

Quantitative Criticalism in Education Research

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Article abstract

The purpose of this manuscript is to educate scholars about emerging approaches to critical quantitative research. We begin by providing our positionalities as scholars to situate ourselves within this content. Next, we overview quantitative criticalism and explore tensions inherent within this approach. Following, we discuss quantitative criticalism examples in education research to highlight specific quantitative methods and critical theories and to overview opportunities for using quantitative criticalism. We close by providing implications for our intended audiences, primarily directing our recommendations to scholars who employ quantitative methods and/or critical perspectives in education research.

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Quantitative Criticalism in Education Research

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Abstract

The purpose of this manuscript is to illustrate the value and potential of critical approaches to quantitative research. We begin by providing our positionalities as scholars to situate ourselves within this content. Next, we overview quantitative criticalism and explore tensions inherent within this approach. Following, we discuss four quantitative criticalism examples in education research to highlight specific quantitative methods and critical theories and to overview opportunities for using quantitative criticalism. We close by providing implications for our intended audiences, primarily directing our recommendations to scholars who employ quantitative methods and/or critical perspectives in education research.



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To embrace quantitative criticalism requires adaptability and translation across two scholarly communities that are historically portrayed among researchers as diametrically opposed. Within quantitative scholarly networks, the emotional, personal, and community investments among justice-driven researchers are often seen as unscientific, biased, oppositional, and too personal. Among critical scholars, a focus on survey and quantitative research is seen as essentializing, limiting, and decentered from persons and communities.

For many scholars, quantitative methods are antithetical to critical scholarship given their historical entrenchment and current complicity in oppression and maintaining racial superiority and social dominance (Zuberi & Bonilla-Silva, 2008). Numerous education researchers have likely experienced harm through quantitative training, by administering surveys, or from being research participants given the dominant presence of white normative ideology in quantitative scholarship. Such harm may dissuade Black, Indigenous, and People of Color (BIPOC) scholars from pursuing quantitative research and likely has detrimental impact on undocumented scholars, trans and queer scholars, and scholars with disabilities who often see themselves as subjects of deficit-based quantitative research rather than agents and creators of knowledge through quantitative scholarship. We believe that quantitative criticalism is an approach that both uplifts marginalized communities in education research while also providing a medium for scholars to conduct justice-driven research. Most importantly, critical quantitative work has the potential to unsettle white supremacist cisheteropatriarchy, potentially uprooting marginalizing assumptions in education research.

Purpose and Intended Audiences

The purpose of this manuscript is to illustrate the value and potential of critical approaches to quantitative research. Our examination of quantitative criticalism is intended to serve as a guide to the expansive emergence of critical quantitative scholarship in education. Whereas recent manuscripts have engaged with quantitative criticalism conceptually (Davis & Saunders, 2022) and regarding its frequency of use in publications (Wofford & Winkler, 2022), our manuscript advances epistemological and methodological considerations to support scholars in discerning the use and value of critical approaches to quantitative research.

Lessons outlined in our manuscript will benefit several stakeholders. Our primary intended audience is scholars who employ quantitative methods and/or critical perspectives in education research, with the goal of expanding conversations regarding the tensions and opportunities possible within quantitative criticalism. Included among these scholars are undergraduate and graduate student researchers, faculty, full-time researchers, staff who work in institutional research, evaluation, and assessment, and instructors who teach methods courses. Information in this article will also support students and educators to evaluate scholarship that applies critical theories to specific quantitative methods. Finally, we hope that material presented will encourage researchers to apply critical theories to their own quantitative studies.

Positionalities

Quantitative research is not, should not, and has never been objective because pure objectivity in empirical research does not exist. Although contemporarily positioned as post-positivistic and objectivist epistemologically, quantitative researchers have implicit biases, assumptions, and perspectives based on their lived experiences and social identities (Delzell &

Poliak, 2013). Methodological self-reflection is essential for education research to unearth biases and assumptions, yet quantitative researchers are rarely asked to situate their own positionalities within their scholarship (Rios-Aguilar, 2014). Rather than minimizing these biases and their influences on research, we recognize that our positionalities and subjectivities are inherent and necessary dimensions of our scholarly process. As such, we begin by providing our own positionalities to demonstrate how our social positionings are embedded in our scholarly inquiries and processes.

Jay's Positionality

My educational journey and queer positionality are etched into the core of who I am as an educator, scholar, and person. In all that I do, I want to uplift and support collective liberation of queer and trans people through education. As a white cisgender researcher, I am invested in dismantling white cisheteropatriarchial dominance across subdisciplines in education research, including quantitative methods, college impact scholarship, and research centering queer and trans people.

