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Ethnodance and identity: Black students representing science identities in the making

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Abstract

We explored how arts-based practices, specifically what we define as ethnodance informs the study of science identity. We present a theoretical argument supported by an empirical illustration of how ethnodance offers Black youth with dance identities a medium to narrate evolving science identities, communicating meanings, interactions, and emotions, and to construct identities further as reified artifacts of participating in science classroom communities. The theoretical argument frames dance as an embodied narrative, identity construction as an ongoing process with interactional and affective commitments, and Black Dances as venues of Black bodies' expressivity of the brilliance, competence, and creativity of Black people. The empirical illustration focuses on Black students in an urban high school choreographing a dance performance to capture their science identity construction transitioning from biology and moving through physics. The students' semiotic choices communicated the experienced (dis) connection between self and science; ballet, lyrical, and contemporary dances represented experiences challenging their position within science, and a Black Dance, majorette, experiences affirming their place or creating a bridge. Majorette offered students a sense of cultural solidarity, symbolic of their collective overcoming of obstacles faced, frustration, and alienation felt at the beginning of physics, and joy of rising above the struggle.

KEYWORDS
arts-based research, Black students, embodied narrative, ethnodance, science identity

1 | INTRODUCTION

Identity studies in science education have spanned a range of research designs and have focused on ways in which identity is produced in, and/or constructed in narrations of, people's experiences as science learners or teachers of science or science practitioners (Avraamidou, 2016; Lee, 2012; Roth & Tobin, 2007; Varelas, 2012). This research centers on understanding identity authoring in terms of constructing positionings of self in relation to others and to the practice of science and of science education, historically and contemporarily. The growing domain of identity research in the science education field includes studies of identities-in-practice (Holland, Lachicotte, Skinner, & Cain, 1998), constructed as people carry out tasks within science-focused communities, and of identities-in-narratives (Sfard & Prusak, 2005), constructed as people recount who they see themselves being and becoming and who they see others recognizing them to be (Carlone & Johnson, 2007; Kane, 2012; Olitsky, 2007; Polman & Miller, 2010; Rahm & Moore, 2016; Tan & Calabrese Barton, 2008; Varelas, Kane, & Wylie, 2011).

We consider identity construction as a process of production of self, alongside the production of knowledge, beliefs, actions, and emotions, as people interact with others within established disciplinary spaces. Structures (material, ideational, symbolic, cultural, sociopolitical) that exist in, and define, the various spaces where individuals learn, and individuals' agency to identify and act on these structures, maintaining or transforming them, are integrally involved in the construction of identities (Gutierrez & Calabrese Barton, 2015; Varelas, Settlage, & Mensah, 2015). The presence of particular structures in science and science education spaces has historically perpetuated alienation, exclusion, oppression, inequities, and injustices for youth of color, and in general for minoritized youth based on their race, ethnicity, gender, language, and/or socioeconomic status. Specifically, for Black youth in the US, scholars have documented such experiences as young people engage with science (Brown, Parsons, Miles, & Henderson, 2013; Mutegi, 2011; Parsons, 2008; Parsons, Simpson, & Cooper, 2009) and school life in general (Hope, Skoog, & Jagers, 2014; Lewis & Diamond, 2015). Thus, exploring the production of self in science education settings for Black students in the US is of particular importance as it may lead to further oppression or may facilitate a path toward liberation and empowerment.

Studying the production of self requires consideration of social, historical, and cultural aspects of the context. While significant progress has been achieved around identity studies in science education research, it is important to consider how identity narratives have been created. Science education researchers have mostly relied on language (oral and written) for cocreating identity portraits with a few exceptions (Mensah & Fleshman, 2017; Tucker-Raymond, Varelas, Pappas, with Korzh & Wentland, 2007) some of which are linked to the maker movement (Calabrese Barton & Tan, 2010). Arts-based practices and especially embodied performances of identities-as-narratives have not been adequately explored in science education, despite the increasing emphasis on arts-based methods that Sullivan (2010) characterized as "creative and critical processes at the core of research practice so as to fully investigate the contexts that shape complex human thoughts and actions" (p. 58). As multimodality scholars note, language is but one, albeit historically dominant, semiotic system that provides specific affordances (opportunities and constraints) in developing and expressing meanings (Jewitt, 2009a; Kress, Jewitt, Ogborn, & Tsatsarelis, 2001). Other semiotic systems, including body movement, gaze, music, visual images, and ensembles of systems, such as dance or theater, have different "epistemological commitments" (Bezemer & Kress, 2008), and, thus, offer different affordances for meaning-making. In addition, when people are led to use more than one system to develop and express ideas, their meaning-making is strengthened through transduction (Bezemer & Kress, 2008)–the process of connecting meanings across semiotic systems. Thus, the modal ensemble of dance enhances meaning-making for the artist and the audience in ways that are absent from language alone.

Moreover, although oral and written narrations have allowed the creation of meaningful and powerful identity stories of young people, and especially people from marginalized groups, vis-à-vis science education (Kane, 2016; Tan, Calabrese Barton, Kang, & O'Neill, 2013; Varelas, Kane, & Wylie, 2012), additional modes of expression by those who have historically embraced such modes may provide additional insights into identity stories. Minoritized people have historically used the arts as a "medium of expressivity" (Gittens, 2012, p. 50) and a form of resistance

against structural dispossession (Perillo, 2017). Thus, consideration of other modes creates opportunities for researchers to facilitate the creation of narratives in more culturally responsive ways. For some Black youth, a meaningful part of social life includes movement and dance, social dances with choreography produced by many people, a community, who use the dance to express their creativity and sense of self, deal with pain, heal, remember, build solidarity with each other, and declare to the world that they are always ready to stand up for their freedom (Gittens, 2012; Gottschild, 2003). Thus, the focus of this study is to explore how arts-based practices and specifically what we define below as ethnodance informs the study of science identity. Specifically, we aimed at exploring theoretically and empirically how a particular type of artistic practice, namely dance, could capture the science identity construction with all its tensions, triumphs, and contours of Black science students in the US for whom dance has been a part of life inside and outside the school and a defining part of who they were. Thus, two main sections follow: theoretical exploration and empirical exploration. Under the latter section, we offer details on the research design, researchers, participants, and context of the empirical part of the study, the data sources and analysis, and an illustration of the theoretical constructs, which constitutes the findings of the empirical part of this study.

2 | THEORETICAL EXPLORATION

2.1 | Ethnodance: Dance as embodied narrative

Denzin (1997) argued that in cultural studies a turn toward studies that embrace performance would be a defining moment of the 21st century beyond the narrative and interpretive turns of the 20th century. Performance is "a site where memory, emotion, fantasy, and desire interact with one another" (Denzin, 2003a, p. 12). Using Goffman's symbolic interactionism, Denzin conceived of a performance as a mimesis or imitation of reality (Denzin, 2003b). Performance is a reconstruction of lived experience and a tool to change social reality. An artistic performance, such as a theatrical performance or a dance performance, is a performance that represents reality and lived experience. It is a dynamic "breaking and remaking" of experience (Conquergood, 1998, p. 32) and, thus, in cultural studies, engaging in performances offers opportunities to understand "process, change, improvisation, and struggle" (p. 31) in experiencing and interacting with the world.

