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PATCHWORK: METHODOLOGICAL AND THEORETICAL BRICOLAGE IN STEM GRADUATE EDUCATION RESEARCH

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Black American quilters have historically crafted masterpieces from remnants of cloth—telling stories, sharing knowledge, and preserving history in their quilts. As a quilter stitches pieces of fabric together to tell stories and create new images, so too does the qualitative bricoleur with theory and method. Researchers, as bricoleurs, utilize multiple theories and/or methods to "uncover new insights, expand and modify old principles, and reexamine accepted interpretations in unanticipated contexts." Bricolage—the product of the bricoleur's labor—has the potential to inspire theoretical and methodological innovation in STEM higher education research. In this article, I describe applications of theoretical and methodological bricolage to my investigation of whether and how the spiritual epistemologies (i.e., ways of knowing) and ontologies (i.e., ways of seeing and being) of 16 Black Christian women in engineering served as cultural resources for them as they navigated their doctoral programs. The ways that I began to piece together different theories and methods to effectively answer my research questions reflected the sensibilities of a bricoleur, grounded in the cultural tradition of Black American quilting. Through this process, I yielded new theoretical and methodological insights that not only helped me answer my research questions, but also indelibly shaped my approach to qualitative research. I also offer implications for STEM education researchers seeking to engage in bricolage in their own work.

KEY WORDS: *theory and method, bricolage, STEM education research, Black women, graduate students, spirituality*

1. INTRODUCTION

When I first received a handmade quilt created by my great-aunt Hazel, I did not fully appreciate the work of art that it was. I somehow missed the vibrant colors, unique pattern, impeccably neat stitching, and whimsical nature of this particular quilt. Patches of paisleys, stripes, florals, gingham, cloudy skies, smiling crescent moons, and rich solid colors like crimson, forest green, and cobalt blue were seemingly discordant, but somehow all working together in the complex diamond patterning.

Upon rediscovering great-aunt Hazel's quilt recently, it was as if I was seeing it for the very first time. I traced my fingers along the stitches she labored over. My eyes danced across the geometric shapes she painstakingly cut and arranged until they satisfied her critical eye. Then I instinctively pulled back a corner—hopeful, expectant—and there it was. My great aunt's signature, stitched in red thread. Beautiful cursive, astoundingly achieved on sewing machine with the date 1999 underneath, twelve years after I was born. I suddenly understood how my mother felt as she fondly gazed upon her quilt

collection. They connected her to the women who made them. Reminded her of her childhood, listening to women talk and share stories as they engaged in their artistry. These quilts were evidence of the ingenuity, resourcefulness, and talent of the women in our family who took immense pride in the work of their hands. Though not a quilter myself, holding and admiring my great-aunt's work made me feel closer to her than ever before. My great-aunt used what she had to make something entirely new and beautiful; I do the same in my research and scholarship.

Black American quilters have historically crafted masterpieces from remnants of cloth—telling stories, sharing knowledge, and preserving history in their quilts (Wahlman, 2001). As a quilter stitches pieces of fabric together to tell stories and create new images, so too does the qualitative bricoleur with theory and method (Lincoln and Denzin, 1994). Bricolage—the product of the bricoleur's labor (Lincoln and Denzin, 1994)—has the potential to inspire theoretical and methodological innovation in STEM higher education research. Researchers, as bricoleurs, utilize multiple theories and/or methods to "uncover new insights, expand and modify old principles, and reexamine accepted interpretations in unanticipated contexts" (Kincheloe, 2001, p. 687). The process of conducting my dissertation research on the role of spirituality in the lives of Black women pursuing engineering doctorates (Morton, 2020b) encouraged me to explore different bodies of literature and bring together various theories and methods. In hindsight, bricolage had clear applications to my research process. I stitched together various theories (e.g., critical race theory and endarkened feminist epistemology) and methods (e.g., portraiture and photo elicitation) to help me better understand my participants' experiences and honorably tell their stories. This yielded new theoretical and methodological insights that not only helped me answer my research questions, but also indelibly shaped my approach to qualitative research. In this article, I describe applications of theoretical and methodological bricolage to my investigation of whether and how the spiritual epistemologies (i.e., ways of knowing) and ontologies (i.e., ways of seeing and being) of 16 Black Christian women in engineering served as cultural resources for them as they navigated their doctoral programs. The purpose of this article is to demonstrate how STEM education researchers can use bricolage to help inspire new methodological and theoretical insights in their scholarship. Moreover, I assert that bricolage has valuable applications for researchers pursuing not easily discernible answers to complex research questions, such as how spiritual epistemologies and ontologies may operate in the lives of marginalized students in STEM.

1.1 My Sewing Room: Positionality

As my great-aunt Hazel's handiwork reminded me, I come from a lineage of artists, storytellers, and creatives. Long before I learned the term bricolage, I saw it in practice. The women in my family piecing together their knowledge, experience, and expertise to create works of art. This ancestry, along with my lived experiences as a Black woman, Christian, former engineer, higher education professional, scholar, and poet has allowed me to find a sewing room of my own as a qualitative bricoleur.

