# Responding to CRT and DEI Prohibitions with QuantCrit and *Post* Methods

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**Abstract**

QuantCrit research challenges the White logic embedded in established research norms. However, translating critical quantitative research into science education practices is not as straightforward as a parallel challenge to established teaching norms. Many teaching norms that embody White logic are also effective means of addressing curriculum and time constraints on educators. Educators who perceive the effects of White logic in their practices may feel they lack the theoretical background necessary to re-orient their practices. Recent state prohibitions on Critical Race Theory (CRT) and Diversity, Equity, and Inclusion (DEI) initiatives further complicate the implementation of justice-oriented practices.

In this paper, I argue that engagement with poststructuralist and posthuman perspectives offers researchers and teachers a pathway to enact tenets of CRT and QuantCrit without adopting the discursive markers targeted by CRT and DEI prohibitions. This paper explores parallel applications of Principal Components Analysis to a large dataset in which the normative use of PCA seems to foreclose the possibility of deriving justice-oriented science education practices. Re-evaluating the use of principal components through QuantCrit and postquant lenses yields tangible recommendations for practice that center the lives, experiences, and values of minoritized students and thus resist the systems that oppress them.

## Problem Statement

Using Critical Race Theory (CRT), Zuberi and Bonilla-Silva expose the "White logic" in normative social science research methodology (Zuberi, 2001; Zuberi & Bonilla-Silva, 2008). They argue that research methods themselves produce certain types of racial knowledge, and that methodological white supremacy may be disrupted via theory-driven "stop signs" that interrupt learned research behaviors. Quantitative Critical Race Theory (QuantCrit) scholars have built on this work, developing principles and practices to disrupt the reproduction of systems of oppression. For example, rather than report the standard *p-value* for the statistical associations at the heart of their study, Van Dusen and Nissen (2020) use the corrected Akaike Information Criterion (AICc), which allowed them "to model and discuss inequities in student outcomes that would have been lost using more traditional methods" (Van Dusen & Nissen, 2020, p. 4).

Engaging in justice-oriented quantitative research requires challenging established research norms. However, translating QuantCrit principles to classroom practice is not as simple as a parallel challenge to established teaching norms. Unlike researchers who can heed "stop signs" and explore other paths, teachers face curriculum and time constraints. Even in teaching settings with greater flexibility and autonomy, teachers may lack (or feel they lack) sufficient theoretical perspective to make a second-guessing of learned teaching behaviors orient toward social justice. Geographic and political factors may further complicate teachers' abilities to implement CRT-informed practices, particularly in Texas, Florida, and other states that have adopted explicit prohibitions against the use of CRT and language related to DEI.

The problem at the heart of this paper is one of connecting insights gained through QuantCrit to recommendations for transformational practices in science classrooms. Here, I argue that engagement with poststructuralist and posthuman perspectives offers researchers and

teachers a pathway to enact tenets of CRT and QuantCrit without adopting the discursive markers that are targets of CRT and DEI prohibitions. The resulting post-quantitative approach to inquiry, "postquant" (Author, 2024), addresses QuantCrit's concerns about social-justice-oriented quantitative research by asserting an affirmative ethical pursuit of relations that orient researchers and educators *toward* practices that challenge the unjust status quo. Postquant's orientation *toward* particular practices develops from a researcher orientation *away* from predictive modeling or establishing causality and significant difference- habits of inferential statistics that reinscribe White supremacy (Zuberi, 2001).

This paper explores parallel applications of Principal Components Analysis (PCA) to a large dataset informed by White logic. PCA is a common strategy to deal with high-dimensional data (e.g., survey data with many questions) (Harlow, 2014). With the data in Author et al. (2024), however, the normative use of PCA seems to foreclose the possibility of using the data to inform justice-oriented science education practices. Re-evaluating the use of principal components (PCs) through QuantCrit and postquant lenses, however, yields tangible (and sanctioned) recommendations for practice that center the lives, experiences, and values of minoritized students and thus resist the systems that oppress them. To illustrate postquant as an orientation toward inquiry, I provide a high-level comparative description of using PCs in justice-oriented research to provide a specific methodology for identifying justice-oriented teaching practices that may be used in areas with CRT and DEI prohibitions.



