

Lived Experiences and Literature Reviews: Leveraging Experiential Knowledge in STEM Education Doctoral Studies

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Abstract

Writing a doctoral dissertation is a daunting task under the best of circumstances. Students must organize and synthesize their research and academic knowledge to make a compelling case for why their research matters and why their results are sound. In STEM education, a significant part of the dissertation is an extensive literature review leading to a conceptual or theoretical framework that guides the research. Enculturation into doctoral work in education research typically includes learning to use academic language and to eschew personal anecdotes in favor of published research findings. Yet most education researchers ground their interests in problems they have observed or experienced. That is, our lived experiences drive our research interests. For those within the dominant culture, others have likely observed, studied, and published about the same problem and situating the lived experience within prior literature is relatively straightforward. For those outside the dominant culture, there may be few prior studies addressing the observed problem and those studies that are tangentially relevant may miss key constructs of interest. In this paper, we challenge the cultural norm of allowing prior literature as the only acceptable form of evidence when establishing the context and framework for a study. Moreover, we posit that disallowing lived experience as a valid form of evidence in contextualizing a study has the potential to do active harm to emerging scholars from marginalized groups. Since it is nonetheless important to make connections to existing literature and to become part of the scholarly conversation about STEM education research, we suggest ways to balance these forms of evidence.

Introduction

The vast majority of STEM education research, until very recently, has been framed within the norms of a culture developed by and for cisgender, able-bodied, heterosexual, upper-middle-class white men. The authentic experiences of individuals of color; members of the LGBTQIA+ community; people with mobility, visual, auditory, or neurological diversity; from lower socioeconomic backgrounds; or combinations of these are not reflected in the vast majority of research. When such studies do exist, many primarily focus on performance outcomes, often with deficit framing, and with little or no attention to issues of intersectionality.

So what happens when your lived experience or research area is one that has not been studied or is only starting to emerge as a field of study yet is the very reason you are a graduate student in the first place? What happens when your lived experience is the foundation of your research focus and you cannot find any relevant literature to support that focus? These questions are the motivation for this manuscript which seeks to put forth a theoretical and personal account for how we as a field can question our normative practices for literature reviews. This challenge of literature reviews has significant implications for professional identity development and for theories of graduate student socialization which themselves rely on long-established cultural norms and academic practices that do not account for this dissonance.

Throughout this manuscript, we share insights in the form of our personal experience as it relates to literature reviews and graduate education. Our experiences are those of two doctoral

students and two faculty mentors from marginalized groups at different stages in their academic journey. These stories are cast as vignettes with the hope of finding a balance between honoring our lived experience and grounding it in limited or absent literature. We discuss the role of feedback and mentoring from instructors, advisors, and committee members on the development of a researcher identity and sense of inclusion into the academic community. We also share strategies we have developed in navigating the balance within our own work and in support of peers. The two faculty mentors share how they are learning to provide feedback that empowers students to connect to existing literature in an authentic manner while validating their lived experiences. We situate these vignettes within relevant literature to problematize the nature of literature reviews in STEM education.

Vignette#1 (SB, Third-year Phd Student): I've thought about this quite a bit. Am I not doing enough work to find the literature? Does what I'm seeking even exist? What will my advisors and peers think about me if I am unable to find literature that supports my claims? Why isn't my lived experience enough to support my claims? How is it ok for me to interview a peer and justifiably put their experiences in my work but not be allowed to personally speak to what I know to be true? These are just a few of the questions that come to mind as I've tried to grapple with this doctoral journey of feeling lost while trying to complete assignments. Who decides what's acceptable and what's not, and why do they get to decide? Can the rules be changed to meet the growing needs of the academic community? Who am I fooling? Yes! Yes, the rules can be changed because that is exactly what happens when dominant groups want change. So, the question becomes, what would it take to update the rules of academic writing?

In many respects, I have accepted the mere fact that education was not intended for people like me. As a Black woman from a low-income background who became the first to graduate from college in her immediate family and now the first in her family to pursue a Doctor of Philosophy, it has most certainly been difficult to maneuver through an education system of a country that didn't value me and people who look(ed) like me as human. I would be remiss if I didn't acknowledge the United States' attempt to keep Black and Brown people and women illiterate. In my opinion, this is what makes it so difficult for academia to accept lived experiences from authors as valid, legitimate, and necessary claims. We've been conditioned to do things the "right" way, and for me, that translates to doing things the "white" way. Not to mention, there are many Black and Brown folx¹ who've attempted to do this work but were unsuccessful in landing their work in popular journals, thereby creating yet more obstacles for people like me trying to shed light on experiences similar to my own.