While earning my Bachelor's degree in engineering, I relied heavily upon my faith to remain resilient in my educational pursuits. I also experienced marginalization first-hand in STEM contexts and have spent the entirety of my career in higher education striving to help historically underrepresented students navigate this terrain. Through my research, I aim to pursue dignifying, meaningful relationships with participants and uplift the stories of Black students who are persisting in STEM fields and the cultural resources they draw upon, such as spirituality, to remain resilient. While my participants and I possessed shared identities as Black Christian women and doctoral students, I was still somewhat of an outsider regarding academic discipline. Though I studied engineering as an undergraduate, I never experienced engineering graduate education first-hand. Thus, I reviewed literature regarding the experiences of graduate Women of Color in STEM fields to help inform my understanding of my participants' lived realities. Further, although all 16 of my participants identified with Christianity to some extent, they came from various denominations, including: African Methodist Episcopal Zion, Apostolic Pentecostal, Baptist, Catholic, Hebrew Israelite, Lutheran, Protestant, and nondenominational. While my Baptist upbringing and more recent nondenominational experience provided some context and shared understanding, I listened carefully to my participants' descriptions of their religious backgrounds to increase my knowledge of denominations less familiar to me.

Finally, my artistry as a poet inspired me to bridge my academic writing with the emotion, lyricism, and storytelling of poetry as I rendered authentic, moving portrayals of my participants. Spoken word poetry is an effective medium for me to process and articulate my thoughts, which translated well to research as I analyzed and synthesized my research findings. Furthermore, spoken word allowed me to creatively disseminate my research findings in a way that was accessible to audiences within and outside of the academy.

2. GATHERING THE FABRIC: THEORETICAL BRICOLAGE

Nora Ezell, a Black American quilter said, "I hardly ever buy material. I have a dear friend who may buy one hundred dollars worth of material to make a quilt. That's not what quilting is all about. Scrap quilts are the prettiest quilts, more so than the ones where people try to match all the pieces up" (Wahlman, 2001, p. 13). For quilters like Nora and my great-aunt Hazel, the fabrics they found and collected for their designs were integral to the craft of quilting itself. There was beauty in taking bits and pieces of used material to make a new quilt. The fabric was not only a medium for their creations but told a story as well.

Delving into the understudied topic of Black women's spirituality in engineering educational contexts, I knew that I would need to choose the fabric for my study carefully. The research questions guiding my dissertation study were complex as I sought to explore Black doctoral women's spiritual and scientific *epistemologies*—ways of knowing influenced by politics of power that determine who is believed and why (Collins, 2000)—and *ontologies*—ways of being and seeing the world (Shajahan, 2010).

Questions I sought to answer included how Black doctoral women in engineering understood and expressed their spirituality. I also was interested in how participants' spirituality helped them navigate challenges in their academic contexts and was implicated in their work as engineers, particularly in their problem solving and assessment of knowledge. Finally, I was curious if participants experienced conflicts between their spiritual and scientific epistemologies. To answer these questions, I needed to think deeply about my epistemological and ontological approach to research as informed by my lived experiences, spirituality, literature, and theory. As Kincheloe (2005) asserts, bricoleurs intentionally seek alternative ways of knowing to inspire new insights and ask new questions:

> *In their appreciation of epistemological complexity, bricoleurs seek out diverse epistemologies for their unique insights and sophisticated modes of making meaning. In this search, they gain provocative insights into epistemological diversity on issues of the relationships between mind and body, Self and Other, spirit and matter, knower and known, things-in-themselves and relationships, logic and emotion, and so forth. These insights allow them to ask new questions of epistemology and the research act (p. 329).*

Understanding my participants' spiritual epistemologies and ontologies also necessitated theoretical frameworks that centered the lived experiences and perspectives of Black women. Furthermore, I needed frameworks that addressed how power and privilege could be wielded to marginalize Black women in the field of engineering which is predominated by White men along with cultural resources Black women may use to contend with marginalization such as spirituality. Thus, I used pieces of Critical Race Theory, Black feminist thought, endarkened feminist epistemology, and critical religious scholarship to create my conceptual framework.

2.1 Critical Race Theory

Established in the 1970s by lawyers, legal scholars, and activists seeking to maintain the advances of civil rights legislation from the 1960s, critical race theory (CRT) offered a lens to examine how race and racism are implicated in the exercise of power and the oppression of marginalized people (Delgado and Stefancic, 2012). Although the tenets of CRT vary depending upon the context in which they are being applied, three tenets proved to be especially useful in unpacking Black women's racialized and gendered experiences in the field of engineering, which is predominantly occupied by White men. While the persistence of racism (Ladson-Billings, 1998) helped explain how legacies of racism could endure in Black women's contemporary academic environments, whiteness as property—how whiteness itself functions similarly to property in that it can be possessed, used, enjoyed, and controlled (Harris, 1993)—provided a starting point in describing how the prototypical engineer as a White man has value to which Black women are often denied access. Finally, counterstorytelling (Solórzano

and Yosso, 2002) encouraged my centering of Black women's voices in the research to disrupt dominant narratives that divorce science from spirituality.

2.2 Black Feminist Thought

Black feminist thought helped ground the study in Black women's ways of knowing, which emphasize the importance of lived experience as a criterion of meaning making and the role of dialogue in assessing knowledge claims (Collins, 2000). Lived experience confers credibility and believability to someone positioning herself as an expert on a particular topic—while in dialogue ideas are articulated and validated through conversation. In my research, I sought to understand my participants' lived realities in their engineering doctoral programs, along with their spiritual and scientific ways of knowing and being, by engaging in dialogue with them. Black feminist thought also includes a set of principles derived from the collective wisdom of Black women, referred to as ethics of care and accountability (Collins, 2000). The ethic of care comprises three components: personal expressiveness, emotion, and empathy. Personal expressiveness speaks to the value of individual uniqueness within Black communities. Emotion serves as evidence of the speaker's belief in the validity of her argument. Empathy refers to a Black woman's ability to see herself in another's experience and thereby better understand that person. The ethic of personal accountability refers to the expectation that a person is responsible for her knowledge claims, which makes that person's character, values, and ethics subject to evaluation (Collins, 2000). Enacting ethics of care and accountability allowed me to foster relationships that honored my participants' as knowers and experts of their lived realities.