In my research I examine queer and trans collegians across educational contexts primarily using quantitative methods. I proudly identify as a quantitative queer, navigating the borders of post-positivistic quantitative methods and post-structural queerness. Throughout my scholarship, I aim to critically interrogate the methodological challenges and opportunities for studying sexuality and gender, clarifying the routinely invisible nature of queer and trans students in survey design and quantitative methods (Garvey & Dolan, 2021). I often employ survey design and quantitative methods to examine the relationship between students and their environments and critically interrogate the methodological challenges and opportunities for studying queer and trans students (Garvey, 2020). In doing so, my research provides guidance to other quantitative scholars studying sexuality and gender and clarifies the routinely invisible nature of queer and trans collegians in retention and student success scholarship.

Methodological training did not permit me to foreground or bring to discussion my queerness relative to quantitative decisions. I am grateful to mentors who empowered me to see my queerness as an invaluable asset to my quantitative scholarship rather than a hindrance or weakness. Recently, I have refined my interests in directing my scholarship to college administrators, researchers, and legislators, recognizing the power and influence of quantitative research for resource allocation, new initiatives, and policy (re)formation to serve queer and trans students.

Jimmy's Positionality

As a Vietnamese-Chinese American, my racial and ethnic identity is often aggregated up to the singular label of “Asian/Asian American” in statistics (Teranishi, 2007). When using this categorization in quantitative research, the underlying assumption is that all individuals underneath this category are the same, despite the reality that our experiences and collective histories are vastly unique. This broad generalization has been used to compare Asian Americans to other marginalized communities of color and have long masked inequalities in wealth and education (Museus & Kiang, 2009). These perceptions then lead to stereotyping, including the perpetuation of the model minority myth (Poon et al., 2016). The truth is only revealed upon disaggregating these data and considering the contexts in which they exist. Without critically reflecting upon these

issues, the true story is lost in the numbers. As a quantitative criticalist researcher, I find it crucial to continuously reflect on our methods, research questions, and analyses to tell the whole story, and not just a simple or convenient one.

Critical reflection is pivotal especially in my role within institutional research, assessment, and analytics. To work with data in all forms is to hold power and influence within an institution that can shape policies and practices that affect students, staff, faculty, community members, and beyond. At the core of my practice is the commitment to “minimizing harm” to my constituents. Although many common quantitative methodologies and post-positivistic epistemologies can be comforting in their predictable and logical tenets, I recognize how convenience may erase certain truths, fail to address inequalities, and perpetuate biases. My hope is for my assessment and institutional research colleagues to join me in critically reflecting on our existing practices, to improve them and better serve our constituents and advance social justice and equity.

Quantitative Criticalism

In its most basic sense, quantitative criticalism combines an understanding and use of methods and epistemologies. Whereas quantitative research is historically rooted in post-positivism with goals of minimizing bias, quantitative criticalists examine phenomena rooted in positionality and subjectivity while also advocating for social justice and dismantling systems of oppression (Carter & Hurtado, 2007). Critical quantitative scholars challenge existing policies, theories, and measures and reexamine traditional questions for populations marginalized in academia (Wells & Stage, 2015). Stage (2007) aptly wrote that “as quantitative researchers we are uniquely able to find those contradictions and negative assumptions that exist in quantitative research frames” (p. 6). Sablan (2019) defined a critical approach to quantitative methods as one that recognizes students holistically and within systems rather than as individuals with deficits. This approach to quantitative criticalism speaks to the overarching structure of oppression and inequity (vs. individualistic determination) in framing, interpretation, and approach. Much of critical quantitative work is concerned with the premise that numbers are not neutral, analyses must account for systemic oppression, and descriptive statistics can unearth counterstories of students and their trajectories through education (Garcia et al., 2018; Gillborn, Warmington, & Demack, 2018).

To practice quantitative criticalism, researchers must engage in justice-driven scholarship throughout the entire design and production, from developing research questions to making meaning of results and offering implications. From the motivation for pursuing an idea, to data collection and analysis, to manuscript publication, quantitative criticalists must embrace tenets of criticality throughout the lifespan of a research project. If education scholars are to truly embrace justice-driven scholarship, then researchers must attend to inequities and embedded oppression within developing research questions, articulating positionalities, factor/construct development, measurement and variable operationalization, sampling, data collection, coding and cleaning, data analysis, and discussions/implications of results.