## ***Post*** **Perspectives**

Similar to QuantCrit, postquant inquiry orients toward the human problems of domination and exploitation. Further, Foucault's post-structuralist aim that "certain phrases can

no longer be spoken so lightly, certain acts… no longer so unhesitatingly performed" within research (Foucault et al., 2000, p. 255), is congruent with Zuberi and Bonilla-Silva's (2008) stop signs. What is perhaps distinctive about postquant is its focus on questions of immanent ethics (Smith, 2007): through quantitative inquiry, what are our capacities for social change? How can we come into active possession of our power? How do we work toward accessing un-sensed potential? Rather than explanation, postquant orients toward praxis - "reflection and action upon the world to transform it" (Freire, 2017, p. 25). Postquant draws from posthuman scholar Rosi Braidotti's "affirmative ethics" (Braidotti, 2017) as a means to extend our capacity to refuse the violence of our present day as a "power to say no in the mode of 'I would prefer not to'" (Braidotti, 2022, p. 239).

Relational materialism (Kuntz, 2018) is a post-qualitative research perspective that offers some suggestions as to what we might affirmatively pursue with quantitative research and its subsequent recommendations for practice. Similar to Zuberi (2001), Kuntz is deeply concerned by the potential that our resistance to systems of power and oppression "furthers the very relations we seek to disrupt" (Kuntz, 2022, p. 595). Kuntz (2018) articulates relational materialist inquiry as comprising "two distinct practices: 1) mapping relations that sustain [a particular pattern of relations]; 2) establishing arenas of potential for new creations, new potentialities" (p. 3). Relational materialist inquiry targets potential that is latent but present in our contemporary relations, thereby exceeding the current limitations of being: our collective imagination, capacity for communal affirmation, and action to overcome the status quo. Accordingly, mapping relations within relational materialism is not undertaken to capture and define. In the context of quantitative research methods, relational materialism orients analytical techniques away from learned behaviors to model, predict, and establish significant differences. Here, I see relational

materialism as a way to heed Zuberi's (2001) critique of inferential statistics by refusing the limits of the status quo as limits on our uses of quantitative techniques. If postquant makes no claims about what identity variable responses in survey data *mean* or *say* about an individual now–as in establishing significant differences–or in the future–as in predictive modeling–we reduce the risk of intensifying the systems we want to transcend.

Generally speaking, then, postquant is an approach to research that attempts to exceed the limits of our unjust status quo by generating maps of social social relations from quantitative data. The purpose of postquant maps is to document the practices and relations that inform our common sense of how to navigate the social world, with the aim of working outward toward the limits of our representational ability - the edges of the map. From the edges of maps, we may become attuned to "the way in which things are leaking out-not so that we can capture them, but maybe that we can follow their trajectories" into arenas of potential (Kuntz & Wooten, 2023, p. 92).

## Methodology

As a mathematical technique, PCA generates a rotation matrix that specifies the orientation of each of the PCs in the n-dimensional space of the dataset (Jolliffe, 2002). The rotation matrix is typically used to define axes of a quantitative dataset that orient along the directions of greatest variation. The normative use of PCA is to select a small number of principal components (PCs) that explain most of the variation in the data (Harlow, 2014). In other words, PCA can generate a simplified version of a complex dataset that uses a small number of variables that preserve the overall effect of the "rules" that generated the whole dataset. From a QuantCrit perspective, racism and other systems of domination play a large role in such data generation "rules." An effect of reducing data based on "explaining variance," then,

is to discard data that are not useful for portraying the social dynamics we might expect from a large study. For example, Black women in STEM who understand their racial and gender identities as protective factors (Morton & Parsons, 2018) are unlikely predictors of a dataset that reflects a largely white population. Thus, positive experiences of STEM by individuals from minoritized groups are at risk of being interpreted as "model noise" when selecting PCs based on explanation of variance. Critically, however, merely generating PCs does not transform or reduce the complexity of data. Selecting particular PCs (and discarding others), however, necessarily skews our view of the data in a particular way. The postquant method I share below is to make a conscious choice about how the PCs re-orient our view of the data, and to do so in a way that affirms the experiences and values of minoritized populations within STEM.