Saldaña (2005) has focused on drama and theater as artistic representations of social life, which he coined as ethnodrama and ethnotheatre. Extending Saldaña's framing, we put forth what we call ethnodance, an artistic representation via dance that constitutes both data and interpretation in studies of identity and identity construction. Similar to theater, a dance performance could capture and interpret lived experience, and dance helps to "more closely examine how we and others experience life, and to shape those moments into new esthetic forms that bring us closer to notions of what is real and what is true as we individually and collectively construct them" (Saldaña, 2005, p. 213). Like Saldaña, we consider that ethnodance is "aesthetically sound, intellectually rich and emotionally evocative" (p. 14). Ethnodance as a performance captures "the unscriptedness in human experience, which is rife with conflicts, ambiguity, questions, and idiosyncrasies" (Rolling, 2010, p. 107). Thus, ethnodance has the potential of illuminating identity work, that is, performative work of the self in the midst of structures, roles, schemas, and resources characterizing communities in which people live (Calabrese Barton, Tan, & Rivet, 2008; Carlone, Johnson, & Scott, 2015; Varelas, Kane et al., 2012).

Similar to language, dance is a form of semiotic representation, a "network of interlocking resources for making signs" (Jewitt, 2009b, p. 44). Each representational mode (e.g., language, images, body movement, music, along with modal ensembles, like dance and theater) has its own grammar, or in other words its own particular resources, configuration, and rules of engagement, which determine what Halliday (1978) called the "textual" metafunction of a mode (that in Halliday's case was language). Moreover, different modes provide different affordances and have different potential to lead to construction of reality, orchestration of meaning, and knowledge production, which Halliday defined as the "ideational" metafunction of a mode. In addition, Halliday's "interpersonal" metafunction of

a mode captures the unique ways in which a mode enables people to enact their various interpersonal relations in particular ways. Moreover, each representational mode, or in other words each semiotic system and communicational act, including dance (as well as its three metafunctions), has been shaped by social, cultural, and historical contexts, and has evolved to include various genres that use particular semiotic resources to represent conceptions and emotions. Dance centers around the body and its movement in space and time, which, as Leander and Boldt (2012) articulate, is in a dialectical relationship with the social, cultural, historical, political, and physical environment.

> *Drawing from Massumi (2002), who in turn draws from Deleuze and Guattari (1987), we conceptualize the body as always in relation to an ever-changing environment. This body is both material and incorporeal. Materially, we move within time and space as bodies. As bodies, we perceive and register, consciously or unconsciously, some of the infinite patterns and variations in our environment. It is in the body that we locate the affective sensations of those registrations that are available to our consciousness, often making meaning of them by giving them form and significance as emotion, physical sensation, response, or energy. (p. 29)*

2.2 | Black bodies and black dance

As Darder and Cronin (2018) articulate, cultural dances "have often functioned as means for emotional, psychological, physical, and spiritual survival, as well as for individual and communal empowerment, even when subaltern dance practices have been negated, rejected, exoticized, or commodified within the dominant society" (p. 27). Dance as an art form has been a persistent venue of expressivity (Perillo, 2017) and vehicle of cultural solidarity (Daniel, 1991) for Black bodies against oppression and injustice. Dance embodies the fight and resilience of Black bodies without spoken words, clenched fist, and tattered flesh (Gittens, 2012). As a choreographer, Dr. Pearl Primus stated, as a Black person in the US, dance is my medicine.

> *It is the scream which eases for a while the terrible frustrations common to all human beings who because of race, creed, or color, are invisible. Dance is the fist with which I fight the sickening ignorance of prejudice. It is the veil of contempt I feel for those who patronized with false smiles, handouts, empty promises, and insincere compliments. Instead of growing twisted like a gnarled tree inside myself, I am able to dance out my anger and my tears. (p. 50)*

"Black Dance" refers to dance styles that emerged from the African diasporic dance and "gave way to fresh and unique movement migrations and combinations that transcend notions of "traditional," contemporary, and vernacular dance styles" (Gittens, 2012, p. 56). Black Dance continues to evolve while maintaining a linkage to the African diasporic dance, standing against the status quo in the dance industry and empowering dancers to engage in styles (or genres) of dance that are rooted in Black culture. However, Black Dance is also "a construction that exists within a broader (white, heterosexual, patriarchal, capitalist) superstructure (and in this way) the historical label for empowerment becomes a political battleground for the engagement of identity politics through notions of race and gender" (Craighead, 2006, p. 29). Thus, on the one hand, the term "Black Dance" may perpetuate in some ways a discourse of othering as it may be used to homogenize diverse artistic practices and position people of Color as different from Whites along with continuing to give power to the White culture that actually developed this label. On the other hand, the term "Black Dance" also pays homage to the Black dancers and choreographers who cultivated a space for body movement derived from African diasporic traditions. It is consistent with the latter that we use the term in this study.

Moreover, choreography in Black Dance has been used to tell stories, narrate the experience, communicate emotions, show defiance, perseverance, and resiliency, and offer counter-narratives to the master narrative, in the

"authentic voices of people of color" (Ladson-Billings & Tate, 1995, p. 58). For Black people and other people of color, narrative expressions, in the form of storytelling and artistic renderings of stories, have a long and rich tradition that was, and continues to be, used for empowerment. "Oppressed groups have known instinctively that stories are an essential tool to their own survival and liberation" (Delgado, 1989, p. 2436). As Black people share narratives of their lived experience and communicate their own ways of making sense of being and becoming in sociocultural contexts, where they have been minoritized, discriminated against, and stereotyped as deficient, they challenge dominant conceptions and help transform belief systems (Solorzano & Yosso, 2001). Thus, such narratives expressed in authentic and liberating ways offer opportunities for capturing students' experiences, conceptions, and feelings of developing science identities intertwined with their racial and other identities.

2.3 | Identity, narrative, and science ethnodance

Identity is a multidimensional, multifaceted, and complex construct (Varelas, 2012) that has been defined and redefined in various ways in science education literature (Lee, 2012). From a sociological perspective, identity is defined by positioning (Stets & Burke, 2003). An identity is an "internalized positional designation" (Stryker, 1980, p. 60), the meanings one has that are tied to particular role relationships the person has as a member of a group or as a role-holder. These meanings are what Stets and Burke call the "content" of an identity. People have multiple identities as they are members of multiple groups and hold various roles in life, and their multiple identities interact with each other, shaping each other's content. Moreover, identities are shaped by the dialectical relationship of structure and agency (Varelas et al., 2015). Structures (e.g., social, cultural, physical, symbolic, political, curricular, pedagogical, etc.) allow or limit particular roles, but agency (human and nonhuman) also leads to the creation or modification of roles.

A student's science identity captures a student's meanings of being a science person in various science classes. However, students position themselves, and are positioned by others, differently in different science classes, and the different discourses (Gee, 1990) of different science classes also position students differently, shaping their identities in different ways (Gee, 2000–2001–2001). In addition, emotions are "one of the central mediators of our identities, or ways of being in the world" (Maulucci, 2012, p. 125) and, thus, play a critical role in identity construction. Emotions are commentaries on what, and the extent to which, people care about (Archer, 2004), and offer, therefore, insights into what people consider important and defining for them. The salience of an identity is based on two dimensions of one's commitment to such an identity–interactional and affective (Owens, Robinson, & Smith-Lovin, 2010). When students perceive themselves as members of the science class interacting with others in ways that strengthen their science identity and feel emotionally satisfied in relationships premised on a science identity, their science identity is boosted. In a dialectical way, their science identity boosts both the interactional and affective dimensions of their being in a science class.

Moreover, when students' experiences with science content and practices allow them to see themselves as knowers and doers of science, they feel a sense of competence, which is socially constructed in a science classroom (Gresalfi, Martin, Hand, & Greeno, 2008), and their science identity is developed and strengthened. A sense of competence and insider status in a community, recognized in the interactions among its members, provide the fuel for strengthening an identity related to that community.