Exploring the potential for critical quantitative research first requires an understanding of who we are as education scholars and our relationships to community and impact. For many scholars who employ quantitative criticalism approaches, it is within solidarity for and alignment with communities violently and systematically oppressed and excluded in education. As researchers, we want to feel kinship with others as scholars, advocates for social change, and

simply as people. Yet, it may be difficult for quantitative criticalists to foster such desires or feelings, particularly when considering how critical theoretical spaces often garner engagement from vastly different communities of colleagues than quantitative research spaces. As quantitative criticalists, we must support each other in community and solidarity if we are to sustain ourselves through enacting justice-driven research. Such community and solidarity are especially important for emerging scholars, who may be at risk of feeling isolated or unsupported when pursuing quantitative criticalism in education research.

Relatedly, connecting empirical work to transformational change in communities must be a central priority for quantitative criticalists. Such transformations must be enduring and deeply connected to the aims and intentions of the communities being studied, which requires community members to be partners throughout the research design and interpretation. For example, inviting leaders within communities to perform cognitive interviews for scale development will elevate such partnerships in quantitative research (Sablan, 2019), which is especially important when challenging dominant and white settler colonial constructs in education research (Lopez & Tachine, 2021). To counter the practices of data hoarding and extraction that can often occur among quantitative data collectors and analysts, scholars may consider insights from Indigenous quantitative scholars regarding data sovereignty and problematizing data ownership (Walter et al., 2020). Lastly, given the hierarchical power structures and dominant discourse within collaborations involving faculty, graduate students, practitioner-scholars, and community members, we find transparency in authorship order and requisite manuscript responsibilities an important component of quantitative criticalism. Understanding research positionalities and social identities relative to the power or oppression experienced in research collaborations must be at the forefront of research to promote sustainable and healthy partnerships, especially within community-engaged scholarship.

Tensions

When conceptualizing quantitative methods through critical frames, there are inherent tensions both generally and methodologically. Rather than dismissing these tensions, we chose instead to name the difficult frictions between quantitative methods and critical theoretical perspectives explicitly. Doing so provides scholars with an opportunity to consider these tensions and reflect on how they may manifest in their own research pursuits. However, we must also acknowledge that these tensions do not exist solely within quantitative research and that qualitative research possesses its own share of challenges in balancing methods and intentionality. As discussed by Stage (2007), “If we focus solely on research methods...we see little difference between the positivistic approach and the critical quantitative approach. However...the most interesting part rests with the motivation for the research” (p. 9). Quantitative criticalists are concerned with the motivation for pursuing research questions, not only on the methods used to answer them. As such, several tensions described below relate to assumptions about scholars’ intentions for performing quantitative research, whether explicit or implicit.

The first significant tension within quantitative criticalism is white supremacist and cisheteropatriarchal notions embedded in the founding and current use of statistics. As noted by Zuberi and Bonilla-Silva (2008), statistical analysis was derived from a logic of racial reasoning to justify racial superiority of white settlers. Francis Galton, a driving force for modern statistics in social sciences research, perpetuated the false notion that genius and success are innate and inherited traits of white men and can be measured statistically to reinforce racial dominance. Such

dangerous assertions supported his conceptual foundation of eugenics where he claimed the superiority of white Europeans and a gradation of racial inferiority derived from white supremacy (Zuberi & Bonilla-Silva, 2008). Similarly, Karl Pearson, who worked closely with Galton and is largely considered one of the founders of statistics, utilized questionable and biased methodology to support eugenics and British nationalism when researching British Jewish schoolchildren. These series of articles were published with co-author Margaret Moul in the *Annals of Eugenics* (now known as the *Annals of Human Genetics*), of which he was the founder and editor, and are contemporarily critiqued as racially prejudice with goals of promoting genetic inferiority of Jews (Delzell & Poliak, 2013). White supremacist notions of objectivity, impartiality, and truth continue to permeate teaching and application of statistics in social sciences, thereby making it difficult to introduce critical theories within quantitative methods. If critical quantitative work is rooted in the premise that statistics are not neutral and researchers therefore subjectively interpret and report numbers, then quantitative criticalists must continually recognize and move towards dismantling the historical remnants and current harm that white supremacy has perpetuated through statistics. Doing so will ultimately require unsettling and rebuilding the foundation of education statistics.

