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RESPONSE

Sitting in the Tensions: Challenging Whiteness in Quantitative Research

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This response to Julie Martin and Chavone Garza's article published in Studies in Engineering Education, "Centering the Marginalized Student's Voice Through Autoethnography: Implications for Engineering Education Research," discusses considerations in the process of research, particularly for white researchers. This reflection draws on coloring epistemologies and white supremacy characteristics to re-examine questions of how quantitative research paradigms can be challenged. Reflection on how the process and product of Martin and Garza's article changed the way the author thinks about her research and begins to raise points of conversation for white researchers engaged in quantitative and mixed methods work.

Keywords: quantitative methods; bias; research paradigms

The first article published in *Studies in Engineering Education*, "Centering the Marginalized Student's Voice Through Autoethnography: Implications for Engineering Education Research," by Julie Martin and Chavone Garza (2020) is particularly timely. It was published against the backdrop of increased attention to the pervasive issues of racism in the United States spurred by the Black Lives Matter protests in the wake of the murders of George Floyd and Breonna Taylor (among many other cases less publicized; "#SayTheirNames," n.d.) and a global pandemic that disproportionately affects Black and Brown people. As such, a conversation about how engineering education researchers engage with marginalized students is essential. The authors pose valuable questions not only about the product of their research—scenes from Chavone's story—but also the *process* of research. The article also raises valuable concerns about deficit theorizing, centering marginalized voices through participation in research, and using research for change. To continue the conversation started by Julie and Chavone's article, I begin to process the question posed by the authors, "How might the process and product of this study change the way you think about your own research?"

Like Julie, I am a White woman and engineering educator. In my research, I explore how the culture of engineering shapes students' experiences and identities and informs their educational pathways. I often use quantitative and mixed methods to answer my research questions, and it from that perspective that I continue a conversation about how the process of research can consider asset-based approaches and center marginalized stories and perspectives. I write this from my own perspective, and I acknowledge that this approach may still result in the erasure or marginalization of Black people and others. I do not have all the answers to the points I raise. However, I hope that a description of how I am grappling my whiteness in quantitative research and my position in the larger enterprise of engineering education and higher education that is steeped in white supremacy is useful to others who are translating Julie and Chavone's work into their practice.

Scenes from Chavone's story compellingly illustrate how education systems "weren't made for [her]" (p. 11), and despite the forces working against Chavone, she succeeded. I do not believe her story is useful because it is an example of Black exceptionalism (and thus excuses the need to address the systemic racism highlighted in her experience). Instead, her story provides a resonant example that sticks; that is the power of her story. The product of this research has generated lingering questions about the experiences of students in my classrooms and how I can create educational environments (curricula, rules, policies, interactions, etc.) that are anti-racist (see Long, 2020 for examples). This story also provides a starting point for engineering educators to face the realities that institutions of higher education and engineering were built to exclude, that we have complicity in their persistence, and that we must be intentional to create change (Holly, 2020).

While the product of the research is an important outcome of this work, the discussion of the process of conducting research is unique. The authors pose important questions about the implications of this work framed in critical theory and

ethical validation (Walther, Pawley, & Sochacka, 2015). Chavone's reflections about the process of research on her agency and liberation reveal the value of this participatory process for the individual, and the results of an individual's story creates a larger call to action and an agenda for reform for all research, not just qualitative and critical theory work.

The answer to Julie and Chavone's question about how their article can change my research practice is to sit in and engage with the tension that has emerged between conducting research studying minoritized individuals, especially in quantitative methods, and my whiteness in the research decisions I make. It is in this tension that change and growth can happen in the products and processes of research. This tension is also uncomfortable, but if I choose not to engage with this tension racism will continue to be a normal and ordinary component of my research (Delgado & Stefancic, 2012). Below, I describe two approaches for engineering education researchers to engage in this process.

First, engineering education research epistemologies and designs should take up the process of *coloring epistemologies* (originally described by Scheurich & Young, 1997, with a response by Miller, 1998). This process calls for White researchers first to engage the rich literature by scholars of color and second to acknowledge the role racism plays in how dominant discourses are shaped. Our predominately white community must consider how racism has infiltrated every aspect of our work and "locate [our]selves in the tensions that characterize fields of knowledge" (Lather, 2006, p. 47).

Second, engineering education must address white supremacy as it manifests in our organizations. Okun (2000) described 13 characteristics of white supremacy culture that show up in organizations: perfectionism, a sense of urgency, defensiveness, valuing quantity over quality, worship of the written word, belief in only one right way, paternalism, either/or thinking, power hoarding, fear of open conflict, individualism, belief that I'm the only one (who can do this right), the belief that progress is bigger and more, a belief in objectivity, and claiming a right to comfort. Okun also offered antidotes to begin to address these characteristics. These antidotes were designed to address actions to change organizations and are not necessarily specific to research design and decisions. However, I leverage these anecdotes to offer some ideas for addressing issues raised by Julie and Chavone. These ideas are only a starting point rather than a comprehensive list.