Varelas, Martin, and Kane (2012) have argued that learning of a subject matter involves both constructing knowledge of the concepts, practices, and nature of the field and constructing a positive identity related to that field.

> *An explicit, in-depth, and extended processing of identity work will enable students to understand themselves and the subject matter they are learning in unison, using one to leverage the other. We argue that this is particularly important for African American students, many of whom are surrounded by rhetoric at micro-, meso-, and macrolevel contexts filled with negative stereotypes and innuendo about Black*

> *competence (Nasir & Shah, 2011), emphasis on the achievement gap, and often limited framings of who they are and who they can become. (p. 336)*

Offering students opportunities to narrativize their experiences in science classes and process who they have been and who they are becoming encourages them to explicitly engage with identity construction, and, thus, intertwine content learning with identity construction. We theorize that for those Black young people for whom dance serves as a medium of expressivity to articulate experiences and emotions (Gittens, 2012), creating narratives about being in a science class via a dance performance fosters their agency. With the movement of their bodies, they communicate frustration and triumph that words cannot fully capture. Ethnodance as a form of artistic expression has multidimensional potential for extending narrative inquiry, giving people a complex tool to create embodied representations of their narrated future, present, and past selves (Bochner & Ellis, 2003). In doing so, ethnodance may provide an opportunity to create "art and words that are not separate or illustrative of each other but instead are interconnected and woven through each other to create additional meanings" (Springgay, Irwin, & Kind, 2005, p. 899).

The creative process of the ethnodance provides the dancers with opportunities for generating self-reflexivity as they story their thinking, perceiving, feeling, and acting both in the dance itself and in the process of sense-making that leads to the dance and is exemplified by the dance. The construction of the ethnodance through the interactions of dancers with each other, and with the semiotic resources of the dance genres, creates narratives of their lived experience that can offer powerful revelations (Harrop & Njaradi, 2013). Dancers create visual imagery that spoken words alone may not encapsulate fully or partially (Leavy, 2009; Marshall & Rossman, 2016). Moreover, videography of such visual imagery allows for further reflection that can lead to extension or expansion of the narratives and the sense-making for both the dancer and the audience.

As Saldaña (2011) wrote about ethnotheater and ethnodrama, "the art form has this ability, this power, to heighten the representation and presentation of social life" (p. 5). As the dance performance is put together, students "recover, yet interrogate the meanings of lived experience" (Denzin, 1997, p. 95) and, thus, engage deeply with who they are and are becoming in the context of their science classes. They re-embody their recounted experience adding layers of complexity, re-embodying the storying of their own experiences. In ethnodance, as dancers come together to share, create, and perform meanings, they embody Bakhtin's (1981) chronotopes, space–time relationships in the figured worlds (Holland et al., 1998) they perform in their dance.

"The inseparability of space and time" (Bakhtin, 1981, p. 84) is actualized through representing their experiences, during which students construct their figured worlds of science, where they "construct and reconstruct the sense of their science self. This sense of self is embedded in the space–time relationships (i.e., chronotopes) that underlie their experiences with science. However, this sense of self is constructed and reconstructed as students tell stories about their experiences" (Varelas, Kane et al., 2012, p. 571). In representing their science identities with ethnodance, students communicate via embodied stories who they see themselves to be in the science spaces they have experienced, and continue to experience, which are constituted by chronotopes that "stand as monuments to the community itself, as symbols of it, as forces operating to shape its members' images of themselves" (Bakhtin, 1981, p. 84).

In addition to theorizing about ethnodance and its potential for identity authoring and identity studies, part of this study is also an empirical exploration guided by the research question: How does ethnodance offer Black students ways to create and portray their analysis of their experiences, learning, and becoming in science classes, which is part of crafting their science identities? We, thus, aimed at capturing the semiotic choices that three Black students for whom dance is an integral part of their lives make to express and further construct science identities in dance performances. The focus was on a student choreographed mesh of dance and music genres, which intertwined narrative inquiry with the creation of artistic, embodied identity artifacts, to produce empirical evidence of the ways in which ethnodance could be useful in science identity studies.

3 | EMPIRICAL EXPLORATION

3.1 | Research design, researchers, participants, and context

To provide empirical illustration of the theoretical constructs about ethnodance and its relation to science identity, we, the two co-authors and co-researchers, Mindy and Maria designed an exploratory case study (Yin, 2003) that combined narrative inquiry (Clandinin & Connelly, 2000; Holstein & Gubrium, 2000) with arts-based research (Leavy, 2009). Our personal and professional experiences have led us to conceive of ethnodance and its relation to science identities of youth of color and particularly Black youth. Mindy identifies as a Black woman who has been negotiating her science, dance, and Black identities in her profession as a science high school teacher for several years and more recently as a doctoral student. Maria identifies as an immigrant to the US, bilingual woman of Greek ethnicity and with Greek as her first native language, who as a science teacher and teacher educator has been exploring possibilities that emerge as young people of color and educators coconstruct spaces of meaning-making via multiple forms of representation and communication.

Mindy has been teaching science at a neighborhood high school in a US large Midwest city, a school with predominantly Latinx students and a small percent (15%) of Black students. When she joined that school, she was asked by Black students to lead a Dance Club specifically dedicated to an evolutionary style of Black Dance, majorette, which is often referred to as the band's danceline at some Historically Black Colleges and Universities (HBCUs). During the year of the study, the Dance Club consisted of six members, five of whom self-identified as Black and one as Mexican. Of the six members, four self-identified as females and two as males. The choreography was not gendered, in that all members performed the same routines and dance moves. The Dance Club met for 2 hr twice a week throughout the school year. Though the Dance Club engaged in a variety of dance genres, the students referred to the club as a Majorette Dance Team. More on majorette as a dance genre will be presented in the Empirical Illustration section below. However, it is important to briefly note here that promoting the same choreography independent of the Dance Club members' gender identities and sexual orientations is consistent with the view that "Black social dance (one example of which is majorette) engages queer potentiality (italics in original) as an achievement of virtuosity, resistance, and social flexibility… pushing forward expansive physical possibilities for expressing Black social life regardless of sexual or gender identity" (DeFrantz, 2016, p. 73).

As one of only four Black teachers in a school of over 50 teachers, Mindy reaches out to Black students in the school including those students she teaches in her science classes, which include biology and chemistry. Passing periods, lunchtime, and after-school activities including the Dance Club become opportunities for her to check with students on their wellbeing, their daily triumphs and struggles, and their performance and experiences in all their classes. These opportunities led Mindy to build a strong rapport and a trusting relationship with Black students in the school, and to also start noticing the ebb and flow of their science identities from the time she had some of them in her science class.

The three Black students: Tiffany, Jasmine, and Fara (pseudonyms), all of whom identified as female, who were the participants in the empirical component of the study were the members of the Dance Club who consented to allow their work to be part of the research study. At the time of the study, 1 year after they joined the Dance Club, all three participants were enrolled in an elective dance class at the school. In addition, Jasmine and Tiffany performed with the school's cheer squad for 1 year before joining the Dance Club. They both also participated in an arts-based after-school program, which cultivated collaboration between teachers of various subjects and artists, and it was there that they first learned that they shared dancer identities with Mindy. Jasmine was known around the school for her ability to "twerk," a move that involves rapid movement of the hips and derriere to the beat of a song while in a squatting stance (Stevenson, 2010; Toth, 2017). This type of dance has been associated with sexual provocation, which, however, has been questioned in the literature as argued in Toth (2017) based on the Sosa and Poncin (2015) documentary about twerking. Nevertheless, twerking was often framed as an unacceptable or inappropriate form of dance by the school's cheer squad coach. The Dance Club was Jasmine's first formal introduction to dance genres. Tiffany was a part of a community-based dance team in middle school and created YouTube videos of self-choreographed dance performances

for fun. Much more than any other Dance Club member, Tiffany was illustrating emotionality during performances through her facial expressions and gestures. It was her frequent requests for a Dance Club that primarily led Mindy to establish it. Fara studied ballet from age 5–9. She joined the Dance Club the year before the study.