Second, because quantitative criticalism is focused on both the intentions and use of statistical methods, the “threshold” of criticality is not clearly defined. Without fully being able to discern authors’ intentions and impact, quantitative criticalists are too commonly held to a moving standard by both critical scholars and quantitative methodologists. Although critical quantitative scholars can openly share their positionality, which may likely include the intentions of their research, readers may never fully know authors’ intentions related to conducting research and enacting positive social change. Although this paradox is true for all researchers employing critical approaches, quantitative researchers must outwardly and transparently state their intentions to counter the contradictory intent and impact of quantitative research in education. This tension is exacerbated because for many critical scholars (and critical race scholars in particular), incremental change is viewed as a tool of white supremacy that does not address or dismantle inequitable processes, structures, or ideologies (DeCuir & Dixon, 2004), which in turn creates an invisible and often seldom discussed threshold of criticality. Although employing mixed methods may help to promote transparency, tensions will always exist given our main goal of broadly influencing meaningful change. And while some tensions from pure quantitative research may be relieved with the mixed methods, the inclusion of other qualitative methods can create new tensions for a researcher. As quantitative criticalists, we embrace being adaptive to instead of dismissive of the potentials of combining critical epistemologies with quantitative methodologies. Yet, adapting quantitative methods may not be viewed as reaching a threshold of criticality, regardless of whether these scholarly works move education policy and/or practice towards equity, justice, and liberation.

Methodologically, there are several inherent tensions for conducting critical quantitative scholarship. For example, among scholars who center identity-based communities and populations of students in education, it is often difficult to navigate the complexities of participants’ social identities. Using survey design to measure respondents’ lived experiences and social identities poses challenges for variable operationalization and quantifying personhoods (Rankin & Garvey, 2015). This limitation is further exacerbated because most federal, state, and institutional survey datasets use identity variables that are essentialist and harmful to these communities, if such demographic variables are included at all (Garvey, 2020). The essentialist nature of racial and gender demographic data in federal, state, and institutional survey datasets are meant to uphold current educational policies and practices, and thus, are tools of white supremacist

cisheteropatriarchy. Demographic data concerning disability identity are often reductive and, consequently, narrowly focus on accommodations and access. Regarding social class, there are innumerable operationalizations for variables and latent constructs, making it difficult for researchers to engage across studies given the different measurements.

Even when demographic data collection is more inclusive to encompass a wide range of social identities and experiences, quantitative researchers are frequently limited in the sophistication and power for their statistical analyses, especially when considering intersectional approaches and respondents with multiply minoritized identities. When communities are underrepresented in data collection and/or do not have a high enough response rate within specific surveys, the analytical options and reliability of results become constricted, which therefore limit generalizability and implications for education policy and practice (Garcia & Mayorga, 2018). Unfortunately, fewer nonparametric analyses are taught in education quantitative methods curricula, which limit analytical possibilities when working with samples that are small or unbalanced. Nonparametric tests enable researchers to transcend assumptions of population parameters and normal distributions, are more likely to detect true differences between samples, and have lower probability of type II errors. These tests also permit outliers and unequal variance among samples and are possible with smaller sample sizes. Such benefits are especially useful when analyzing data involving multiply minoritized people or communities with smaller populations in education (Leech & Onwuegbuzie, 2020).

Beyond individual identity operationalizations, critical quantitative scholars are also interested in understanding how systems of power and marginalization shape individual, institutional, and societal discourses and outcomes. For too long, quantitative scholars have placed responsibility and burden on minoritized communities for educational inequities that are driven overwhelmingly by institutional and societal oppression and injustices. These dominant and individual-level methodological frames inherently blame minoritized students for disparities in educational outcomes rather than recognizing perpetuating agents, policies, and practices that impede student success (Rios-Aguilar, 2014). In contrast, quantitative criticalists question systems and policies by bringing power and identity-based examinations to the fore (Solórzano, 1998). Worth noting, though, is that creating valid and reliable measures to analyze institutional and societal oppression across and between communities and institutional environments requires in-depth psychometric development and a reimagining of latent construct development in education.

From a broader perspective, quantitative data and analyses are typically meant to illuminate large educational trends and patterns across data. Yet, critical scholars often explore nuances within and across communities to promote power-driven and equity-minded perspectives. Quantitative criticalists may experience a double bind in that we desire community-specific scholarship to uplift counterstories while also desiring large-scale generalizability to influence policy and professional practice. However, generalizability is an explicitly post-positivist logic that assumes a universal and objective truth. Statistics is rooted in post-positivistic and objectivist epistemological assumptions that promote generalizability, focusing on the majority and rejecting outliers and minoritized communities (Hernandez, 2015). Especially when conducting research in historically and predominantly white institutions, generalizing findings to all students statistically and conceptually centers white students by assuming shared and majority (white) experiences, thus inherently comparing all BIPOC participants to white normative values. When adopting deficit-based comparative frameworks that collapse all BIPOC participants into one racial minoritized group, quantitative researchers assume homogeneity within and across BIPOC communities.