The process of co-constructing rather than taking data from participants for research use is a challenging and important consideration of ethical validation (Walther et al., 2015). Engineering and historically engineering education has emphasized objectivity, value-free decisions, and dispassionate arguments with calls for rigor and an emphasis on quantitative research (Riley, 2017). More recently, a methodological diversity discourse has fostered the rise of qualitative research (Beddoes, 2014). However, there is often little translation between these paradigms. I believe that the process of qualitative research quality readily translate to quantitative research quality. As people who make and engage in every decision associated with research, a divide between the researcher's role in qualitative and quantitative research is artificial—what we choose to study, how we frame our research, what we choose to measure, how we analyze data, and what we choose to report are all influenced by the researcher and by the hierarchical social systems in which the research is situated (Oakley, 1998). We leave our research fingerprints all over our work. Few quantitative researchers have discussed and engaged with this reality.

This area is one where white supremacy still manifests unquestioned. The sense of urgency in getting research publications out the door (often to meet promotion and tenure expectations or reporting deadlines for funding agencies) and worship of the written word (through authorship on journal publications as the only scholarship that counts) create spaces in which taking data from participants for quantitative study is a relatively unquestioned practice. It is also aligned with meeting the "objective" norms of quality in rigorous research. In doing so, two other white supremacy characteristics emerge: power hording and paternalism. As experts, researchers center their power in the process of creating knowledge and believe themselves capable of making decisions for and in the interests representing those without power. Participants often do not know what happens with their data.

One way to begin to address these issues in studies where the number of participants is greater than a few is to share the results of studies with participants. At the 2017 American Society for Engineering Education Annual Conference & Exposition, Jo Walther and Nicki Sochaka described their practice of sharing survey results with students or instructors. With studies that collect identifiable data, an individual's responses and their meaning can be directly sent to each participant. In studies with anonymous data collection, general findings can be shared with the entire group that was sampled or students could provide contact information that was not linked to data. Additionally, this process of sharing could invite students to respond or provide input to the data shared. This action can help to decenter some of the power associated with the researcher as the objective, decision-making expert. While sharing data does not change the nature of quantitative data collection, it does take a step to engage participants and decentralize some white supremacy characteristics. One consideration in engaging in this process is the impact of findings on the individual. For example, it may cause harm to report that a minoritized student has less motivation than their peers without considering the context in which measurements are conducted (a white supremacist culture). The ways in which results are used and communicated should be aligned with asset-based approaches.

Additionally, the positionality and influence of the researcher should be a central consideration rather than being treated as an issue that undermines the supposed objectivity of quantitative research (Hundleby, 2012; Sprague & Zimmerman, 1989). It is accepted practice to include positionality statements in most qualitative research studies. I argue that it is equally

important to include a positionality statement in most quantitative research studies, and I have begun to do so with recent work (Godwin & Boudouris, 2020).

How engineering education constructs are measured can engage in either/or thinking about student responses on quantitative measures or objective measures of test scores, grade point averages, and so on. This white supremacy characteristic manifests in trying to simplify complex phenomena into simple measures; for example, believing that poverty is simply a result of lack of education. The use of measurement to make conclusions or policy decisions must move away from either/or thinking and treating demographic variables as causal reasons for group differences (Holland, 2008). Often, quality in quantitative measurement is considered in terms of validity (i.e., Does the measurement accurately capture the reality studied?) and reliability (i.e., Does the measurement consistently capture the reality studied?). More recent discussions of quantitative validation also include fairness as a quality criterion (Douglas & Purzer, 2015). Fairness considers the construction of measures as accessible for all students; the administration of measures; the scoring of measures, especially assessment; the comparison of results across students; and the use of measures to make conclusions and policies (Dorans & Cook, 2016). However, few engineering education quantitative studies consider this quality criterion (Douglas, Rynearson, Purzer, & Strobel, 2016), thus maintaining the status quo. It is important to not only consider how measurement functions for students in general, which reflects a White and masculine majority, but also for minoritized students through techniques like measurement invariance and the development of measures with input from these students.

Another tension is how to decenter White supremacy characteristics in quantitative research methods. You might consider this goal naïve or impossible, but I am hopeful that continued conversation can create new ways of framing and conducting quantitative research. Often qualitative research critiques quantitative research as promoting and preserving limited or problematic narratives of human experiences and identities, and quantitative research critiques qualitative research as not generalizable (which is not the purpose of qualitative research) and unable to examine casual mechanisms. I believe that this dispute, while having several points of merit, detracts from the goal of decentering whiteness.