2.3 Endarkened Feminist Epistemology

Endarkened feminist epistemology provided further insight into Black women's ways of knowing—including the unique intersections of identity and oppression—while also highlighting the importance of spirituality among Black women, particularly in resistance to oppression and pursuit of life purpose (Dillard, 2000, 2006). To explain her intentional usage of endarkened to describe this epistemological standpoint, Dillard (2000) wrote:

> *In contrast with the common use of the term 'enlightened' as a way of expressing the having of new and important feminist insights (arising historically from the well-established canon of White feminist thought), I use the term endarkened feminist epistemology to articulate how reality is known when based in the historical roots of Black feminist thought, embodying a distinguishable difference in cultural standpoint, located in the intersection/overlap of the culturally constructed socializations of race, gender, and other identities and the historical and contemporary contexts of oppressions and resistance for African-American women (p. 662).*

Additionally, endarkened feminist epistemology offered what Dillard (2006) calls a "methodology of surrender" which shaped my ontological and methodological approach to the study. The methodology of surrender calls for researchers to embrace love, compassion, reciprocity, and ritual in research (Dillard, 2006). Love required me to look and listen carefully to my participants to recognize their truths. Compassion entailed that I care deeply for and desire to bring joy to the women participating in my study. Reciprocity involved eradicating artificial boundaries that create distance between myself as the researcher and my participants, along with finding ways to give back to those who have shared their time and stories with me. Finally, ritual encouraged me to "[unify] the human and the divine," remembering that research is not only an intellectual pursuit, but also a spiritual one (Dillard, 2006, p. 85). Endarkened feminist epistemology's methodology of surrender (Dillard, 2006) allowed me to engage in a research praxis that was intentional, ethical, and humanizing.

2.4 Critical Religious Scholarship

Finally, critical religious scholarship deepened my understanding of the role of spirituality among Black people in resisting and transcending oppression. For example, Stewart (1999) asserted that resilience, resistance, and transcendence are inherent in an African American spiritual ontology. To survive the atrocities of slavery, Blacks in America relied upon spiritual ontologies to affirm their humanity and maintain hope for liberation. Black people's spiritual realities also gave them the capacity to achieve transcendence, or the "ability to extend beyond the misfortunes and constraints of their existential condition" (Stewart, 1999, p.32). Relatedly, Bridges (2001) wrote that African American spirituality is an "underlying and guiding force that enabled [Black] people to be resilient, to 'spring back into shape' with courage and dignity in the face of the intense cultural oppression experienced during four hundred years of white racism" (p. 166). Stewart (1999) also suggested that the spiritual ontologies that preserved the sanity of Blacks' enslaved forebears persist among Blacks today, particularly in light of contemporary racism.

My research is also informed by current scholarship on critical spirituality in education (Dantley, 2003; Giles, 2010; Scanlan, 2011) and specifically Black women's spirituality as they navigate professional contexts (Agosto and Karanxha, 2011; Witherspoon and Taylor, 2010). Dantley (2003) first advanced the construct of critical spirituality by bringing together critical theory and prophetic, African American spirituality. Within critical spirituality, "the element of critique and deconstruction of undemocratic power relations is blended with spiritual reflection grounded in an African American sense of moralism, prophetic resistance, and hope" (Dantley, 2003, p. 5). Other scholars such as Giles (2010) and Scanlan (2011) have built upon Dantley's (2003) work and examined the influence of critical spirituality on the lives and decisions of educational leaders. Regarding my research, this scholarship piqued my curiosity about how Black doctoral women in engineering may use their spirituality to challenge power within their academic and professional environments. Additionally,

Agosto and Karanxha's (2011) partial life history of a Black woman in academia demonstrated how critical spirituality can be a source of strength and resilience for Black women contending with racism and sexism in their professions. Similarly, in their study of four Black women principals, Witherspoon and Taylor (2010) highlighted how spirituality can equip Black women with defensive and proactive strategies as they encounter obstacles in their professional and personal lives. Taken together, this scholarship heightened my sensitivity to how Black women's spiritual epistemologies and ontologies could contribute to their resilience, resistance, and transcendence in academic environments.

2.5 The Fabric of the Study

Critical race theory, Black feminist thought, endarkened feminist epistemology, and critical religious scholarship not only helped frame my understanding of participants' lived experiences and ways of knowing, but also informed my epistemology and ontology as a researcher. This study was conducted from a critical, Black feminist, spiritual standpoint, which influenced the questions I asked, my analysis of the data, and decision-making throughout the study as it pertained to protecting my participants. For example, during the first interview with participants, I used principles from endarkened feminist epistemology to help guide the conversation. As previously discussed, endarkened feminist epistemology's methodology of surrender attends to the importance of love, compassion, reciprocity, and ritual in one's research. Thus, I asked participants how they took up these principles in their work and scholarship in engineering. For example, to discover what participants loved about their work in engineering, I asked participants what they valued about their engineering studies. Regarding compassion and reciprocity, I asked participants what motivated them to pursue their doctorates in engineering, as well as how their studies aligned with their personal values, which gave them an opportunity to discuss how their work potentially allowed them to help others and perhaps give back to their communities. Concerning ritual, I wanted to understand how participants' engineering work might be an intellectual *and* spiritual pursuit, which led me to ask participants if they had an overarching sense of purpose in their lives and how their work in engineering related to that sense of purpose.

