. Warmington, *Quants and Crits: Using Numbers for Social Justice (Or, How Not to Be Lied to with Statistics)*, in *Understanding Critical Race Research Methods and Methodologies* (Routledge, 2018).
- [28] N. M. Garcia, N. López, and V. N. Vélez, *QuantCrit: Rectifying Quantitative Methods through Critical Race Theory*, Race Ethn. Educ. **21**, 149 (2018).
- [29] M. Rodriguez, R. Barthelemy, and M. McCormick, *Critical Race and Feminist Standpoint Theories in Physics Education Research: A Historical Review and Potential Applications*, Phys. Rev. Phys. Educ. Res. **18**, 013101 (2022).

- [30] M. Walter and C. Andersen, *Indigenous Statistics: A Quantitative Research Methodology*, 1st ed. (Routledge, 2016).
- [31] A. Hayward, L. Wodtke, A. Craft, T. Robin, J. Smylie, S. McConkey, A. Nychuk, C. Healy, L. Star, and J. Cidro, *Addressing the Need for Indigenous and Decolonized Quantitative Research Methods in Canada*, *SSM - Popul. Health* **15**, 100899 (2021).
- [32] K. Mostern, *Three Theories of the Race of W. E. B. Du Bois*, *Cult. Crit.* **27** (1996).
- [33] D. Small-Rodriguez and T. Rocha Beardall, *The Limits of Race for American Indians*, in *The Oxford Handbook of Indigenous Sociology*, edited by E. by M. Walter, T. Kukutai, A. Gonzales, and R. Henry (Oxford University Press, Oxford, New York, 2023), pp. 322–328.
- [34] S. Misra, S. C. Kwon, A. F. Abraido-Lanza, P. Chebli, C. Trinh-Shevrin, and S. S. Yi, *Structural Racism and Immigrant Health in the United States*, *Health Educ. Behav. Off. Publ. Soc. Public Health Educ.* **48**, 332 (2021).
- [35] B. Kamai, X. C. Cid, X. R. Quichocho, A. Little, K. Daniel, C. Gray, H. Neilson, and J. B. Bird, *Indigenous Peoples Exist Within Physics*, *Gazette* **39**, 4 (2020).
- [36] S. T. Ziliak and D. N. McCloskey, *The Cult of Statistical Significance: How the Standard Error Costs Us Jobs, Justice, and Lives* (University of Michigan Press, 2008).
- [37] J. D. Lopez, *Indigenous Data Collection: Addressing Limitations in Native American Samples*, *J. Coll. Stud. Dev.* **61**, 750 (2020).
- [38] M. Bang, *Towards an Ethic of Decolonial Trans-Ontologies in Sociocultural Theories of Learning and Development*, in *Power and Privilege in the Learning Sciences: Critical and Sociocultural Theories of Learning*, edited by Indigo Esmonde and Angela N. Booker (Routledge, New York, 2017).
- [39] C. K. Y. Nguyen-Truong, S. F. Waters, M. Richardson, N. Barrow, J. Seia, D. U. Eti, and K. F. Rodela, *An Antiracism Community-Based Participatory Research With Organizations Serving Immigrant and Marginalized Communities, Including Asian Americans and Native Hawaiians/Pacific Islanders in the United States Pacific Northwest: Qualitative Description Study With Key Informants*, *AsianPacific Isl. Nurs. J.* **7**, e43150 (2023).
- [40] G. L. Cochran and M. Boveda, *A Framework for Improving Diversity Work in Physics*, in (2020), pp. 9–15.
- [41] G. A. Chen and J. Y. Buell, *Of Models and Myths: Asian(Americans) in STEM and the Neoliberal Racial Project*, *Race Ethn. Educ.* **21**, 607 (2018).
- [42] J. C. Ng, S. S. Lee, and Y. K. Pak, *Chapter 4 Contesting the Model Minority and Perpetual Foreigner Stereotypes: A Critical Review of Literature on Asian Americans in Education*, *Rev. Res. Educ.* **31**, 95 (2007).
- [43] N. C. Allred, editor, *Asian Americans and Affirmative Action: From Yellow Peril to Model Minority and Back Again*, *Asian Am. Law J.* (2007).
- [44] K. Shih, T.-F. Chang, and S. Chen, *Impacts of the Model Minority Myth on Asian American Individuals and Families: Social Justice and Critical Race Feminist Perspectives*, *J. Fam. Theory Rev.* (2019).
- [45] S. S. Yi, S. C. Kwon, R. Suss, L. N. Doan, I. John, N. S. Islam, and C. Trinh-Shevrin, *The Mutually Reinforcing Cycle Of Poor Data Quality And Racialized Stereotypes That Shapes Asian American Health*, *Health Aff. Proj. Hope* **41**, 296 (2022).
- [46] N. E. Martinsen, *Supporting Pacific Islander Student Success in Higher Education through Culturally Sustaining Leadership*, San Francisco State University, 2017.
- [47] D. H. Wright and P. Spickard, *Pacific Islander Americans and Asian American Identity.*, in *Contemporary Asian American Communities: Intersections And Divergences* (Temple University Press, 2002).
- [48] K. Fox and C. Prescod-Weinstein, *The Fight for Mauna Kea Is a Fight Against Colonial Science*, *The Nation* (2019).
- [49] H. Kaluna, C. K. Baybayan, and B. Kamai, *Creating Spaces for Indigenous Voices within Planetary Science — Part 1*, *Bull. AAS* **53**, (2021).