In terms of their science trajectories, all three participants were taking physics as juniors in the year of the study, and they were making comments to Mindy who was teaching chemistry that year, regarding how helpful it would have been if they had taken chemistry before physics. The students had taken environmental sciences in their freshman year and biology as sophomores, due to a change in the school's science course sequencing that in previous years had chemistry for sophomores. Tiffany and Jasmine had taken regular biology with Mindy as sophomores and Fara honors biology with another teacher. At the time of the study, Fara and Tiffany were enrolled in honors physics with one teacher, whereas Jasmine was enrolled in regular physics with a different teacher.

3.2 | Data sources and analysis

As members of the Dance Club, the three students were accustomed to engaging in conversations with Mindy regarding their experiences in and out of school. Though sometimes the focus of the conversations was in direct response to a "check-in" question by Mindy, oftentimes the students freely shared their experiences without probing, even seeking out the Mindy during passing periods just to talk. Thus, Mindy had developed a relationship with the students and a level of trust that made the students comfortable and honest in sharing about their science identities and who they saw themselves being and becoming in relation to science.

To illustrate constructs of the theoretical exploration of ethnodance, Mindy wondered how these three students would narrate their science identities in a dance performance that they would choreograph to think about and express their experiences with science. What dance genres would they use and how? What would various moves represent? How would a dance performance express authentic representation of experiences, ideas, and feelings? The students were excited to use their favorite activity, namely dancing, to tell their stories about science classes.

Over a period of 6 weeks and during after-school time, the three students engaged in an open-ended task: To work together to develop a dance performance that would give them an opportunity to think about who they were as science students using their passion for dance. The students worked alone for two sessions to generate ideas about who they were in science and naturally mostly focused on who they were and were becoming in their physics class, the class they were currently completing, with an eye toward producing a dance performance to represent the evolution of their science identity. The artists needed time to think about their craft on their own, without intrusion by Mindy and without data collection in place. Eventually, Mindy made herself available to the group and joined one of the meetings to get a sense of how they were thinking about the performance and possibly offer them any help they needed. It was that meeting that was audio-recorded. Due to a schedule conflict, Tiffany was not present at that meeting but was an integral part of the team that was working on this project.

The three students continued to work by themselves to create a dance performance that included various dance and music genres, which they performed in the hallway where their science classrooms were located. The dance was videotaped, and the students watched it afterward to assign titles to the various segments that captured the twists and turns of their science identities. Using WeVideo, they entered these titles into the video of their performance, which had a duration of a little over 2.5 min. We consider this process as part of both data collection and data analysis that informed the empirical illustration of this study since the performance itself and the labeling of its segments involved the students' own processing, analysis, and representation of their experiences and science identities. Thus, the data that both authors–researchers analyzed included data that have been first analyzed and interpreted by the students themselves along with the actual dance performance. The students had linked moves and dances they were planning to perform with intended meanings associated with their science identities in the recorded discourse. They had also come up with labels for the various dance segments after they were performed, which captured in words the meanings they believed these segments communicated about their identities. Thus, the data for the empirical part of this study, aiming to explore ethnodance as a research tool and artifact of the

youth's narratives of their science identities, appropriately consisted of both the young people's performance and how they considered it as representative of their science identities.

The data analysis was informed by narrative inquiry practices and arts-based research practices, both of which illuminate aspects of the ways of being in the world, marked by one's own exploration and representation and, thus, giving voice to, and highlighting the voice of, people themselves (Leavy, 2009). The analytic focus was on the meaning-making related to who the students were, and were becoming, in science that they were communicating in planning and executing their dance performance and in the oral language they were using. This meaning-making was captured by paying attention to how the students were labeling, identifying, and classifying ideas about themselves and science and including them in the ethnodance. We also paid attention to the emotional aspects of identity construction that artistic representations are more effective in communicating, thus capturing how emotions and meanings were intertwined in the dance performance.

As Rolling (2010) noted, "there is no one set of criteria for judging the artistic quality of a work of arts-based research just as there is no one paradigm for the beauty of a work of art; for some, the beauty of a work of art is in the esthetics of its forms and the mastery of its techniques, for others, it is in the authenticity and expressiveness of voice, and for still others, in the incisiveness of its social critique" (p. 105). First, we watched and rewatched several times the dance performance. We noted the various segments that the students had marked and the titles that they had associated with them, analyzing the identity meanings that they put forth with these titles. Then we categorized and described the features of each dance genre used in each segment. Mindy's personal engagement in the artistic form of dance was used to define moves and distinguish among dance genres. We looked for what each dance segment evoked as an esthetic form, the salient technical elements of the body movements and positions, how the dance segment expressed understandings related to the students' science identities, and how it connected with what the students had orally shared about the intended meanings of that dance segment.

Thus, as we looked at each part of the performance and the meanings communicated (meanings intended by the dancers, and meanings developed by us as researchers), we attended to the three metafunctions of any communicative system as noted earlier–ideational, interpersonal, and textual (Halliday, 1978; Jewitt & Kress, 2003; Kress & vanLeeuwen, 2006). We captured the ideas communicated about science identity and science identity construction (ideational metafunction). We interpreted the ways in which the students interacted with each other planning and enacting the performance–interactions intertwined with the meanings the performance intended to communicate (interpersonal metafunction). We also analyzed how the students engaged with, and organized, the semiotic resources of each of the dance genres they used in their choreography to reflexively construct meanings and perform the intended meanings (textual metafunction). As noted above, the recorded student discourse during the planning of the ethnodance captured the students' interpretations of the ways in which their ethnodance captured their science identities. Thus, the various discourse excerpts provided triangulation of the researchers' understanding of the dance segments and their significance in representing the students' science identities.

3.3 | Empirical illustration

Analysis of the creation of the dance production and the dance performance itself revealed important dimensions of the students' identity authoring who chose to portray first the move from the previous year's biology classes to that year's physics classes and then dedicate most of their performance to how they experienced engagement and learning in their physics classes. Students used particular dance and music genres to express cognitive, social, and affective components of the experiences, which were associated with various aspects of identity construction, including competence, participation in science practices, emotions, recognition, insider/outsider status, and interactions among peers and teacher. The nature of each dance genre, with its specific features, and the orchestration of various genres in one dance performance offered them opportunities to delve deep into their experiences and articulate, in ways that made sense to them, what these experiences meant regarding who they were becoming in the physics class.