Much like the fabric of a quilt, each of the frameworks for this study were gathered over time and thoughtfully selected. They also reflected my style as a researcher while helping me tell my participants' stories. Theoretical bricolage reiterates the vital importance of the theories and conceptual frameworks we as researchers use to guide our studies—they are the material our empirical quilts are made from.

3. CREATING THE DESIGN: METHODOLOGICAL BRICOLAGE

To the untrained eye, the patterning of Black American quilts may seem random, but to the skilled observer, the shapes and symbols commonly found in these quilts can be

linked to African textiles, traditions, folklore, and religions (Wahlman, 2001). While many Black quilters describe being inspired by dreams and childhood memories, the connections between the designs they create and those from Africa demonstrate that their artistic decisions are not idiosyncratic but informed by cultural knowledge and experience (Wahlman, 2001). The methodological decisions I make as a researcher are similarly influenced.

My use of portraiture as the methodology for the study was culturally informed in that it afforded me the freedom to be creative without compromising the integrity of the study design—just as Black quilters use improvisation to elevate an existing pattern. Portraiture encouraged me to combine "systematic, empirical description with aesthetic expression, blending art and science, humanistic sensibilities and scientific rigor" (Lawrence-Lightfoot and Davis, 1997, p. 3). Portraiture also emphasized the search for goodness in participants' experiences, which involved adopting an approach to inquiry that depicted actors' strengths with authenticity, integrity, and honesty leaving room for a discussion of weaknesses that is not pathologizing or deficit-based (Lawrence-Lightfoot and Davis, 1997). This approach was integral in uplifting the Black women in my study as possessors and creators of knowledge, while also giving them the space and opportunity to be vulnerable when expressing areas of insecurity in their spiritual and academic lives.

Additionally, Black feminist thought and endarkened feminist epistemology grounded me in a cultural understanding of research praxis, which in turn influenced the methodological moves I made. For instance, Black feminist thought emphasizes the importance of dialogue in Black women's articulation and assessment of knowledge claims, which encouraged me to consider how my interviews with participants could become more conversational. Further, my lived experiences of sharing, rethinking, and building upon ideas while in intimate conversation with a trusted sister-friend affirmed this methodological choice. Endarkened feminist epistemology inspired me to consider how I could extend love, compassion, and reciprocity to my participants during the interview process. For instance, as I interacted with the Black women in my study, I asked myself, "what can I do to make participating in this study a joyful experience?" or "how can I offer support, encouragement, or validation as participants share difficult experiences with me?" Questions such as these helped me engage in a more humanizing research praxis.

Kincheloe asserted, "sensitive to complexity, bricoleurs use multiple methods to uncover new insights, expand and modify old principles, and reexamine accepted interpretations in unanticipated contexts" (Kincheloe, 2001, p. 687). The ways that I began to piece together different methods and improvise within my study design to effectively answer my research questions reflected the sensibilities of a methodological bricoleur, grounded in the cultural tradition of Black American quilting. In my study, I drew connections between key elements of portraiture (i.e., context, voice, relationships, emergent themes, and aesthetic whole), data collection methods, as well as principles from Black feminist thought and endarkened feminist epistemology to create the study design.

3.1 Context

Context, in portraiture, is considered to be "a dynamic framework—changing and evolving, shaping and being shaped by the actors" (Lawrence-Lightfoot and Davis, 1997, p. 59). As I sought to learn more about participants' doctoral program environments and understand how context influenced participants' expression of their spirituality, I needed data collection methods that captured the dynamism of the spaces participants occupied when I could not be physically present. According to Denton et al. (2018), "the use of visual images in higher education research and practice can allow participants to illuminate their life experiences as well as otherwise taken-for-granted or invisible aspects of their institutions" (p. 24). Therefore, in addition to conducting three semi-structured interviews with each of my 16 participants over the course of six months (48 interviews in total), I also engaged participants in photo elicitation—the use of photographs to explore the meaning participants attach to particular topics (Denton et al., 2018)—and journaling. These photos and journals deepened participants' reflections about their academic contexts during interviews and provided valuable insight into spaces participants enacted, and did not enact, their spirituality.

After the first interview, I sent participants a series of prompts and requested that they take or provide existing photographs of spaces they frequented in their engineering schools and departments, where they felt the most and the least spiritual on and off campus, and personal photos they believed captured their most authentic selves. The principle of ritual in Dillard's (2006) methodology of surrender inspired me to learn more about places Black women in the study frequented because I believed the rituals participants performed in these spaces would provide insight into what made these spaces feel more (or less) spiritual. For example, one participant shared that her research lab felt spiritual in the evenings after her colleagues left because when she was alone, she would feel comfortable expressing her spirituality by praying, meditating, or practicing yoga. Performing these rituals without her peers present shifted the atmosphere of her lab and made it a temporarily spiritual place. In addition to the photo submissions, I also asked participants to draw timelines of when they worked through a difficult problem or situation while in their doctoral programs, and where spirituality informed the steps before, during, or after. Participants were then asked to write journal entries in which they described where the photos were taken and reflected on their choice to photograph these spaces.