The first year of my doctoral journey was very lonely. Though other students were present, it felt like I didn't fit in. To my knowledge, I'm the first Black woman in my program and have been solo for the entire time. I'm pleased to know that at least one other Black woman is joining the program this fall, but I can only pray that she doesn't feel as lonely as I did. There were times when I didn't catch cultural references and times when no one understood my references and illustrations. This led to me minimizing/suppressing my personality to cope with the pain of loneliness. While I no longer feel the loneliness I felt a few years ago, the research process feels lonely in that I cannot find existing literature that supports my research interest and/or directly speaks to experiences like mine. Moreover, while peers are moving forward with their work, I find myself working much harder to support claims. The literature

isn't there, our experiences don't count, and yet, we are still required to produce a product that is nearly impossible to do without telling our stories.

Though this work has been difficult to navigate, I have found ways to cope and persist. One coping mechanism has been to minimize my desired work by staying within areas where literature already exists. A more productive approach is explicit communication with my advisor and instructors. They have listened and provided guidance on how to maneuver a system that wasn't designed to confront diversity, equity, and inclusion work by a Black woman scholar. Additionally, I utilize our campus librarians to ensure I have done a thorough search before totally giving up on literature searches. I have also leveraged relationships with peers doing similar work and engaged in meaningful conversations about our lived experiences. Finally, I made sure to surround myself with people who valued me and the work I have sought to undertake. Having such support makes this doctoral journey bearable and worthwhile.

¹We use the term "folx" rather than "folks" deliberately as gender-inclusive terminology to explicitly signal the intentional inclusion of commonly marginalized groups.

Theoretical Grounding

In the next section of this manuscript we highlight Socialization and Professional Identity Development, and Graduate Student identity to help motivate and provide context for issues related to literature reviews and academic enculturation. We then draw on Critical Race Theory as a lens to problematize the structures around literature reviews and suggest alternative approaches to supporting minoritized STEM Education graduate students in their academic journey.

Socialization and Professional Identity Development

Concerns over high attrition rates in graduate school are long-standing (Lovitts, 2001; Golde, 2005; Gardner, 2009), as are concerns over whether current models adequately prepare graduate students for success in academia (Austin, 2002; Austin & Sorcinelli, 2013; Gardner, 2008). Many efforts to study and address these concerns are grounded in socialization theory, the idea that success in a discipline comes from, "the acquisition of the specialized knowledge, skills, attitudes, values, norms, and interests of the profession" (Bragg, 1976, p.6). Programs such as Preparing the Professoriate, begun in 1993 at a handful of schools and now widespread, include deliberate program elements for socialization into the academic discipline. These programs typically provide enhanced mentorship with an established faculty member, development of research and teaching knowledge, and interpersonal skill development (Austin & McDaniels, 2006).

The process of socialization is intricately connected to the formation of professional identity for graduate students. Ronfeldt and Grossman (2008) describe the cycle of observation, experimentation, and evaluation that emerging professionals go through as they internalize messages about who they are and can be within the professional spaces of counseling, clergy, and teaching. Gallagher (2016) describes a similar process for mathematics graduate students. In these models, students observe the practices of professionals in the discipline, attempt to emulate those practices, and receive both direct and indirect feedback on their performance. Positive

feedback solidifies connection to the discipline and strengthens professional identity whereas negative feedback weakens professional identity and may contribute to departure from the field. Yet, there are serious critiques of such programs and theories that frame socialization as an assimilation into existing academic culture and practices that may marginalize women and racially minoritized individuals (Austin & McDaniels, 2006).