Doing so incorrectly assumes that all racially minoritized communities are equally comparable and that instruments used to measure differences across groups are universally relevant (Teranishi, 2007). These methodological foundations once again reinforce that all statistical assumptions are rooted in white dominance.

Rather than viewing these methodological tensions as closed barriers, we instead recognize that with transparent intentions and adaptability to new possibilities, we as quantitative criticalists may circumvent or directly address these methodological tensions. As discussed by Hernandez (2015), “Scholars who wish to take on quantitative criticalism should be well trained not only to understand the paradigmatic tensions that arise from this kind of approach, but also to be able to work within it and explain how they have done so” (p. 100). Within critical theoretical frameworks, tension can be generative. Tensions reveal methodological fault lines and make ruptures in assumptions and norms possible.

Examples

In this section, we review four articles written by various quantitative criticalist scholars. For each article, we provide a summary of the study, overview the main theories used in the study, compare differences between these studies and traditional quantitative studies, examine the methodology within each study, name the tensions that come up within critical quantitative approaches, and evaluate the benefits and limitations of each study. Each study was selected to emphasize a different component of quantitative methods and we organize subsections by critical and post-structural theories used with each example, including critical race theory, queer theory, and intersectionality. By introducing these examples across various educational contexts, we hope that scholars may begin to embrace and incorporate quantitative criticalism into their own works.

Critical Race Theory

In general, quantitative methods have epistemological and ontological implications that do not align with critical race theory (CRT) and praxis in education, and such methods are often criticized for their lack of nuance in capturing individual experiences (Garcia et al., 2018). Although quantitative methods may never match the nuance of qualitative studies, quantitative studies are indeed better positioned to examine these experiences on a broader level (Gillborn et al., 2017). However, without considering the contexts in which these experiences exist, the motives or positionality of a researcher, or the intentions of the study, interpretations of data can harm or hinder attempts at equity or mask inequality (Gillborn et al., 2017; Huber et al., 2017). Thus, quantitative methods must be infused with tenets of CRT to supply context for a study and provide the framework through which data are analyzed. QuantCrit (Garcia et al., 2018) is a specific approach to quantitative criticalism that combines CRT with quantitative methods. To utilize QuantCrit, researchers must begin with the formation of research questions rooted in CRT, explain their intentions and positionalities, reflect on the role of CRT and epistemology, and analyze various interacting macro systems at play.

Sablan’s (2019) article overviewed the educational and legal origins of CRT and quantitative methods, discussing the synergies and limitations between these seemingly incompatible approaches. QuantCrit creates space for the presentation of counternarratives in policy discourse, where qualitative methods may be less influential. Using Yosso’s (2006) model of community cultural wealth model (CCW), which is grounded in CRT frameworks, Sablan’s

(2019) study illustrated how critical theories can be infused into quantitative methods to model a QuantCrit approach.

CRT's main assertions are that race and racism are endemic in society, ideas such as objectivity, neutrality, and meritocracy are flawed and only serve those in power, commitment to social justice must move beyond interest convergence, and that experiential knowledge should be seen as legitimate and valued. Yosso's (2006) CCW model views students of color through an asset-based perspective and highlights the various forms of nondominant cultural capital they possess, values and skills that are absent, undervalued, or erased in dominant ideology. Sablan (2019) operationalized CCW into four separate scales that each correspond to one of the following types of nondominant cultural capital: aspirational, familial, navigational, and resistant. Sablan addressed scale validity through extensive literature review, expert/collegial review, pilot testing, cognitive interviewing, and instrument analysis.

Benefits and limitations. The level of criticality reached in Sablan's (2019) study makes it apparent that applying CRT in quantitative research is a lengthy endeavor. The theoretical framework of choice must be embedded within each step of a study, from instrument creation and data gathering to analysis and publication. Further, the intention and motivation of the researcher must be made clear. One major tension that exists between critical and non-critical quantitative studies is that the analysis of two studies can look the same, but questions and motivations can vary, which may elicit confusion among researchers and audiences. However, the criticality lies in the attention that a researcher gives to creation, interpretation, and application of their study through a lens of justice.

Sablan's (2019) study serves as one potential model for future QuantCrit studies that seek to employ critical theories. By viewing racial identity as a complex factor and not simply diminishing it to a categorical variable within a model, Sablan created space for counternarratives in quantitative studies and analyses. Although Sablan's study and methods are worth examining, it is also limited in its generalizability given that it is only a single study conducted with a narrow population. Validating Sablan's scale requires more studies across populations that are more representative of the multiple and intersecting identities that exist. More work is necessary with this specific framework, but Sablan's study provides a foundation for QuantCrit scholars where few studies currently exist.