Prior to the second interview, I reviewed participants' photo and journal submissions and developed a set of guiding questions for each participant. Then, during the second interview I re-introduced the photos the participants took, along with content from their journals, to further explore where, when, and with whom they felt most comfortable expressing their spirituality along with critical spaces where their spirituality and/or educational resilience may be operating in their pursuit of engineering doctorates. Personal expressiveness in Black feminist thought motivated me to include questions that were unique to each participant during the second interview. For instance, there was a woman in the study who loved listening to music and described it as one way she expressed her

spirituality. This led me to ask her what songs she would include in the soundtrack of her life. That question opened the door to a deeper conversation about the meaning and life lessons she ascribed to certain songs during key chapters of her life. Participants' engagement in photo elicitation and journaling was a pivotal part of the study both for their meaning making and my own as these activities provided valuable insight into participants' academic and spiritual contexts, and how those contexts influenced and were influenced by the women in the study.

3.1.1 Voice

Voice describes "stance and perspective, revealing the place from which the portraitist observes and records the action, reflecting the angle of vision, allowing her to perceive patterns and see the strange in the familiar" (Lawrence-Lightfoot and Davis, 1997, p. 105). The element of voice in portraiture aligns strongly with Dillard's (2006) principle of love in endarkened feminist epistemology. Enacting love entailed observing and listening carefully to my participants to recognize their truths. This meant paying close attention to their countenance, demeanor, and tone as we engaged in conversation with one another. How participants told me their stories (e.g., excitedly, hesitantly, tearfully) was just as important as what they said. For example, when I asked Kala (a pseudonym) who influenced her understandings of religion and spirituality, her tone shifted as she said, "I learned about religion from my family, and then I learned about spirituality from my friends." There was a weightiness to Kala's emphasis on friends, which led me to ask a probing question about those relationships. When she began talking about how a childhood friend demonstrated what it meant to live out one's faith, tears fell from Kala's eyes, and she shared, "just seeing how [my friend] was so accepting of people, and loving, and giving, and helpful—I realize I never talked about her in this capacity." The reverence I heard in Kala's voice when she mentioned the influence of friends regarding her spirituality inspired a new direction in the conversation, which encouraged her to process the significance of a particular friendship in a way she had not before. Relatedly, I also honored participants' silences if they wished to keep aspects of our dialogues private and undisclosed in the study (see Morton, 2020a).

Collins' (2000) discussion of lived experience and dialogue in Black feminist thought also resonates well with portraiture. In crafting the portrait, the portraitist's voice is interpretative (seeking meaning), attentive to autobiography (the researcher's history, background, experience, and culture), preoccupations (intellectual interests, disciplinary background, and conceptual frameworks), and dialogue (discerning the sound and meaning of actors' voices) (Lawrence-Lightfoot and Davis, 1997). Similarly, from a Black feminist epistemological standpoint, lived experience is the foundation from which meaning making begins. Further, it is through dialogue that knowledge claims are articulated and assessed. Thus, what Lawrence-Lightfoot and Davis (1997) refer to as autobiography and preoccupations could be considered aspects of lived experience according to Black feminist thought. Moreover, both portraiture and Black feminist thought emphasize the importance of dialogue in meaning making—though in portrai-

ture the dialogue between the researcher and participant may occur indirectly as the researcher brings her voice in conversation with participants' through data analysis and interpretation. Attending to voice in my study encouraged me to reflect on my personal and professional experiences in STEM academic contexts along with the conceptual frameworks that informed my preoccupations as I listened to my participants' narratives. I also balanced my own interpretive voice as the portraitist with those of my participants by consistently revisiting their interview transcripts and ensuring that I did not overshadow their narratives with my perspectives, but rather artfully co-constructed an authentic rendering of my participants' experiences.

3.1.2 Relationships

Building relationships with participants is central in portraiture. Lawrence-Lightfoot and Davis (1997) noted, "it is through relationships between the portraitist and the actors that access is sought and given, connections made, contracts of reciprocity and responsibility (both formal and informal) developed, trust built, intimacy negotiated, data collected, and knowledge constructed" (p. 135). As I cultivated relationships with my participants, I drew upon principles from Black feminist thought's ethics of care and accountability and endarkened feminist epistemology's methodology of surrender. Attending to love, compassion, ritual, and reciprocity throughout the data collection and analysis process encouraged me to truly listen to participants' truths, find ways to bring them joy, remain attuned to my own spirituality, and seek out opportunities to give back to my participants. Additionally, enacting an ethic of care and accountability involved exercising empathy, addressing emotion during interviews (both my own and that of participants), and being responsible for my words, actions, and writing as a researcher. For a more in-depth discussion of my application of these principles in my work, see Morton (2020a).

Further, the relationships I fostered with my participants were strengthened through our dialogue with one another. Lawrence-Lightfoot's (1997) described a similar experience in her discussion of the connections she fostered with her participants: "not only was the depth of these relationships defined by the duration and rhythm of the time we spent together, it was also shaped by the intensity of the discourse" (p. 138). This relates to Collins' (2000) assertion that human connection is the driving force of dialogue in assessing knowledge claims among Black women, "a primary epistemological assumption underlying the use of dialogue in assessing knowledge claims is that connectedness rather than separation is an essential component of the knowledge validation process" (p. 260).

3.1.3 Themes

Portraitists also uncover themes in the data using five modes of analysis: by listening and looking for repetition in participants' speech and actions, resonant metaphors that reflect an experience or meaning shared by multiple participants, rituals which symbolize what

participants or an institution value, as well as triangulating points of convergence in the data and searching for patterns (Lawrence-Lightfoot and Davis, 1997).