Vignette #2 (EG, Faculty Member):

Faculty members, by definition, succeeded in their own graduate programs and socialization into academic norms. And it's natural for us to want to pass on what worked for us. That's certainly true for me, and it hasn't been easy to come to terms with the fact that what worked for me might not work for everyone. In the late 1990s, as a white woman pursuing a PhD in mathematics, I participated in one of the first Preparing the Professoriate programs in the nation. The goal of the program was to prepare graduate students more deliberately to "hit the ground running" as new faculty members. For me, it worked. I started a tenure-track position at an undergraduate-only institution with a solid awareness of the cultural values, norms, and expectations for mathematics faculty members at that time. Additional formal mentoring in mathematics education allowed me to quickly learn and model the norms and values of education faculty members as well. I was promoted to associate professor and tenured with ease, racking up awards and recognitions along the way. My experience with explicit, formal socialization into a discipline also informed my mentoring of others. After all, it worked for me, so it must be good, right?

After departing academics for a while to be a stay-at-home mom, I restarted my research program with a focus on postsecondary STEM education. Starting back as an assistant professor on the tenure track, I had the opportunity for the first time to mentor doctoral students. With the best intentions in the world, I built formal mentoring processes to support socialization into the discipline of education research. As part of that, I had first-year students write literature reviews once a month to build their skills in finding and citing relevant research and in developing their academic voice. I found myself writing, "citation needed" and "replace anecdote with data" in the margins so often that I began to wonder what I was doing wrong as a mentor. My students helped me find the answer. What I was doing wrong was not recognizing how profoundly absent their own experiences were from the literature. They couldn't replace anecdotes with data because relevant data didn't exist in the literature. The closest citations they could add were indirect at best. And yet, they knew their statements to be true from their own lived experience.

As my research practice has shifted more and more into examining issues of diversity, equity, and inclusion in STEM, I have begun to question whether socialization into the discipline is really the right way of thinking about how to best prepare independent scholars. Do I really want to encourage students to adopt the knowledge, skills, values, and norms of the discipline if that means they have to silence their own voices when those run counter to, or aren't represented in, the existing body of literature? Or do I want to support a generation of scholars who can leverage their lived experience as they frame studies and explore underexplored issues? Do I want to add to the chorus of voices saying, "you don't belong" or do I want to say, "yes, teach me"? For me, the answer is clear. While I still might write, "citation needed," I am learning to check my own privilege and consider whether such a citation even exists, or

whether my student might need to be the one to eventually provide it for others. In the process, I hope the skills, values, and norms of the discipline shift to lift the voices of our emerging scholars rather than quieting them.

Graduate Student Identity and Literature Reviews

As STEM education scholars develop their professional identity through socialization, an early stage in this process is the development of their graduate student identity. Identity can be conceived as how an individual defines oneself as a “kind of person” (Gee, 2000). Research shows that graduate students’ research identity can be developed in three ways: performing research, thinking about oneself as a researcher, and being thought of as a researcher (Chen, 2014). The transition to graduate school is often a unique one. There are multiple factors that affect the experience of graduate students as they transition from their previous identities to the role of researcher and scholar. Our review of the literature paired with our personal experiences suggest that there are several factors that affect these three aspects of graduate student identity development.

First, students are more likely to develop a stronger graduate student identity when they feel more competent in their disciplinary and writing skills (Burt, 2014). In a study that investigated the impact writing had on graduate student identity, graduate students shared that they often feel ashamed of their work and compare themselves to their peers (Del Toro, 2017). Students were afraid to share their work in fear that other scholars would be able to identify their perceived incompetence. Our experience suggests that, for STEM education graduate students, the early observation-experimentation-evaluation cycles critical to identity development rely heavily on feedback from writing literature reviews. Furthermore, one of the major milestones of becoming a PhD candidate typically requires a dissertation proposal that centers an examination of past literature. Persistent messages of “citation needed,” particularly when the student has searched assiduously for citations that do not exist, may convey the message that the student does not belong in the academic space, contributing to departure from the field. This taps directly into the second branch of graduate student research identity: thinking about oneself as a researcher.

Second, faculty advisors play a key role in reassuring graduate students of their ability to produce “good work” and shaping how much students perceive themselves as researchers. Graduate school coursework and the journey through graduate school is commonly categorized as rigorous and challenging. The presence of mentorship and faculty support is a key contributor to the success of graduate students, particularly those from marginalized groups (Borum & Walker, 2012, O’Meara et al, 2017). Underrepresented and racially minoritized (URM) students often struggle with their sense of belonging in graduate programs (Borum & Walker, 2012, O’Meara et al, 2017, Shahjahan & Baker, 2009). They report that faculty advisors often have low expectations for their work and apply stereotypes rather than providing needed support. This in turn leaves them feeling unwelcome in their graduate programs which negatively contributes to their graduate student identity. The strength of one’s professional network and quality of mentoring experiences impacts graduate students’ sense of belonging (O’Meara et al, 2017).