In the next section, I report key findings from Author et al. (2024) along with a parallel illustration of PCA using the PCs that best explain variance. The pertinent data from the study asked a sample of 15,725 first-year college students to rate the desirability of 16 attributes in their future careers. As these students are near-peers to secondary science students, we were interested in future career dynamics that might be replicated through science teaching practices. We were particularly interested in eight career attributes that might also characterize dynamics of science learning: helping people, leading people, collaboration, inventing things, learning new things, autonomy, creativity, using one's talents, having an exciting job, and having an easy job. We generated 19 PCs from students' self-reported STEM enjoyment, two variables to represent minoritized racial and gender identities, and the 16 career items. We examined the lengths of the identity variables and STEM enjoyment along each PC and projected the data onto a biplot (Greenacre, 2010) that establishes minoritized identities, and greater-than-average STEM enjoyment as a ruler against which the career variables might be measured. We understand this

rotation of the coordinates as untethering our inquiry from the status quo and orienting toward a desired future where people of color, women, and non-binary individuals are statistically associated with positive STEM enjoyment.

## Data and Analysis

Table 1 shows the loadings of STEM enjoyment and the identity variables onto some of the PCs. PC1 and PC2 would typically be selected for analysis (through biplots, as the basis for a model, etc.), and we see that STEM enjoyment and identifying as Black or non-white Hispanic are *negatively* associated (i.e., they have opposite signs). Along PC9 and PC13, however, STEM enjoyment and both of the minoritized identity variables are all positive. Figure 1 shows the biplot of PC1 and PC2, the PCs that best explain variance within the data (i.e., the two PCs that do the best job of recreating the dynamics of the entire dataset).

Table 1

*STEM Enjoyment and Minoritized Identity Loadings on PC1, PC2, PC9, and PC13*

| | PC1 | PC2 | PC9 | PC13 |
|---|---|---|---|---|
| STEM enjoyment | 0.248 | 0.592 | 0.043 | 0.069 |
| Minoritized Racial/Ethnic Identity | -0.256 | -0.516 | 0.115 | 0.151 |
| Minoritized Gender Identity | 0.080 | 0.281 | 0.220 | 0.287 |

Figure 1

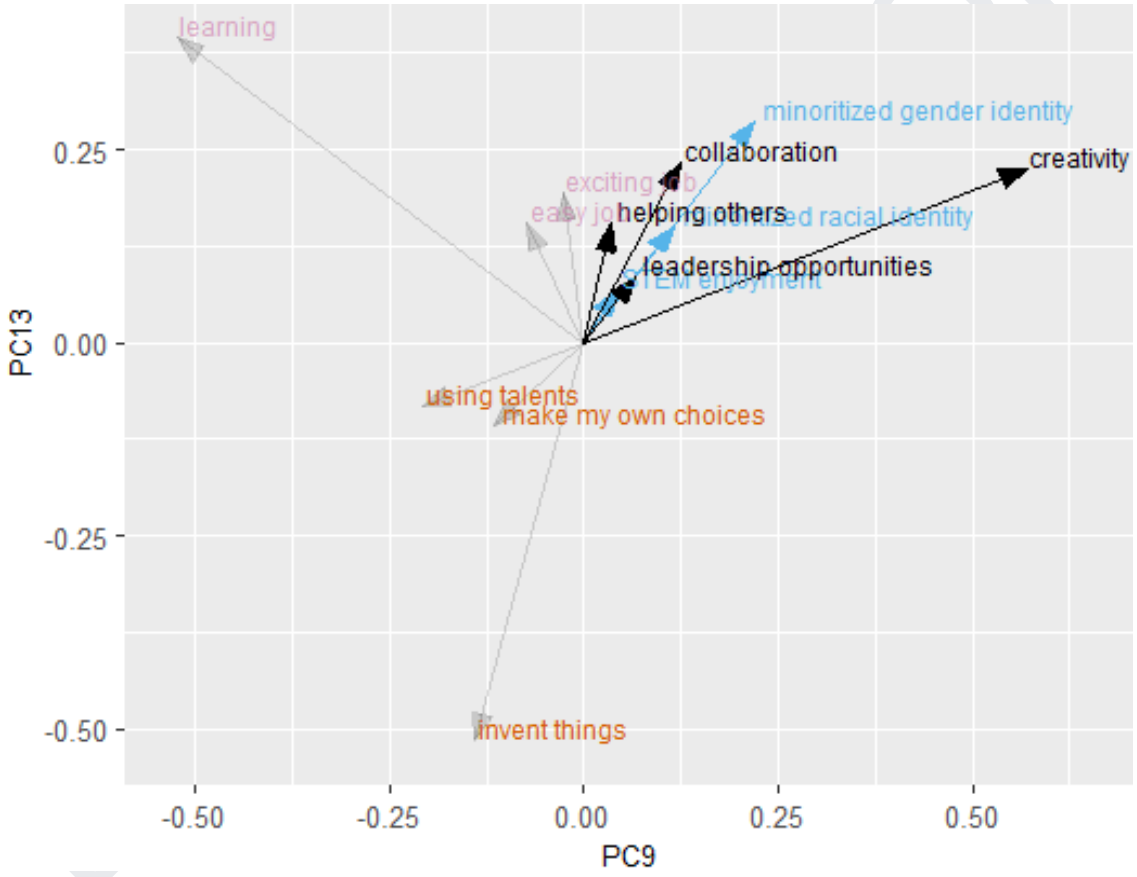
*Biplot of PC1 and PC2, the Principal Components that Best Explain the Status Quo*