A summary of the dance performance with its 11 parts is provided in Table 1 that includes information on each part regarding (a) the dance genre, (b) the selected song to accompany the dance, (c) the salient choreography

TABLE 1 Summary of dance performance and its parts

Dance genre	Song	Choreography features	Experience and meanings	Title
Hip-hop (upbeat)	Missy Elliot: Lose Control (hip-hop)	Began with an 8-count sequence and transitioned to a 16-count sequence.	Being in the biology class (happy and easy)	Biological Bliss
Ballet/lyrical (slow)	John Legend: Glory (R&B)	Abrupt change of song, fast to slow song, puzzled expressions, unsure of dance moves. Joined in at random movements.	Moving to physics without taking Chemistry coupled with the math-heavy aspect of physics (challenging)	The Gap
Contemporary (slow-motivational)	John Legend: Glory (R&B)	Faced forward and danced for 8-counts. Struggled through a heel extension. After struggling to catch up with each other's moves, eventually ended together in unison.	The beginning of physics class (uncertain, frustrated, yet willing to try)	Whet???
Contemporary (slow-enticing)	Kalin White: Twisted (R&B)	Music transitioned to a slow R&B song as slowly dropped arms for 4-counts.	Physics lab activities (growing to like it)	The Glow Up
Contemporary (slow-enticing)	Kalin White: Twisted (R&B)	The Mirror Effect: Danced in a unison trio facing forward. All worked to be on the same beat throughout the segment.	Teacher–student interactions (matching teacher's energy)	A New Attitude
Contemporary (slow-enticing)	Kalin White: Twisted (R&B)	Faced backward and danced for a four-count sequence and turned around in unisons.	Teacher–student interactions (additional support, success)	Don't Stay Behind
Majorette (slow)	Kalin White: Twisted (R&B)	Adjusted spacing to make room to do a death-drop in tight hallway space. Performed the drop on the same beat in a triangular pattern.	Student–student interactions (collaboration)	The Co-Lab
Majorette (upbeat)	Snappy Jit: We go to Work (dance mix)	Built-up anticipation for the next dance moves by bouncing/skipping in place.	Enjoying physics (energy, time, critical thinking)	Werk
Majorette (upbeat)	Snappy Jit: We go to Work (dance mix)	Performed dance moves in unisons with one dancer being slightly off-beat.	Persisting in physics (difference, place in the group)	The Challenge
Majorette (upbeat)	Snappy Jit: We go to Work	Came together and leaned on each other into a unison row, into a quick turn, ripple leg kick, and a smile.	Epiphany of understanding (critical thinking and common sense)	The Mesh-Up
Majorette (prancing-walk)	Snappy Jit: We go to Work	Marched into the Physics classroom in a straight line with backflip kicks.	Approaching a new quarter (open-minded attitude)	TBA

features of the dance performed by the students in relation to an experience represented, (d) the experience represented by the dance and the main highlighted meanings of the experience, and (e) the title of that part of the dance performance that captures both the experience and its interpretation by the students and representation via the dance.

The semiotic decisions that the students made by the dance genres they chose to perform represent the connection or disconnection between self and science that they had been experiencing at various parts of their journey. The students used ballet, lyrical, and contemporary dances to represent experiences that either challenged their position within the practice of science or positioned them outside of the practice altogether. The students selected majorette or hip-hop style dances to represent experiences that affirmed their position within the practice of science or created a bridge for them to enter that space. Below we elaborate on the dance genres performed and the meanings communicated related to these students' experiences and identity construction and illustrate how an ethnodance offers possibilities for identity authoring.

3.4 | Challenging dances and insider | outsider transitions

The students saw the start of the physics class as a significant change from the biology class they had experienced the year before. They represented this shift with dramatically different dance genres to embody the difference between their previous biology class versus the start of their current physics class. They started their dance performance with an upbeat hip-hop dance. True to the origins of hip-hop dance, they came together to celebrate themselves as knowledgeable beings (Durden, 2009). In this part of the performance, students used a variation of bounces (i.e., up and down movement with feet planted on the ground) coupled with side rolls (i.e., side to side movement initiated through the hips), popping (i.e., forward thrust of a body part), locking (i.e., a hard stop in between moves such as a pop), and step sequences (i.e., movement of the feet forward and back in or out to the rhythm of the beat). Although these types of movements show up in other genres of dance, the way the students performed them aligned more with the free-flowing style of hip-hop. Although the students were performing the choreography, they moved into individual expression by letting go of the agreed-upon movements and using improvisation to show what was inside of them, a crucial aspect of being able to truly engage in hip-hop dance (Durden, 2009). Snapshots 1–5 in Figure 1 show how the students were performing variations of the same move during the first segment of their dance performance. Snapshot 6 captures the moment students transitioned from "Biological Bliss" to "The Gap."

The students named this first segment of the dance "Biological Bliss" to denote the happiness and level of comfort they had developed in the biology class. Although they also acknowledged that the biology class "was difficult," they felt good about themselves because the teacher "helped (them), (and therefore) it was easier to understand, (and this was the case) throughout the whole year." Making sense, in a sustained way, of the science ideas involved in a course seemed to be an important part of identifying with the subject matter. The dance title the students used to represent their overall experience in the biology class captured the euphoria they had associated with it and with science, which was different from how they were seeing themselves in the physics class.

From science insiders in the biology class, the students felt like science outsiders, challenged, confused, and frustrated, which came across via the ballet/lyrical and contemporary dance genres they performed to symbolize their early journey in the physics class. In their Dance Club with the Mindy, students were open to learning such dances but they often had difficulty connecting to the dances and/or performing some of the technical moves. Choosing these dance genres, with which they were not particularly comfortable, to embody their being in the physics class captured the struggle and alienation they were experiencing as their science identity was morphing. Who they were and becoming in relation to dance was informing their ways of explicating and constructing who they were and were becoming in relation to science.

In what they named the "The Gap" segment of their dance performance, the students used ballet to communicate their initial experience in physics as "sad" and "frustrating," as they articulated in Discourse Excerpt 1 and portrayed in their dance performance.

FIGURE 1 Snapshots of the first part of the dance performance: From "Biological Bliss" to "The Gap" [Color figure can be viewed at wileyonlinelibrary.com]

Discourse Excerpt 1 (transcription symbols key provided in the Appendix)

Fara:	In the beginning, you [referring to Jasmine] didn't like physics that much |
Jasmine:	Yea!
Fara:	But toward the end, you was like #"yea, I like this!"#
Jasmine:	#It's fun!#
Fara:	You can do ~ like what in terms of the sad to jolly ~ you can do [chuckling] like um uh no ~ types // ballerina type moves in the beginning and then go into like some |
Jasmine:	Fun!
Mindy:	What would the ballerina type moves represent?
Jasmine:	Sad, hurt!
Fara:	I say ~ [chuckling] hurt?
Fara & Jasmine:	[Laugh]
Fara:	Um the #frustration of [still chuckling]#
Jasmine:	#Yea I'm hurt#
Fara:	how frustrating it [referring to physics] was at first and then slowly changing to like understanding it.

Ballet, according to the Oxford Dictionary of Dance, is a "western academic theater-based dance" most often performed under classical music, and associated with a high level of rigor, technique, and power "to create a dramatic or lyric effect" (Craine & Mackrell, 2010). Although the students had learned to try all genres of dance in their Dance Club, they had been most resistant to dance genres that require the use of slow music and specific alignment of arms, legs, and feet in relation to the center of the body, as in ballet.

As the students enacted the dance performance and moved from the hip-hop routine "Biological Bliss" to the ballet "The Gap," they included an abrupt change in the music and they showed facial expressions of confusion to reinforce the idea of "the gap" between biology and physics classes and the immensely different emotions they had experienced in these classes. Missy Elliott's up-tempo R&B/hip-hop song "Lose Control" quickly faded into John Legend's slow and methodical song "Glory." Figure 2 shows Tiffany's smiling being replaced by a somber expression.