Third, graduate student identity is multifaceted, discipline-specific, and influenced by prior educational experiences. For instance, engineering identity is different from science and

math identity as it refers to both a discipline and profession (Eliot & Turns, 2011). Research shows that many students develop their STEM identity during their undergraduate experiences. Students who matriculate into graduate programs with an undergraduate degree outside their intended program have comparatively lower STEM identities (Choe et al., 2017). Like graduate student identity, graduate student STEM identity can be developed through skills acquired from coursework and faculty advisors (Burt, 2014). In an effort to operationalize these multifaceted identities, Choe and colleagues (2017) put forth a model that shows how research and engineering identity of graduate students are separate but are both affected by competence as a researcher and an engineer and by interest in the research topic and discipline of study. Further complicating this model are the intersections of racial, gender, sexual, and STEM identity. These complexities can easily contribute to students' motivations to persist in graduate school in STEM programs that have a traditional demographic make-up. The experience of the “only one” graduate student is real and relevant (Borum & Walker, 2012). We turn to the work of critical race and intersectionality theorists to understand how these unique identities also produce unique experiences related to the doctoral journey.

Vignette #3 (SD, second-year PhD Student): As a Black, Haitian-American female, I find it hard to wholly identify with one model of intersectionality. My identity is affected by more than my gender or my race. The way I experience life is shaped by the nuances of who I am completely. The existing literature does not speak on my complete experience. It captures bits and pieces. This is the very preface of my motivation to become an education researcher. Identity is so complex and plays a huge role in lived experiences. When writing a paper or drafting a statement, it becomes difficult to detach my not yet supported experiences from my supported ones. If there is not a strong literature base that studies Caribbean-American experiences in American STEM education, am I not supposed to include my own? Should this positionality be ignored?

My experience in graduate school has been shaped by my previous experiences in undergrad. In the short time as a graduate student my greatest struggle has been situating myself in the literature that exists. My story has been the greatest motivator of my decision to come to graduate school. As I begin to conduct my own research and take classes, I've tried to find ways that my experience can be validated in research. The struggle I've come to find is that the research to validate my experience doesn't exactly exist at this time. Although the research on experiences of unique minorities is growing, there are still notable aspects of my experience that I want to reference. In the current research climate, that experience can only be referenced if I've conducted my own study on my experience. This is the crossroad that I find myself at. This struggle to validate what I hold to be true with literature that does not yet exist can be discouraging.

Coming from a technical background I was never really afforded the opportunity to highlight the ways in which my identity made my viewpoint unique. Most of the writing I did in undergrad was about traditional electrical engineering topics. Social justice issues and culture were seldom topics of influence or conversation. I was trained to only bring out those differences when vying for an opportunity. That seemed to be the only time it counted. The transition to engineering education has been an uncomfortable one. For six years I noticed microaggressions, racial and gender disparities, hardships faced by specific groups, emotional

turmoil around government elections, and lack of representation at my undergraduate university but had never found the forum in my engineering space to discuss them. Bearing this experience in mind, I hadn't realized that I had trained myself to exclude the identities that made me unique when I was doing "real work" and not in an interview. Entering the Engineering and Science Education space as a graduate student, I've been exposed to an area of study that gives way to my cultural identity and values the effects and implications they have on my identity as an engineer. However uncomfortable this transition is, it has opened me in ways I had not known was possible. I find myself constantly making connections between my experiences and theoretical frameworks found in STEM education that I wish I could highlight in my writing.

In the last two years I have relied heavily on my black female identity to position myself in my work. I have come across some papers that include the experiences of Black students that do not identify as African American, and this has truly helped me find a space that I can relate to. I remind myself of my whole identity and have found ways to integrate who I am into class discussions. I find that consistently acknowledging my own different perspectives and sharing them in class by making relevant connections helps me to shift my training of only seeing my differences as tools for career advancement. Moving forward, I want to look towards other areas of study such as education or psychology that may highlight stories of Caribbean students in their literature. Although they may not highlight their experiences in STEM, it will be a great building block to present my own experience.