In Author et al. (2024), we postulated that some of the career desires of college students could be replicated in secondary science classroom dynamics. As a means to generate justice-oriented teaching practices, Figure 1 leaves much to be desired. The lengths directions of the blue arrows suggest that promoting female and non-binary participation in STEM may conflict with minoritized racial identities. Moreover, the career items are clustered together and roughly perpendicular to the STEM enjoyment and identity variables. In the context of this biplot, variables that are perpendicular to the axis of STEM enjoyment and identity variables are uncorrelated. Thus, the question of which career desires of individuals reporting minoritized

identities might be replicated in secondary science education is unanswerable from a biplot of PC1 and PC2. In contrast, Figure 2 shows the biplot of the PCs that were selected to establish Black or non-White Hispanic, non-male identities, and greater-than-average STEM enjoyment as a ruler against which the career variables might be measured.

Figure 2

*Biplot of Principal Components 9 and 13*




When we established an axis of interest comprising STEM enjoyment by individuals reporting minoritized identities, we saw that collaboration, helping others, leadership opportunities, and creativity were also oriented along our axis of interest. Moreover, these desirable attributes in future careers (reported by individuals of minoritized populations who enjoy STEM) are readily

facilitated in secondary science education. In Author et al. (2024), we argue that the data and our use of PCs suggest the potential for projects of racial equity that structure secondary science education around opportunities for students to collaborate, lead one another, and use their creativity in service of helping others. This prescription is borne of a quantitative inquiry process that began with the tenets of CRT and QuantCrit and resulted in recommended practices that are consistent with Reformed Science Teaching (Sawada et al., 2002). Although they were derived from non-standard PCA, the recommendations for practice are congruent with some of the literature on goal congruity and STEM identity (Diekman et al., 2011).

## Contribution to the Teaching and Learning of Science

This methods paper explores the problem of connecting QuantCrit to transformative science education practices in areas with prohibitions against CRT and DEI. I illustrated a postquant approach to using Principal Components to refuse the inequities of the present as a means to understand what to do next. Instead, we may orient toward a desired future by choosing a non-standard set of PCs that centers the experiences and values of minoritized populations in STEM. This challenge to the research norm of using PCs based on explanation of variance yielded concrete recommendations for justice-oriented teaching practice that are "just good teaching" (Ladson-Billings, 1995). These results are directly applicable to supporting teachers in areas with CRT and DEI prohibitions, as we can reframe transformative teaching for racial equity as sanctioned student engagement. Beyond the specific recommendations for practice suggested here, I offer postquant as a means of engaging with imperfect datasets, collected with flawed instruments that were constructed with White logic, to orient quantitative inquiry toward greater equity and justice. While QuantCrit scholars are doing the important work of disrupting

White logic in study and instrument design, postquant may give us something to do to advance social justice through engagement with secondary data that have previously reinscribed systems of oppression.

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