Queer Theory

Quantitative studies are necessary to create change in education. However, quantitative studies generally rely on categorization to compare populations to one another in order to enact policy change and resource allocation. Sexual identity as a demographic identity has been generally absent from education research, although many surveys within education have recently opted into including questions soliciting respondents' sexual identities. With the emergence of this practice, researchers must be aware of the tensions that exist in how these identities are presented and how these data are analyzed. Although identity categorization is important to quantitative research, researchers must also understand that nuances exist within and across groupings of individuals. Without proper care and context, researchers may cause unintended harm for the populations they seek to support.

Garvey's (2017) study on sexual identity classifications in education survey research is an extension of Dugan and Yurman's (2011) study, which empirically demonstrated differences within

a singular category for LGB students. Both studies center LGBQ populations and provide a methodological foundation for future studies. Garvey's (2017) findings reinforce the notion that there is danger in collapsing all LGBQ respondents into a singular category, especially when differences are likely to exist within that category. Using queer theory as a framework, Garvey advocated for the inclusion of *queer* as a sexual identity response option in survey design and for quantitative scholars to test for within-group differences to acknowledge that the experiences of queer individuals are not uniform.

Queer theory is a post-structural theory that critiques the social construction of sexual and gender identities, the positioning of heteronormativity as the norm for understanding gender and sexuality, and the binaries that exist around these identities (Denton, 2019). Rather than being limited by categories, queer theory provides fluidity and freedom from oppressive, binary definitions of identity such as *normal* or *deviant*. Two main concepts within queer theory include liminality, or the ambiguity of being between different stages of development and identity, and performativity, the idea that individuals define their own identities through their behaviors each day (Wiegman, 2012). Through queer theory, identities are treated as social, multiple, fluid, and everchanging, free from restriction.

Benefits and limitations. Although categorizing the LGBQ population presents challenges, Garvey's (2017) study shines light on a population that requires more advocacy and attention. However, through the lens of queer theory, the limitations of studying this population become quite apparent. The inclusion of *queer* as a sexual identity is antithetical to the tenets of queer theory, a tension that Garvey directly named within his study. Nonetheless, categorization and data coding are necessary in quantitative analyses to compare different populations of individuals. Categorizing individuals and operationalizing identity is an important dimension quantitative analyses yet contradicts the fluid nature of gender and sexual identity as described in queer theory. However, ignoring this population causes more harm than the inclusion of a flawed categorization. Garvey stated that "scholars must advocate for the construction of sexual identity classifications while also exploring the fluidity and non-normativity of sexuality in surveys" (p. 1117).

Labels also generally imply homogeneity within populations even though this is not the case. Garvey empirically demonstrated the need to include *queer* as a separate sexual identity response through a within-group analysis to identify differences that existed between individuals from the same categorization. When considering the multiplicity of identities that individuals hold and the unique experiences they may have, especially concerning sexual identities, it is misleading to consider any sample truly representative. Regardless of one's approach to quantitative work, tensions will always exist between the necessity to categorize and the reality that categorization is problematic and requires destabilization. A non-critical quantitative study may not address these tensions, whereas quantitative criticalists explicitly acknowledge their presence.

Intersectionality

Although identity categories are socially constructed, their existence has real material, social implications, and consequences for marginalized people (Crenshaw, 1991; Gillborn et al., 2017). One such example of these implications is in primary and secondary educational systems, where a student's identities can influence their placement and progression through specific academic tracks, which can affect their academic outcomes and in the long term, their preparation

for rigorous academic and career opportunities (Wilson & Urick, 2022). Often in quantitative studies, social identity categories are treated as variables that are independent of one another rather than variables that directly interact and influence one another. In education research specifically, studies tend to examine populations through singular social categories such as race, class, or gender rather than studying the various intersections of these identities and systems of oppression and privilege (López et al., 2017). Employing quantitative methods that dive into the nuances of intersectionality can be a difficult task for researchers for several reasons including the reduction of generalizability due to smaller group sizes and the difficulty of recruiting enough participants from certain social groups. Despite these barriers, it is crucial for researchers to contribute to research that centers intersectionality to embrace more liberatory scholarship.

Legal scholar and Black feminist Kimberlé Crenshaw (1991) coined the term *intersectionality* to describe the ways in which Black women experienced racism similar to Black men and sexism similar to White women (single-axis), but also the compounding (additive), multiplicative (interactional), and interlocking (intersectionality) form of gendered racism, oppression that is specific to those with multiple minoritized identities. Crenshaw argued that one's multiple identities are not unitary, mutually exclusive entities but are reciprocal, constructed phenomena that shape, are shaped by, and reproduce complex systems of social inequalities. Through this framework, different forms of oppression can be studied in tandem with one another, rather than in isolation, allowing for a deeper understanding of how one's various social identities play out.