Critical Race Theory as a Lens into Citation Practices

Critical Race Theory (CRT) is a movement wherein academics and activists collaborate to study and transform how race and racism functions in society (Delgado & Stefancic, 2017; Yosso, et al., 2009). It uncovers power structures rooted in racism and accentuates the effects of systemic racism in various aspects of the United States. CRT has its underpinnings in radical feminism and critical legal studies and surfaced after scholars and activists noticed a stall in the Civil Rights Movement (Delgado & Stefancic, 2017; Ladson-Billings, 2009; Yosso et al., 2009). CRT made its initial appearance in education when scholars expressed doubt about the 1956 Brown vs. Board of Education ruling (Ladson-Billings & Tate, 1995). Derrick Bell believed the ruling pushed an agenda that benefited white elites of the country rather than the educational well-being of Black people, a phenomenon Bell (1980; 1995) referred to as interest convergence.

In much the same way, traditional citation practices and the manuscript review process benefit established scholars often with privileged identities (Mott & Cockyane, 2018). For example, the American Society of Engineering Education (ASEE) author's kit for paper submissions discusses citation guidelines almost exclusively as it relates to issues of plagiarism or redundant self-publication. At face value these guidelines seem appropriate and necessary. However, consider the ways in which these guidelines promote interest convergence for established scholars to protect against intellectual theft those whose "original" research has benefited from the marginalization and exclusion of a more diverse pool of emerging scholars. These guidelines also further entrench the notion that citations are used to establish paper authority by referencing the reader to external validation (University of Wisconsin - Whitewater, 2021) as the sole source of credibility. For emerging scholars whose experiences run counter to established literature, these guidelines serve as further exclusion from the professional space.

Citation styles themselves evolved to privilege brevity in the flow of text at the expense of detail about authors (Connors, 1998; 1999). These practices contribute to continued gender bias in the perception of who counts as a researcher particularly in STEM fields (Bond, 2020). Citing papers by number and relegating author names to a bibliography at the end of the document dehumanizes the contributions of the authors and obscures the connection between research and person.

Yosso and colleagues (2009) shared five tenets of CRT identified by Solórzano (1997) that can help scholars delve into inequitable issues in education. We will discuss three that are particularly relevant to this work: centrality and intersectionality of race and racism, critique to the dominant ideology, and centrality of experiential knowledge and counter-storytelling. The first tenet indicates that race and racism are centralized and intersect with other forms of subordination such as class, language, sexuality, gender, etc. (Yosso et al., 2009). The stance is that race and racism are endemic and will always be part of the U.S. society (Delgado & Stefancic, 2017; Yosso et al., 2009).

Similarly, we contend that traditional citation practices and literature reviews are engrained in racist gatekeeping practices (Ray, 2018). For example, Chakravartty and colleagues (2018) noticed a lack of non-white scholars in citations. After analyzing 12 peer-reviewed communication journals, Chakravartty et al. (2018) found that non-white scholars made up only 14% of authorship (746 out of 5,262) from 1990 to 2016. Similar studies are emerging in STEM education showing discriminatory acceptance and citation practices for racially diverse author teams (Lerback et al., 2020; Murray, et al., 2019). There are many factors that are attributed to this lack of authorship diversity in publication, some of which are inherently tied to systemic exclusionary practices. For instance, editorial boards have high proportions of white scholars (Roberts et al., 2020), women of color are more likely to receive desk-rejects (Williams, 2020), and scholarly work that addresses issues of diversity is often held to higher standards than non-diversity-focused scholarly work (Stanley, 2016). Taken all together, the limited nature of prior studies makes it extremely difficult for STEM graduate students from underrepresented identities to produce literature reviews in their respective areas of interest. Moreover, as we attend to intersecting identities we encounter the unique problem of confronting multiple forms of discrimination and marginalization. Delgado and Stefancic (2017) define intersectionality as overlapping traits or interests that attribute to isolated experiences. For example, a Black woman may have a different experience than one who is a white woman or a black man. Her intersecting identities make her experience with both racism and genderism distinct when compared to someone without intersecting identities. As we account for the complex nature of intersectional identities in literature reviews, we further narrow down the corpus of prior studies available to support research driven by the lived intersectional experiences of emerging scholars.