- [50] B. Kamai, C. K. Baybayan, and H. Kaluna, *Creating Spaces for Indigenous Voices within Planetary Science — Part 2*, **53**, 503 (2021).
- [51] Urban Indian Health Institute, *Best Practices for American Indian and Alaska Native Data Collection*, Urban Indian Health Institute, 2020.
- [52] R. Marks and M. Rios-Vargas, *Improvements to the 2020 Census Race and Hispanic Origin Question Designs, Data Processing, and Coding Procedures*, <https://www.census.gov/newsroom/blogs/random-samplings/2021/08/improvements-to-2020-census-race-hispanic-origin-question-designs.html>.
- [53] *Guidance on Demographic Questions*, <https://research.mcmaster.ca/home/support-for-researchers/ethics/mcmaster-research-ethics-board-mreb/guidance-on-demographic-questions/>.
- [54] C. Prescod-Weinstein, *Creating a Shared Vocabulary: Intersectionality*, *Gazette* **38**, 1 (2019).
- [55] G. L. Cochran, *The Need for Intersectionality in Physics*, *Gazette* **38**, 2 (2019).
- [56] A. Covarrubias, *Quantitative Intersectionality: A Critical Race Analysis of the Chicana/o Educational Pipeline*, *J. Lat. Educ.* **10**, 86 (2011).
- [57] S. R. Carroll, M. Duarte, and M. Liboiron, *Indigenous Data Sovereignty*, in *Keywords of the Datafied State*, edited by J. Burrell, R. Singh, and P. Davison (Data & Society, 2024).

- [58] M. Hudson et al., *Indigenous Peoples' Rights in Data: A Contribution toward Indigenous Research Sovereignty*, *Front. Res. Metr. Anal.* **8**, (2023).
- [59] K. G. Claw, M. Z. Anderson, R. L. Begay, K. S. Tsosie, K. Fox, and N. A. Garrison, *A Framework for Enhancing Ethical Genomic Research with Indigenous Communities*, *Nat. Commun.* **9**, 2957 (2018).
- [60] K. Crenshaw, G. Peller, and K. Thomas, *Introduction*, in *Critical Race Theory: The Key Writings That Formed the Movement* (The New Press, 1995), pp. xiii–xxxii.
- [61] C. I. Harris, *Whiteness as Property*, *Harv. Law Rev.* **106**, 1707 (1993).
- [62] R. Delgado, J. Stefancic, and A. Harris, *Critical Race Theory*, 3rd edition (NYU Press, New York, 2017).
- [63] D. G. Solórzano and T. J. Yosso, *Critical Race Methodology: Counter-Storytelling as an Analytical Framework for Education Research*, *Qual. Inq.* **8**, 23 (2002).
- [64] D. G. Solorzano and T. J. Yosso, *Critical Race and LatCrit Theory and Method: Counter-Storytelling—Chicana and Chicano Graduate School Experiences*, *Int. J. Qual. Stud. Educ.* **14**, 471 (2001).
- [65] R. Miller, K. Liu, and A. F. Ball, *Critical Counter-Narrative as Transformative Methodology for Educational Equity*, *Rev. Res. Educ.* **44**, 269 (2020).
- [66] J. T. Decuir-Gunby and D. C. Walker-Devose, *Expanding the Counterstory: The Potential for Critical Race Mixed Methods Studies in Education*, in *Handbook of Critical Race Theory in Education*, edited by M. Lynn and A. D. Dixson (Routledge, 2013).
- [67] P. H. Collins, *Black Feminist Thought: Knowledge, Consciousness, and the Politics of Empowerment*, 1st edition (Routledge, New York, 2008).
- [68] S. Hyater-Adams, C. Fracchiolla, T. Williams, N. Finkelstein, and K. Hinko, *Deconstructing Black Physics Identity: Linking Individual and Social Constructs Using the Critical Physics Identity Framework*, *Phys. Rev. Phys. Educ. Res.* **15**, 020115 (2019).
- [69] K. Rosa and F. M. Mensah, *Educational Pathways of Black Women Physicists: Stories of Experiencing and Overcoming Obstacles in Life*, *Phys. Rev. Phys. Educ. Res.* **12**, 020113 (2016).
- [70] X. R. Quichocho, J. Conn, E. M. Schipull, and E. W. Close, *Who Does Physics? Understanding the Composition of Physicists through the Lens of Women of Color and LGBTQ+ Women Physicists*, in (2019), pp. 488–493.
- [71] L. A. Barth-Cohen, T. G. Young, J. M. May, and A. L. Adams, *Acquisition of Qualitative Video Data: Methods and Reflections in PER*, in (2023), pp. 46–51.
- [72] L. G. E. McDermott and N. A. Mosley, *“Academia as a Whole Is Structured Entirely without Any Consideration for Neurodivergency,” and Other Things Neurodivergent Students Want You to Know*, in (2023), pp. 217–223.
- [73] N. M. Garcia and O. J. Mayorga, *The Threat of Unexamined Secondary Data: A Critical Race Transformative Convergent Mixed Methods*, *Race Ethn. Educ.* (2018).
- [74] L. A. Tabron and A. K. Thomas, *Deeper than Wordplay: A Systematic Review of Critical Quantitative Approaches in Education Research (2007–2021)*, *Rev. Educ. Res.* **93**, 756 (2023).