Using intersectionality as their key critical theory to inform their study, Szymanski and Lewis's (2016) study explored how African American women specifically coped with gendered racism, the intersection of being both a woman and African American, using various forms of engagement and disengagement strategies. In their study, Szymanski and Lewis sorted coping methods into two general domains: engagement strategies (resistance, education/advocacy) and disengagement strategies (detachment, internalization, and drugs/alcohol). This study focused on African American women in college due to their risk of experiencing gendered racism in the academic environment and their life experience navigating discrimination and other challenges. Further, the researchers explored how one's response to gendered racism are influenced by the centrality of one's identity to their self-concept (Leach et al., 2008).

Wilson and Urick's study (2022) also used intersectionality as one of many guiding frameworks for their study alongside the previously mentioned CCW (Yosso, 2006) and cultural reproduction theory (Bourdieu, 1977). Bourdieu emphasizes how students' dominant social identities grant them social, economic, and cultural capital which are directly converted into power within the field of education. Wilson and Urick (2022) conducted a secondary analysis on the opportunity gap between different populations of high school students using data from the 2015 Program for International Student Assessment. Their study expanded upon past methods of examining opportunity to learn which only emphasized content covered as the primary outcome by also considering method of instruction, teacher characteristics, school resources for learning, and student inputs into their analysis. They noted that the goal of QuantCrit researchers is to question existing models, measures, and practices to improve and offer competing practices to better represent voices that are missing or not adequately represented.

Benefits and limitations. Szymanski and Lewis (2016) considered the multiplicative and interactive effects of gendered racism compared to a more traditional analysis that might have examined the additive effects of racism and sexism. To add nuance to one's study or model,

quantitative researchers may choose to use interaction terms to account for non-isolated effects. They explicitly centered intersectionality at the root of their study and added nuance by including a moderator to understand how identity centrality and one's self-concept may affect one's response to psychological distress from the result of gendered racism. Quantitative criticalists must seek to adapt critical practices from other disciplines and apply them towards quantitative studies to improve the accuracy and generalizability of their findings. That said, the method of analysis is not the only important factor in a study – the quality and type of data that researchers use to inform their analysis also plays a role. Although Szymanski and Lewis did employ tools with an emphasis on intersectionality, measures like the Racialized Sexual Harassment Scale and Coping with Discrimination Scale were not developed specifically for African American women. Other instruments may offer better generalizability, inferential power, and culturally specific recommendations to cater towards this population due to more relevant or enhanced data. Another limitation is that although their study emphasized the intersections of race and gender, the study's scope was limited due to their sample containing mostly undergraduate students. A future study would benefit from a sample from a population with wider ranges of age, socioeconomic status, education, and other demographics that may help broaden the impact of their work.

In Wilson and Urick's (2022) study, participants were grouped into homogeneous classes based on responses to several domains of categorization including immigration background, language spoken at home, social class, and cultural capital. The value of using latent class analysis allows for the data to naturally sort respondents into groups that can become too complicated or unwieldy for a researcher to manually designate. These homogeneous groups can often fall outside of the scope of purely examining social identity. That is, latent class analysis offers researchers the ability to categorize participants with more complexity and nuance. Wilson and Urick also noted that this study may incorporate parental inputs in the future.

It is worth noting there is no clear consensus between scholars on the best approach to integrate intersectionality into quantitative research. Both study examples sought to apply tenets of intersectionality into their analyses but employed different methods to do so. Szymanski and Lewis (2016) used interaction effects between identity groups in a regression model whereas Wilson and Urick (2022) chose to employ latent class analysis. Although interaction effects can be a valuable tool for a researcher to explicitly identify subgroups, a study may have sample sizes that do not allow for meaningful analysis within cross-sections of a population. It is also critical to recognize that interaction effects are typically researcher-defined, thus this methodology could unintentionally cause some groups to be neglected. And in contrast, while latent class analysis allows homogeneous groupings to naturally emerge from heterogeneous populations, these groupings may not be populations that a researcher is interested in centering in their study.

Implications

We intend our primary audiences for this manuscript to be scholars across all ranks and experiences who are interested in quantitative criticalism for their research. We also direct our implications to educators who teach quantitative methods and encourage these instructors to intentionally incorporate both methods and epistemology in their curricula.