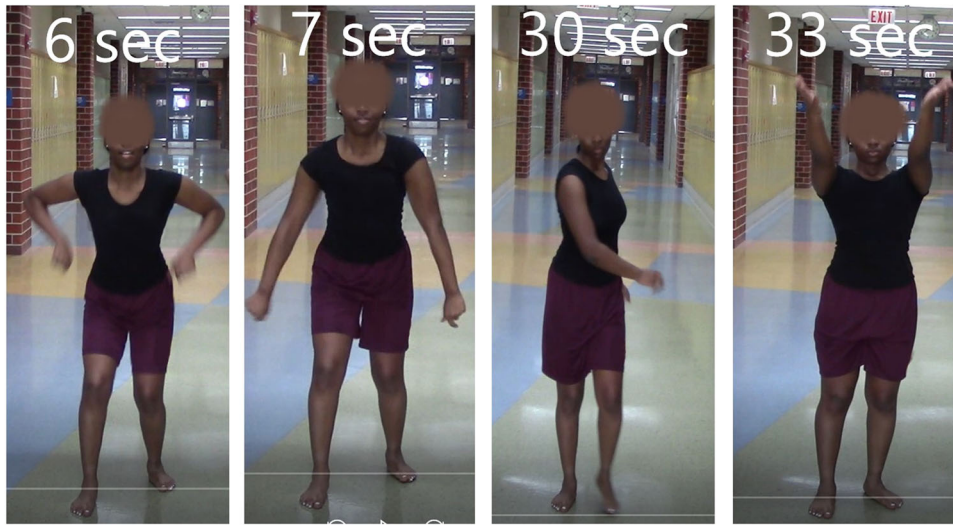

FIGURE 2 Tiffany's facial expressions in "Biological Bliss" (6 s and 7 s) and "The Gap" (30 s and 33 s) [Color figure can be viewed at wileyonlinelibrary.com]

Jasmine (on right side in Figure 3) turned to Tiffany (middle) and Fara (left) with a look of confusion and pivoted on her left leg while stretching her arms up, out, and down in a circular motion (Figure 3, Snapshots 1–2). Tiffany and Fara watched Jasmine before joining in on the next move. They all span in a low plié (i.e., bending at the knee with feet planted on the ground) to the right and repeated the circle arm move to the front (Figure 3, Snapshots 3–4). Moving into "Whet???" (which in urban youth vernacular means "What the hell???"), they continued dancing together, whereas struggling to be "on one accord" where all dancers complete the moves at the exact same time while maintaining proper arm, leg, and foot positioning (Figure 4, Snapshots 1–5). As they pulled a right heel stretch (i.e., upward extension of the leg using the arm to pull up via the heel), Jasmine's right leg was almost straight at a 135-degree angle. Tiffany and Fara's knees were improperly slightly bent. Tiffany's right foot was correctly pointed while Jasmine and Fara's feet were improperly in the flex position. Jasmine's torso was improperly in a slight lean to the left and Fara's left arm was slightly higher than intended (Figure 4, Snapshot 3–5). Jasmine and Tiffany held their heel stretch for the intended 2-count sequence but Fara seemed to lose balance and quickly stumbled back out of the move.

Though the choreography that the students created for the "The Gap" dance would be more accurately classified as lyrical, as it looked like more of a blend of ballet and jazz, the students referred to it as "ballerina type moves" that signified dance moves requiring precise arm, leg, and foot positioning, which the students struggled to perform but also persisted and completed them in their dance. The "Whet???" dance was a contemporary dance, specifically what has been referred to as contemporary commercial dance: An "emotive, dramatic, and virtuosic" ensemble of dance styles and techniques (Kwan, 2017, p. 42). Though still including technical elements and challenging moves, in contemporary dance the focus is not on the center of the body as in classical dance to allow innovative manipulation of the body. Every part of the choreography is laced with the emotional and physical state of the dancer. The students used the semiotic resources of contemporary dance to express that physics was "uncertain and frustrating, yet (they were) willing to try." They depicted the ambivalence, frustration, and compromised competence that they were experiencing at the start of the physics class, a higher status science course than biology, which was contrasted to the "happy" confident science identity the students had at the end of their biology class. However, they also represented being "willing to try" as they performed the slow-motivational contemporary dance "Whet???"

FIGURE 3 Snapshots of "The Gap" segment of the dance performance [Color figure can be viewed at wileyonlinelibrary.com]

FIGURE 4 Snapshots of "Whet???" segment and struggling to be "on one accord" [Color figure can be viewed at wileyonlinelibrary.com]

The students attributed their painful experience at the beginning of physics class to the rearranged curricular sequence that the school had implemented and the math-heavy nature of physics, which seemed to had created barriers as shown in Discourse Except 2.

Discourse Excerpt 2

Fara: They [school administrators] wanted to experiment with our class so they gave us environmental instead of biology our freshman year.
Jasmine: Everything was new to me.
Mindy: Is it new because you didn't take chemistry [in sophomore year but took biology] or was it new because it's physics, what do you mean?
Fara: Because we didn't take |
Jasmine: It [physics] is like another math.
Fara: Physics is definitely a math class
Jasmine: So, it's like ==
Fara: So, coming from biology where it was #more about#
Jasmine: #Science#
Fara: more science-related going to a class where it is mostly math-related, it [physics] was challenging because I'm not good at math ~ but I'm somehow good at physics!

The physics class was for the students their first encounter with a science class that relied so much on math. As Fara positioned herself with less competence in math, she was surprised that she was both "not good at math" but "somehow good at physics," which meant that she was good in thinking about physics ideas. The students were making a distinction between the qualitative dimension of science and the math-based one. Being confident in one but not in the other meant that Fara's confidence at the end of biology was fragmented. Fara questioned her science competence because of the math-heavy nature of the physics class yet affirmed her position as a doer of science.

This commitment to trying and continuing to work toward succeeding in science despite the frustration and rough start was represented with a switch to a contemporary dance while the same song was playing (John Legend's Glory). The students were intentional in working against their frustration as shown in Discourse Excerpt 3.

Discourse Excerpt 3

Mindy: What type of moves will you use to show that you're like frustrated, what do you think you'll be doing?
Jasmine: Slow.
Fara: I would say yea! I can imagine like a |
Jasmine I can imagine like ~ yea! |
Fara: Mime-ish type of dance |
Jasmine: Yea! You know how they be like trapped in something // like you tryna fight // you basically fighting the battle within yourself, tryna break that frustration. So, sum like that.
Fara: I was tryna say contemporary dance ==
Jasmine: Yea!

As the students were "telling a story through dance," they then moved on to identify aspects of their physics class experiences that gave rise to more positive involvement. They continued with contemporary dance but switched to Kalin White's R&B song "Twisted," a song better fitted for the slow-enticing contemporary dance they created for that part of their story. The dance was segmented into three parts to convey their engagement in lab activities ("The Glow Up"), the changing teacher–student interactions ("A New Attitude"), and the support they were receiving from their physics teacher ("Don't Stay Behind").