> *The portraitist draws out the refrains and patterns and creates a thematic framework for the construction of the narrative. She gathers, organizes, and scrutinizes the data, searching for convergent threads, illuminating metaphors, and overarching symbols, and often constructing a coherence out of themes that the actors might experience as unrelated or incoherent. This is a disciplined, empirical process—of description, interpretation, analysis, and synthesis—and an aesthetic process of narrative development (Lawrence-Lightfoot and Davis, 1997, p. 185).*

Guided by portraiture, I looked for evidence of repetition, metaphor, and ritual in participants' transcripts as I coded. Common refrains during participants' interviews were how family and community members provided faith-based support during trying times in participants' doctoral program experiences. Also, an example of a metaphor that participants often used to describe their doctoral experience was "searching for a light at the end of the tunnel," referring to how at times their doctoral programs could feel dark, cold, and perhaps unwelcoming, yet if the promise of light was present (e.g., finishing their degrees, achieving a breakthrough in their research) there was hope. Finally, examples of participants' rituals were regular spiritual practices, whether that be prayer, reading religious texts, or engaging in meditation.

Throughout data collection and analysis, I wrote impressionistic records—reflective pieces that help identify emerging hypotheses, themes, interpretations, and potential dilemmas occurring in the research (Lawrence-Lightfoot and Davis, 1997)—to capture my thoughts and identify central themes. I also began writing spoken word poems that highlighted select themes to "reach for the souls" of my participants as I strived to convey holistic portraits of their experiences in engineering (Lawrence-Lightfoot and Davis, 1997, p. 238). Moreover, the spoken word poems helped me synthesize my research findings and weave multiple participants' stories together as brief portraits. Below is an excerpt of a poem included in my dissertation (Morton, 2020b), which describes some tensions Black women in the study experienced between their spiritual and scientific epistemologies and how participants began to reconcile some of those tensions by considering how engineering may be aligned with their life purpose (p. 207).

Where I delight in the mystery
Find truth in the unknown
Those near me hunt for answers
Attempting to equate life with equations
Squeezing infinity into a symbol
And losing sight of the sacred for manmade solutions
Though we sit side by side, we don't see the same problems
Can't comprehend the other's confusion
For where they see a discovery in the making

I see an adept Author keeping audiences guessing
With awe and great admiration, I read on
Knowing everything couldn't possibly be revealed in this chapter
Perhaps not even this book

3.1.4 Aesthetic Whole

My methodological patchwork inspired innovation as I imagined how I would bring the data together and tell a coherent, aesthetically whole story of my participants. Whereas emergent themes were the threads that tied the portrait together, achieving an aesthetically whole narrative in portraiture involved attending to conception, structure, form, and coherence. Conception refers to the "total gestalt-like grasp of the story that enables the author to control the development of a situation, the characters, theme, plot, style, and technique, so that in the end they cohere, as in a single charged image" (Lawrence-Lightfoot and Davis, 1997, p. 248). A slight departure from Lawrence-Lightfoot and Davis' focus on a single portrait, my dissertation comprises a set of portraits—both in narrative and poetry form—that reflect the experiences of my participants in relation to my research questions. Structure provides the frame, stability, and organization of the narrative (e.g., subheadings, metaphors that are threaded throughout the piece) which scaffold the narrative. Form offers intellect, emotion, and aesthetics which breathe life into the structural elements of the portrait. According to Lightfoot and Davis (1997), "[form] expressed in stories, examples, illustrations, illusions, and ironies—[give] life and movement to the narrative, providing complexity, subtlety, and nuance to the text, and offering the reader opportunities for feeling identified and drawn into the piece" (p. 254). Further, coherence refers to the "orderly, logical, and aesthetically consistent relation of parts, when all the pieces fall into place and we can see the pattern clearly" (p. 255). In other words, coherence is the unity and integrity of the portrait as a whole. While my analysis allowed me to conceive and scaffold the narrative of the study, the poetry provided form and coherence regarding participants' collective experiences. Moreover, as a spoken word artist, I found spoken word to be an effective medium to synthesize and represent the findings of my research in a way that felt authentic to me and that reflected my positionality as the researcher. Rooted in a longstanding cultural tradition of oral storytelling, spoken word poetry allowed me to simultaneously capture the complexity and richness of my participants' narratives while conveying the depth of emotion laden in those narratives in the writing.

Study designs, like quilts, are largely informed by cultural knowledge and experience. Allowing principles from Black feminist thought and endarkened feminist epistemology to guide my approach to portraiture enriched my study and encouraged me to engage in a research praxis that reflected my epistemological and ontological standpoint as a Black woman. Lawrence-Lightfoot and Davis (1997) suggest that "with portraiture, the person of the researcher—even when vigorously controlled is more evident and more visible than in any other research form" (p. 13). Thus, my interpretation of portraiture is a clear reflection of who I am as a person and how I op-

erate in the world. Connecting Black feminist frameworks with portraiture to develop my study design felt authentic and natural to me as a researcher, which I imagine is similar to how Black American quilters feel as they actualize the patterns they have seen in their dreams.

4. DISCUSSION

Through bricolage, STEM education researchers can embrace interdisciplinarity in their practice, which may inspire new methodological and theoretical insights. As Kincheloe (2001) asserted, "if the cutting edge of research lives at the intersection of disciplinary borders, then developing the bricolage is a key strategy in the development of rigorous and innovative research" (p. 690). Additionally, bricolage can help researchers pursue complex research questions, the answers to which are not readily observable, such as the epistemologies and ontologies of marginalized students in STEM.