Two foundational principles shape how we frame our implications for quantitative criticalism. First, claiming expertise in quantitative criticalism is antithetical to our role as educators and understanding of critical thought. We hope to promote community within

quantitative criticalism while also acknowledging that to reach collective liberation, we must engage in coalition building and decenter individual uplift. Second, our positionalities ground everything in our approach and use of critical quantitative scholarship. We encourage readers to ground themselves and their personhoods when reading these implications, particularly because our positionalities change how and why we engage with quantitative criticalism.

Although we encourage various critical methodological approaches, including data sovereignty (Walter et al., 2020), inclusive and dynamic demographic data collection (Garvey & Dolan, 2021), and community member involvement (Sablan, 2019), among others, there are far too many methodological techniques to list that will fully capture the potential of quantitative criticalism. Instead, we offer several musings to encourage deep epistemological and methodological meaning-making among quantitative criticalists. These musings will require readers to closely consider their own positionalities while also contextualizing decision-making within their research projects. Rather than seeking simple solutions to complex questions, we again reaffirm that difficult problems require nuanced explorations. As such, we return to the tensions outlined throughout our manuscript and present musings for readers to consider. These musings may be a helpful starting point to facilitating discussions with research collaborators and examining our own assumptions introspectively.

Our musings all in some form or another relate to authors' intentions and perceived reception from readers. As we mentioned earlier, authors' intentions for using various approaches matter just as much as methodological techniques. Yet, it is difficult to discern authors' motivations and intentions. When authors use certain techniques that have historical groundings in oppression and racism (for example, comparative analyses), inferring their intentions separately from their methods and impact can be quite challenging. Put differently, authors' intentions and methodological choices are more complex than evaluating scholarship binarily using good/bad or critical/objectivist criteria. Determining authors' intentions and impact can be especially difficult when analyses are post-hoc and use datasets that were not intended to be analyzed through critical frameworks. An over-reliance on intentions without recognizing the potential harm of post-positivistic and objectivist variables and analyses can undermine the broader goal of justice and liberation within critical approaches to quantitative research.

This gradient in acceptability within quantitative criticalism leads us to another musing: a threshold of criticality. We view criticality as a continuum with no one technique decidedly critical or post-positivistic. The gradient of criticality, or determining whether a manuscript is 'critical enough,' may create a multitude of interpretations for the utility and impact of critical quantitative articles. In the same way we encourage introspective and collaborative research development for critical approaches to quantitative research, we also implore journal editors and readers to understand that there is no threshold of criticality to examine quantitative scholarship universally. Yet at the same time, we also acknowledge that incremental change in quantitative methods is a tool of white supremacy. In other words, if authors embrace criticalism in some (but not all) aspects of a quantitative research design, these decisions likely contribute to further oppressing BIPOC and other groups marginalized in education research.

We ground ourselves in the belief that quantitative criticalism is relevant and meaningful when there is an intentional interplay between research, policy, and advocacy (Rios-Aguilar, 2014). To promote continual learning and reflection, we close our implications with three questions for all quantitative criticalists to consider. In addition to considering these questions

introspectively, we also encourage scholars to engage with colleagues through these questions to broaden our quantitative critical coalition.

- What are your intentions for using quantitative criticalism? How do your intentions advance equity and justice in education policy and practice?
- Quantitative methods are rooted historically and contemporarily in white supremacy. Can we truly use these methods as a vehicle for justice and liberation?
- What is your threshold of criticality, both broadly and specifically within quantitative techniques?

Closing

Through employing quantitative criticalism, our main goal is to advance social justice and equity through our scholarship and teaching. Yet, as people who hold oppressed social identities, we have often felt marginalized in academia broadly and minimized especially within discourses about quantitative methods, while also benefitting from our privileged identities through dominant academic systems. We have chosen to reclaim the power and influence of quantitative methods through critical frames so we can redistribute and dismantle power structures in education research to work towards collective liberation. To this aim, we hope this manuscript and other quantitative criticalism initiatives will help develop a more robust coalition of quantitative scholars to build upon this knowledge and center criticality within our methods use and instruction.

Quantitative methods devoid of philosophical or epistemological groundings are neither sufficient nor acceptable to our communities and their needs, for they cause harm and are limited in both generalizability and nuance. As our understanding of social problems continues to evolve, so must the methods we employ as quantitative scholars. Our hope is for readers to move beyond objectivist quantitative approaches and begin employing criticality at the root of their work. Although tensions will always exist in this work, collective advocacy through discomfort and uncertainty outweighs complacency in comfort and continued hegemony. Critical and conscious reflection must be at the forefront of our work.

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