In the "The Glow Up," the students slowly dropped their arms as the music changed from John Legend's Glory to Kalin White's Twisted (Figure 5, Snapshots 1–6). As the verse began, they all stepped right into two rotating pliés

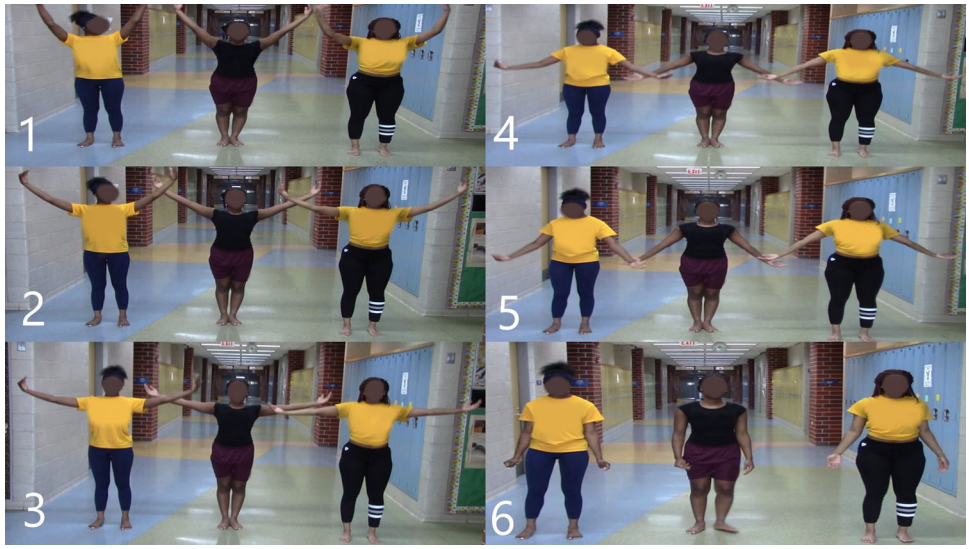

FIGURE 5 Snapshots of "The Glow Up" segment of the dance performance [Color figure can be viewed at wileyonlinelibrary.com]

while beating their right fist to their right hip following the beat of the song in the segment they entitled "A New Attitude" (Figure 6, Snapshot 1). Next, they all fell into a split followed by a right-left foot tap in a right-facing, sitting, bent-knee position before using a spiral leg kick to turn to the back and stand (Figure 6, Snapshots 2–6).

They all danced backward for a 4-count sequence before turning into the "Don't Stay Behind" segment of the dance performance by stepping onto their left leg while contracting and swiping up their left leg with their left arm. Facing forward, they moved into a dutty wind sequence (i.e., a traditional dancehall move involving isolation of the hips), ending this segment of the performance (Figure 7, Snapshots 1–4).

The moves in the slow-enticing contemporary dance of the students' performance denoted their transition back to insiders of science. They were "fighting the battle within yourself, tryna break that frustration" experienced in physics with the beating of the hip. The change in the tempo and mood of the song coupled with the slow release of the arms represented how they had grown to like physics and especially the lab activities, "The Glow Up." With the segment "A New Attitude," the students showed the importance they were attributing to the attunement between teacher and students and mutual respect and recognition of each other's positive attitude, echoed in Discourse Excerpt 4. "Don't Stay Behind" represented the active roles the students needed to take to perceive and receive teacher support and be successful in physics.

Discourse Excerpt 4

Fara: The teacher's definitely relevant to be able to teach you what you need to be taught but you're gonna have to put forth the effort to want to be taught and to actually sit there and listen to it so ==

Jasmine: And then like some students // they'll like come in the class with an attitude |

Fara: Yea.

Jasmine: You gotta come in with the same vibe the teacher has ~ So the teacher is all happy and willing to help you, take it. Like don't |

Fara: Right.

Jasmine: give them attitude cause that makes them not want to help you and they'll help the next person.

Fara: Right.

FIGURE 6 Snapshots of "A New Attitude" segment of the dance performance [Color figure can be viewed at wileyonlinelibrary.com]

Jasmine: You can't be disrespectful to the teacher and want the teacher to be nice to you but you can't be nice back.
Fara: Yea.
Jasmine: You can't show the same #respect#
Fara: #Right, but then later on want help#
Mindy: So how do you show that in your dance?
Jasmine: So basically like ~ like doing the same thing ==
Fara: I say like on one accord
Jasmine: Yea! Same beat, same everything, or like mirroring each other

FIGURE 7 Snapshots of "Don't Stay Behind" segment of the dance performance [Color figure can be viewed at wileyonlinelibrary.com]

The student identities of the young people, which included being respectful and willing to engage, were shaping their identification with physics in a class where they perceived the teacher as a genuinely "happy" person and eager to help them learn physics. Their science identities that were initially challenged in the physics class were being reconstructed as they were supported in participating in the practice of physics and recognizing that they were members of that community. Physics was challenging and required sustained involvement "you cannot miss a day. You cannot like // you just can't miss out on nothing. If you miss out on something it is hard to catch up or it's hard to understand. You have to be there every single day." However, utilizing the bridges created by the teacher-positive attitude and willingness to help students, and the students' own persistence and willingness to "fight" their frustration, provided an opportunity for them to see themselves as successful members of the physics class. The students' ethnodance was masterfully portraying their science identity construction. The ethnodance communicated meanings, interactions, and emotions, some of which were confirmed by the oral language students used to plan for their dance performance and negotiate how to represent who they were and were becoming.

3.5 | Black dance and the insider science identity

As the students were evolving back to science insiders and becoming competent knowers of physics, they chose to portray their more joyful experiences and moments of perseverance with the majorette dance genre. Generally speaking, a majorette is defined as a female member and / or leader of a marching band who twirls a baton during performances (Stevenson, 2010). While this definition of majorette still remains, the term has evolved to its own dance genre. Majorette as a dance genre is rooted in the United States South and the South's Historically Black Colleges and Universities (HBCUs) where majorette dance teams performed under the tunes and drumlines of the HBCUs' marching bands constituting a crucial aspect of HBCU culture. Over the years, the dance genre evolved to offer dancers more ways to show their power, their athleticism, and command over their bodies. Majorette's recent prominence may be attributed to the 2014 nationally syndicated television show "Bring It," which airs on the US Lifetime Network. The show documents the experiences of an elite majorette dance team in Jackson, Mississippi, known as the "Dancing Dolls." As an example of Black Dance, majorette offered the three Black students and dancers space to "turn to the thing they have rights over their body" (Bakare-Yusuf, 2005, p. 267) and a sense of cultural solidarity providing an opportunity to navigate the constraints of "mainstream dance" to convey their story, similar to how they navigated boundaries and constraints to become active members of their physics classes.

The students ended Kalin White's "Twisted" song with a death-drop, a typical majorette move in which dancers jump from a standing/squatting stance and then catch themselves with their hands as they drop to the ground fanning both legs up and around and lay down on the floor (Figure 8, Snapshots 1–4). In this segment of the dance, the students reoriented themselves in the hallway so that they could all perform the death-drop in the given space. They represented what they entitled the "The Co-Lab," student–student interactions and collaboration which provided support and affirmation of students' belonging in physics.

The students then switched to Snappy Jit's Dance/Electric fast tempo dance-mix song "We Go to Work" to represent feelings and conceptions of the physics class toward the end of their third quarter. Three segments entitled "Werk" (a celebratory expression used when someone is "going hard" or performing movement with vigor, precision, and excitement), "The Challenge," and "The Mesh-Up," were choreographed in upbeat majorette. Majorette is a dance genre that involves rapid movements, bucking (i.e., forward hip thrust simultaneously coupled with quick chest release/contractions while in a wide stance plié), stunts (i.e., technically and physically challenging moves, as seen in cheer and/or gymnastics, requiring athleticism, strength, control, and agility), stand battles (i.e., face-off competitions between captains, coaches, or dance teams via a back and forth dance performances), and a confident, bold attitude.