Within STEM, and engineering in particular, prevalent epistemologies include positivism (Harding, 2005), meritocracy, and depoliticization (Cech, 2013), which may be in tension with ways of knowing that value subjectivity, collectivism, and social consciousness. For instance, positivism emphasizes rationality and logic as valid ways of knowing, thus legitimizing objectivity rather than subjectivity. Meritocracy attributes success to natural talent and motivation, which valorizes individualism as opposed to collectivist orientations toward communal uplift. Additionally, depoliticization encourages the separation of science and scientific design from political, social, and cultural concerns (Cech, 2013). I would assert that these ways of knowing also pervade STEM and engineering education research. As Dillard (2006) suggests, too often scholars rely on "formal academic training designed to encourage us to decontextualize our deeply raced/gendered/classed/sexualized lives and alienate ourselves from our communities, families, and even ourselves in order to do 'legitimate' scholarship" (p. 27). Although Dillard (2006) is speaking of Black women scholars specifically, her words are applicable to a broader audience, including STEM education scholars. The pervasiveness of positivism, meritocracy, and depoliticization in STEM education research calls for interdisciplinary methodological and theoretical approaches to disrupt dominant epistemologies, advance alternative viewpoints, yield new insights, and transform the research enterprise.

In my work, bringing elements of critical race theory, Black feminist thought, endarkened feminist epistemology, and critical religious scholarship together was essential in unearthing the complexity of participants' spiritual epistemologies and ontologies, as well as their experiences in their academic contexts. While critical race theory helped explain how racial dominance may be wielded and maintained in engineering doctoral programs, Black feminist thought provided insight into the particularities of Black women's experiences along with how Black women assess and validate knowledge. Moreover, endarkened feminist epistemology and critical religious scholarship helped foreground the salience of spirituality in participants'

ontologies and navigation of potentially marginalizing academic contexts. Additionally, my research raised theoretical questions of how Black women develop critical spiritual ontologies and epistemologies. Examples of such epistemologies and ontologies were participants' contestation of dominant narratives that depicted God and God's chosen people as White, and engagement in spiritual counterstorytelling that centered Black people, and particularly Black women in their imaginings of God and themselves as God's children. Moreover, the study provided insight into how Black women's spiritual and scientific epistemologies and ontologies may co-exist, and occasionally interact as they perform their engineering work. This research also uniquely centered spirituality in critical scholarship pertaining to graduate student experiences in engineering, and also foregrounded the importance of epistemology and ontology in participants' perceptions of and responses to their academic contexts.

Methodologically, Black feminist ethics of accountability and care (Collins, 2000) and endarkened feminist epistemology's methodology of surrender (Dillard, 2006) allowed me to engage in a research praxis that was intentional, ethical, and humanizing. This entailed attending to my participants' personal expressiveness and emotion; being accountable for my words and actions; exercising empathy, love, compassion, reciprocity, and remaining mindful of my own spirituality through ritual. I also found Black feminist thought and endarkened feminist epistemology to be complementary to portraiture (Lawrence-Lightfoot and Davis, 1997), which required the search for goodness in participants' stories, as well as the creation of authentic, multilayered portraits of participants rendered through attentiveness to context, voice, relationship, emergent themes, and the aesthetic whole. Collectively, Black feminist thought, endarkened feminist epistemology, and portraiture encouraged intentionality and care in every stage of the research process. Bringing these frameworks together with portraiture also led me to consider new possibilities for crafting participants' portraits and conveying the study findings, namely through spoken word poetry.

The usage of spoken word in the study to create a mosaic of participants' experiences was a unique and valuable extension of portraiture. Spoken word allowed me to work through the challenges of portraying the various contexts, narratives, and experiences of my participants in a cohesive, coherent manner. With spoken word, I was able to creatively integrate themes across participants in the poems, while maintaining the integrity of their narratives and honoring the spirit of our conversations. According to Lawrence-Lightfoot and Davis (1997), portraiture in research requires vigilance and attentiveness to feelings, perspective, and experience to render an accurate and thoughtful portrait of participants, which I aimed to do in my study. Additionally, Lawrence-Lightfoot and Davis (1997) stated that a clear motivation for portraiture is to make research more accessible for audiences within and outside of academia. My use of spoken word not only helped me synthesize my research findings, but also disseminate my research in a way that could resonate with wide-ranging audiences. Furthermore, spoken word gave me the freedom to tell participants' stories in a style

and language that breathed life into their narratives and authentically represented me as an artist and scholar.

5. QUILTING LESSONS: IMPLICATIONS

Bricolage in STEM education research can help scholars access new perspectives, bodies of literature, theories, frameworks, and methodologies that can inspire innovation in one's scholarship as well as transform the research enterprise. Bricolage invites scholars to question, explore, and seek alternative ways of knowing to help complicate and deepen our understandings of the topics we study as well as shift how we conduct research. For STEM education researchers interested in applying theoretical and methodological bricolage to their work, I offer lessons that I have learned engaging in this process. First, venturing outside of disciplinary boundaries is key to discovering theories and methods from which to begin empirical patchwork. When I was formulating the research questions for my dissertation, I did not know that I would be drawing from critical race theory, Black feminist thought, and endarkened feminist epistemology, and critical religious scholarship to create my conceptual framework—I allowed my questions to lead me toward literature and theory that could help contextualize my participants' experiences, epistemologies, and ontologies. As I read and pursued educational opportunities in critical theory and methods, I shared what I was learning with mentors, colleagues, and friends, who directed me to additional bodies of literature that I had yet to consider. For instance, while I was studying critical race theory, a peer who was familiar with my research interests recommended that I read Dillard's (2000) work on endarkened feminist epistemology. Later, after re-encountering Dillard's scholarship in a critical qualitative methodology course, I was compelled to read more about Black feminist thought upon learning that endarkened feminist epistemology had roots in Black feminism. Reading, sharing, and pursuing new leads was an iterative process that allowed me to gather the fabric I needed to conduct my study. Thus, I encourage other STEM education researchers to consider, what fabrics have you been gathering over time? What new bodies of literature might you explore to help answer your current research questions, and perhaps inspire new ones? Who are potential collaborators with whom you could review and discuss new literature? For those in positions of power, how might you support, or advocate for other scholars who may need protected time and resources to engage in this type of work?