Some quantitative methods can answer particular questions that cannot be answered with qualitative methods and they can move beyond postpositivist epistemological framings, that is, the belief that reality can be known within some degree of certainty (Godwin et al., 2020, 2019). While postpositivism acknowledges the role of other potential factors, it still maintains a commitment to measurement and observation (i.e., so-called objective sources of information; Reed, 2010). Recent methodologies of QuantCrit and FemQuant (see McCall, 2001; Oakley, 1998; Sprague, 2005; and a special issue by Gillborn, Warmington, & Demack, 2018) decenter objectivity; engage in reflexivity and intersectionality; and frame neutrality and domination as unnatural and socially constructed. These new epistemological and methodological approaches can support the process of *zooming out* to consider not only the individual student in quantitative work but also the to understand how the culture of engineering underlies the student experience (Secules, Gupta, Elby, & Turpen, 2018). Additionally, person-centered analyses, as methods, challenge assumptions about group homogeneity, variable effects, and the generalizability of conventional inferential analyses (Eye & Wiedermann, 2015). Often marginalized students' responses are erased by using average values (which are dominated by White men) or treated as outliers in the spread of the data. Person-centered analyses can begin to represent responses of marginalized students holistically by simultaneously understanding each student's response and the larger data trends.

However, even in simple and traditional quantitative studies, the role of White supremacy can be challenged through an open acknowledgment and discussion of its role. Silence creates the space in which White supremacy thrives (DiAngelo, 2018). Methodological silence will continue to re-create Whiteness in studies and conclusions. My argument is not that traditional statistics or quantitative studies should be abandoned, as I believe they still have value in answering particular types of questions, but rather that research decisions need to be critically examined and discussed.

For example, in a study to understand the experiences of marginalized students, a typical approach might be to use a survey to collect data about students' feelings of support in a College of Engineering. Students' responses identifying as Black, Latinx, or Indigenous may be compared to White and Asian students' responses using basic inferential tests. The results of this study could indicate particular areas in which, in general, Black, Latinx, or Indigenous students may feel more or less supported and provide ways for the college to allocate additional resources. This outcome is valuable and provides actionable steps to support students in the raced, classed, and gendered context of engineering. A quantitative approach to answer this type of question can result in a systematic study to quickly identify areas for focus.

Many decisions within this example may connect to white supremacy characteristics and can be discussed to work against methodological silence. First, the tools for data collection may not reflect the experiences of marginalized students, which can bias results in one-to-one comparisons; that is, students' responses to the measurement tool may be due to differences in interpretation of the items or the use of the scale rather than actual differences. Published valid measures, while having merit, may not be designed for their re-purposed use and should be critically evaluated. Second, comparing marginalized students to the normative category of White and Asian has embedded assumptions. One assumption is that the majority is the standard from which all other experiences are judged. Another assumption is that the experiences of marginalized students as a whole are the experiences of the individual. This approach does not take into account the layered effects of

race, class, and gender in hierarchies of oppression (Bilge & Collins, 2016). Finally, basic inferential tests rely on the central limit theorem and comparisons of averages between groups. As such, these statistics require sufficient sample sizes and use probability to determine significance rather than the lived experiences of the individual. The (mis)use of these results can either perpetuate White supremacy or highlight areas to challenge it. Ultimately, it is the role of the researcher both in the process of conducting research but also in its characterization and use that shapes the potential of quantitative research for change. These issues do not make this study invalid but emphasize areas in which quantitative studies must consider their adherence to White methods and discuss them (Zuberi & Bonilla-Silva, 2008).

This response is not a prescriptive way to address the critical implications raised by Julie and Chavone in quantitative research. Rather it reflects my ongoing engagement with this question. My thinking is evolving and has been shaped by conversations, both in literature and in person, with scholars of color. I do not have solutions but raise examples for further discussion in the engineering education community. Ultimately, the discussion of asset-based approaches and centralizing marginalized students' experiences is not only for autoethnographic or "small n" (Slaton & Pawley, 2018) studies but also for engineering education research as a whole. I echo and concur with Julie and Chavone's statement, "We understand that this will be difficult and messy. You will make mistakes. We urge you to do it anyway" (p. 16). Speaking to White researchers, I encourage you to challenge the White supremacy characteristic of a right to comfort. Discomfort is an essential part of growth and learning. We can engage in the discomfort of sitting in the tension of our roles and decisions as researchers through coloring epistemologies, identifying and challenging White supremacy characteristics in our work and practice, and asking difficult questions about our role in racism. I am working through these questions as well, and I hope we can continue to do this as a community.

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The author has no competing interests to declare.

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