A second tenet of CRT is the critique of the dominant ideology, challenging assertions of race neutrality, colorblindness, and equality of opportunity (Yosso et al., 2009). Race neutrality conveys the illusion that each race has homogeneous experiences and are innately neutral (Ladson-Billings, 2009). This idea is debunked by the mere fact that Black and Brown scholars have been historically excluded from major journals. In fact, some publication guidelines were amended to account for racial and gender bias by requiring blinded submissions (Cressey, 2014). Blinded submissions leave room for equitable reviews with less bias and increased journal

acceptances. Colorblindness asserts that, regardless of one's race, all people should be treated equally (Delgado & Stefancic, 2017). A colorblind mentality in academia contributes to the perpetuation of few scholars of color doing race-related research since it puts forth a narrative that race does not matter. Finally, equality of opportunity asserts that everyone be given the same opportunities for advancement, notwithstanding one's race (Bonilla-Silva, 2014). As one may guess, an historically oppressed people cannot possibly be given the same opportunities for advancement if they are already starting behind their oppressors. The same can be said for citation practices and the dismissal of lived experiences as acceptable forms of literature. Scholars of color and those doing diversity, equity, and inclusion (DEI) work have found themselves playing a game of "catchup" after obtaining access to the academy (Gregory, 2001). Their resilience has led to scholarship that has pushed back against the dominant ideology and fought for their place in academia (Cooke, 2014), which leads to the social justice tenet.

A third tenet of CRT is the centrality of experiential knowledge and counter-storytelling which accentuates the voices and lived experiences of Black and Brown people (Delgado & Stefancic, 2017; Yosso et al., 2009). Further, it acknowledges the experiences of people of color as credible, relevant, and germane to the comprehension, analyzation, and education of and about racism (Carrasco, 1996; Delgado Bernal, 2002; Yosso et al., 2009). CRT scholars use the stories of people of color and other marginalized folk to counter the dominant narratives that have been ever so present throughout history and persisting to this day.

Vignette #4 (MV, First-Year Faculty Member): How can I advise and support students in the literature review process when my own privilege and enculturation into academia influences what I consider general knowledge, research evidence, and claims needing citation? I ask this question in the broadest sense because it was (in part) the motivation for this paper. As a new faculty member providing feedback and support on student conducted literature reviews and manuscripts, I was consistently adding the comment "citation needed." As a white, cisgender man with many societal privileges I started reflecting on why I felt certain sentences needed citations to make the claim "stronger" or "defensible" to the reader. Was I perpetuating whiteness? In one instance I asked a student to provide citations claiming that Black communities experience higher levels of poverty to show that it was evidence based. Was I discounting the lived experience of women of color who were making claims about racism and systemic inequity? How do I support students to "play the game" and get their manuscripts accepted into academic outlets that often function as spaces of whiteness and masculinity? You may see that I was left with a lot of questions and not a lot of answers.

In response to this introspective anti-racism work, I spent time reflecting on my own academic journey and how I encountered similar or inherently different responses to my research. My doctoral research focused on the experiences of Queer students in undergraduate mathematics programs. This work was personal and deeply emotional since I identify as a Gay man who has pursued advanced degrees in mathematics. I can recall struggling to conduct a literature review of the topic since existing research was limited and I had to draw on related studies in gender and race issues in STEM Education. As an emerging scholar still understanding the field this task presented additional cognitive focus and energy on top of the design and implementation of the research study. I felt more pressure to theorize and conduct a high caliber literature review since it would be one of the first in the area and I did not want to "let my community

down” or open it up for attacks. I can recall criticism of the work feeling deeply personal, so much so that it seemed people were attacking my identity as they asked questions about the research. I share this experience to help illuminate the challenges that marginalized students have when conducting research that may serve their communities. How can we make this process easier for them? How do we rethink the gatekeeping practices of literature reviews and academia overall to broaden participation from the most marginalized in STEM education?

Discussion and Implications

One of our aims in writing this manuscript was to trouble, perturb, and re-examine the ways in which literature reviews and current citation guidelines may marginalize, devalue, or put additional cognitive burden on scholars who are not from dominant groups. As you are reading this manuscript you may be asking yourself: where is the data? Where are the traditional scholarly methods? Why are personal narratives interjected into the writing? If you are asking yourself these questions, then we have achieved our goal! We hope the reader is left questioning what should be the best practices for citation guidelines. Furthermore, we hope that you as the reader have a deeper understanding for how literature reviews can serve to isolate and make students and scholars feel invisible.