Second, allow dilemmas to become opportunities. After conducting my first interview, I knew that I would have a wealth of stories to draw upon for my dissertation. However, I was unclear as to how I would share those stories in a way that felt authentic to my participants and myself. To help me think through this dilemma, I turned to friends and colleagues with different areas of expertise. One evening, while having such a conversation over dinner, a friend encouraged me to read *The Art and Science of Portraiture* (Lawrence-Lightfoot and Davis, 1997). She had taken a course with Dr. Lawrence-Lightfoot and said that how I spoke of wishing to create artful renderings of my participants experiences reminded her of portraiture. As I began to explore portrai-

ture, I immediately began to make linkages to Black feminist thought and endarkened feminist epistemology. I also was inspired to use poetry to help synthesize and disseminate my findings creatively. Storytelling is such an integral part of spoken word, and I knew that I could effectively tell the collective stories of my participants through poetry. What began as a dilemma became an opportunity for innovation. What conceptual or methodological dilemmas exist in your work, and how might bricolage help you resolve them? Who might you call upon to exchange ideas and learn from their diverse areas of expertise? What linkages could be made between your research interests and alternative theories and methods to enhance your work?

Finally, consider how your cultural knowledge and experience may inform your approach to engaging in theoretical and methodological bricolage. What led me towards critical race theory, Black feminist thought, endarkened feminist epistemology, and critical religious scholarship were my lived experiences navigating the world as a spiritual Black woman. The tenets and principles of these frameworks strongly resonated with my ways of knowing and being, which piqued my curiosity about how they could contextualize my participants' lived realities, epistemologies, and ontologies. Further, these frameworks coupled with portraiture revealed a methodological approach that aligned with my ethics and values. My desire to engage in a loving, compassionate, reciprocal, and responsible research praxis was a reflection of the cultural values that my family instilled in me from a young age—treat people with respect, honor their dignity, affirm their humanity, exercise love, and act with integrity. How do the theories and methods you use reflect your cultural knowledge and experience? How might the piecing together various theories and methods guide you toward an ethical, values-driven approach to research?

Throughout this article, I have likened theoretical and methodological bricolage to the art of quilting. Returning to this analogy, bricolage, like quilting, requires patience and diligence. Working to complete the finished product may seem daunting, but the fabric you have gathered and the design you have imagined will eventually come together. The charm of patchwork quilts is using what you have to create something new. Innovation lies in the combination of unexpected fabrics and improvisation as obstacles arise or new ideas emerge for the design. The same goes for research. Embracing interdisciplinarity, allowing dilemmas to become opportunities, and remaining attuned to cultural knowledge and experience can inspire new insights and innovation in your scholarship.

6. CONCLUSION

You can learn a lot about someone by what they create. In the case of my great-aunt Hazel, the craftmanship of her quilts speaks volumes about who she was as a person. She was resourceful and innovative, taking leftover pieces of fabric and patchworking them together to create the most beautiful designs. She also took great pride in her work, never compromising the integrity of her design with a haphazard stitch or mis-measured piece. And, when she stitched her name on her finished products with that bright red

thread, she was making a statement—her signature marked the skill of a professional who possessed a style all her own. My great-aunt Hazel honed her gift and shared it generously. After finishing a quilt, she would proudly display her work throughout her home, and if a dear friend or relative stopped by, they might very well have left with one of her custom creations in hand. As lovely as her quilts were, great-aunt Hazel never forgot their purpose—beyond decoration, they could keep someone warm. As a researcher, I sincerely hope that my work says as much about me.

Theoretical and methodological bricolage inspired innovation in my work and perhaps may be equally inspiring for other STEM education researchers. Stitching together elements of critical race theory, Black feminist thought, endarkened feminist epistemology, and critical religious scholarship helped me answer complex research questions pertaining to the Black doctoral women's spiritual and scientific epistemologies and ontologies. Additionally, applying principles from Black feminist thought and endarkened feminist epistemology to portraiture motivated my use of spoken word as a creative medium to synthesize and disseminate my study findings. Finally, as one of the only studies, to my knowledge, of Black women's spiritual epistemologies and ontologies in the context of engineering doctoral programs, this research has clear implications for fostering more diverse, equitable, and inclusive STEM academic contexts that embrace alternative ways of knowing and seeing the world—particularly from communities that have been historically marginalized in STEM fields. Taking yet another lesson from my great-aunt Hazel, while we as researchers engage in empirical patchwork, we should remain mindful of purpose—remembering that what we create has implications for the future of STEM in higher education. If we are creative, resourceful, and conduct our work with integrity we can help establish the equitable, liberatory educational contexts we have only imagined.

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