Taking a non-traditional approach to such a manuscript does not come without risks and pushback. In fact, this has been an emotional journey but also a learning experience for the authors on this manuscript. When we submitted the abstract for consideration to share our stories and interest in presenting this topic, we were met with reviewers who saw our effort as “editorial” and we should construct a “proper abstract.” A reviewer deemed our abstract as, “a complaint against having to do the work” and “doesn't buy it.” Ask yourself how these words are othering for minoritized scholars who are sharing their perspective and data of their lived experience. While we are grateful for the reviewers for their perspective and expertise, our research team felt this only further drove our point that lived experiences are not valued as evidence within our community. If a STEM education researcher were to interview the authors of this work, the results of their analysis would be deemed proper and scholarly. Yet our daily lived experience, our constant observation, reflection, and analysis of our surroundings are somehow deemed only editorial. This is not to say that we do not promote thorough, rigorous, and defensible research paradigms; however, we want to trouble the idea of what counts as evidentiary support in framing the context of a study when existing research and literature have yet to emerge. We want to problematize the normative practices within our discipline which continue to center the experience and research both on and for white straight men.

Our shared experience in navigating this issue has led us to some partial recommendations for practice. Graduate students facing a lack of directly relevant results in the STEM education literature may find that valuable expertise can be drawn from other fields. Reaching out to supportive faculty members, research librarians, and peers in other departments may uncover pockets of literature that might have otherwise remained hidden. A bonus to this approach is that it may allow the scholar to become a bridge between disciplines by applying one body of work to a novel setting. However, this approach represents a significant additional investment of labor above and beyond that required of doctoral candidates researching more heavily traveled roads and there is no guarantee that it will yield fruitful results. A second approach for graduate students is to modify their research direction to situate it solidly within

existing literature. We find this approach to be problematic as it perpetuates existing exclusionary practices and skews the literature base even further away from non-dominant groups. A third approach, and one that we ourselves are attempting to model, is to balance lived experience with existing literature. That means accepting lived experiences as a valid form of evidence for context, conducting a thorough literature search for the research interest, and using the lived experience as a lens for organizing, synthesizing, and challenging the existing body of work. This balanced approach provides a valuable tool for identifying gaps in current research and pushing back against systems of oppression. It also, however, requires a relationship of trust and open dialogue between mentor and student. To find the “right” balance -- as opposed to the “white” balance -- mentors may need to interrogate their own reliance on normative practices of which they may not be fully conscious.

Conclusion

Research interests are driven by lived experiences, yet the research interests of those doing DEI work may be curtailed if citation practices fail to deem lived experiences credible. We maintain there is value in existing literature and lived experiences and that leveraging both produces high caliber scholarly works. Much of STEM education research has been shaped by dominant norms, making it difficult for cultural differences to manifest. This piece offered lived experiences of STEM education doctoral students and faculty from a diversity of marginalized groups in the form of vignettes to raise awareness and encourage students and faculty with similar experiences. Drawing on CRT, we discussed how socialization and professional identity can potentially hinder authentic graduate student identity development. STEM graduate student identity requires feelings of competency, reassurance from advisors, and prior knowledge. CRT was used to shed light on the absence of DEI literature and devaluation of prior knowledge of those doing DEI research. We aimed to disrupt dominant norms and call attention to the real experiences of graduate students struggling to balance between what is grounded in literature and what they know to be true through their experiences. Nevertheless, graduate students, especially those in STEM disciplines, must persevere by using resources and capitalizing on support from advisors. It may also require searching for literature outside of one’s field. Where possible, STEM graduate students should challenge the standards and encourage others to do the same. Advisors should help their graduate students find confidence in their voice and value the competence of their lived experiences by encouraging them to share in manuscripts when warranted. Finally, citation guidelines and literature review standards should be revisited to account for lived experiences in ways that highlight voices from marginalized groups, as well as provide room for DEI work to exist without bias in publication selections. If the academy moves forward without addressing citation and literature review barriers for STEM education researchers from marginalized identities and/or those doing DEI work, graduate programs may risk losing enthusiastic scholars, and graduate students will continue experiencing unnecessary developmental impediments towards their professional identity.

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