After the death-drop, the students laid on the floor for 2-counts (Figure 9, left) before standing and running in place to the quick tempo change as Snappy Jit's "We Go to Work" echoed in the background (Figure 9, right). Tiffany continued to dance center, but Fara and Jasmine switched positions. As they moved to the faster tempo of

FIGURE 8 Snapshots of the "Co-Lab" segment of the dance performance [Color figure can be viewed at wileyonlinelibrary.com]

the song, Fara was a 1/2 count behind Tiffany and Jasmine on the first 8-count sequence of this segment. Fara eventually caught up, as the trio finished the choreography in unison. They all faced right toward their biology classroom door and leaned on each other's back while completing three rotating pliés (Figure 10, Snapshots 1–2). Next, they pivoted to face left as Fara started a ripple (i.e., a movement passed from one dancer to another in quick sequence), sidestep out, which traveled from Tiffany to Fara (Figure 10, Snapshots 3–5), before they all marched into their physics classroom door to end the dance (Figure 10, Snapshots 6–8) in the segment they entitled "TBA." The students used the hard-hitting moves, fast tempo, sassy attitude, and physically demanding stunts of the majorette dance to express their progression into the 4th quarter of physics class.

FIGURE 9 Ending "The Co-Lab" segment and beginning the "Werk" segment of the dance performance [Color figure can be viewed at wileyonlinelibrary.com]

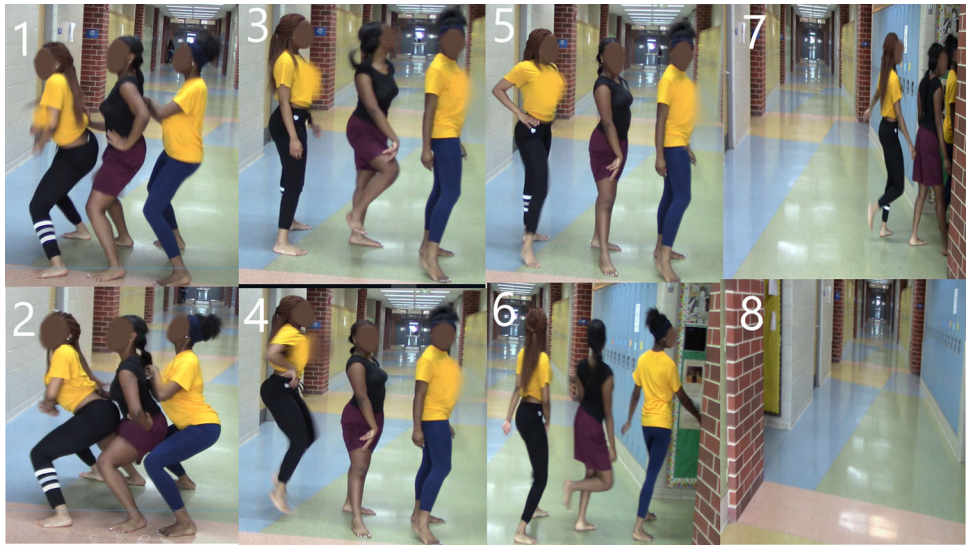

FIGURE 10 The "Mesh-Up" and "TBA" segments of the dance performance [Color figure can be viewed at wileyonlinelibrary.com]

Discourse Excerpt 5 shows how the students arrived to the decision to perform majorette dances to communicate their growing understanding and enjoyment of, and identification with, physics. Working together with peers seemed to be one of the main reasons for using a dance genre like majorette to stand for such identification.

Discourse Excerpt 5

Mindy:	What moves would represent you getting to that point where you understand? What would you do to represent that?
Fara to Jasmine:	What would you do?
Jasmine:	Smile.
Jasmine & Sara:	[Both chuckle].
Mindy:	What type of dance do you do when you smile the most?
Jasmine:	Majorette.
Mindy:	Ok.
Fara:	The students don't get on my nerves, so they're alright.
Jasmine:	Um ~ we could like come together and dance like ~ we can like dance with each other and like interact with each other in the dance. Like we helped |
Fara:	Right.
Jasmine:	each other out or something.
...	
Fara:	You can actually depend on your classmates, well some of your classmates |
Jasmine:	Yea.
Fara:	to help you understand or help each other out.

As a dance genre with which the students identified more strongly, majorette provided them with a way of crafting and communicating that they were becoming insiders of the physics class by working and supporting each other in a space where they originally faced challenges. As Discourse Excerpt 6 shows, the students continued to

see physics as requiring "a lot of work" but they also had found a place in that class that was comfortably and enjoyably challenging for them, just like majorette dances.

Discourse Excerpt 6

Jasmine:	[Physics is] a lot of work.
Fara:	[laughs] I wouldn't necessarily just say a lot of work. It is a lot of work but it requires you to actually think about it. Like put forth your knowledge to figure it out. It's definitely a class that helps you challenge yourself.
Jasmine:	Critical thinking |
Fara:	Yea!
Jasmine:	It's actually common sense too!
Fara:	It's like one of those things they say don't overthink it |
Jasmine:	Um yea.
Fara	look at it, calm yourself down.
…	
Jasmine:	The hard work it [majorette] is. It's tiring.
Fara:	I would say, yea it's tiring, it takes dedication.
…	
Mindy:	Majorette would represent ~ what did you say again?
Fara:	Um it's a lot of work. It takes dedication ~ You have to really be focused with it |
Jasmine:	Yes!
Fara:	because of like the type of movement it is |
Jasmine:	You have to be on beat, on track.
Fara:	It's like the same thing with class.
Fara & Jasmine:	[Both chuckle]
Fara:	You gotta be on track ~ you gotta try to stay on top of it. You gotta be dedicated to tryna do what you gotta do to get where you want to be. But at the same time you gotta try and have fun with it ~ because I mean |
Jasmine:	Yes!
Fara:	If you're not having fun while you're doing it, what's the purpose of doing it?

As the students performed the majorette choreography, from "Werk" through "The Mesh Up," the emotional content of the dance was communicated all over Tiffany's face. Seconds into this choreography Tiffany stuck her tongue out while dancing (Figure 11). Throughout this segment, she moved through a variety of smiles. Though not being present during the audio-recorded planning meeting that Mindy attended, these snapshots reveal that, just like Jasmine and Fara, Tiffany associated "smiles" and "having fun" with majorette.

The students' performance of majorette to represent their sense of who they were becoming in the physics class communicates salient ideas regarding their identity construction and positioning of themselves in that class. In the Dance Club, majorette was the students' preferred dance genre; when given the option, students almost always chose to perform majorette dances. In fact, their persistent request to have a majorette team was the only reason Mindy had agreed to turn the once informal, nonschool affiliated, externally sponsored dance club into a formal, school-sponsored, and affiliated club. The students linked the dedication, hard work, focus, and resilience required to perform majorette dances to the same elements needed to be successful in physics. They also considered two seemingly opposing features they had experienced in physics–being challenged, since doing physics required "critical thinking," and also being at ease and calm, since doing physics also meant "common sense too." This "in-between state," which they performed in their majorette dances, felt to them both natural and challenging to perfect and was instrumental in allowing them to continue to be hopeful and engaged as members of the physics class.

FIGURE 11 Tiffany's facial expressions throughout the majorette choreography [Color figure can be viewed at wileyonlinelibrary.com]

That segment of the students' dance performance also exuded pleasure. The students had come to experience fun with physics, which they considered a vital aspect of positively identifying with it, in addition to staying on top and being on track. As Fara verbally wondered, "if you're not having fun while you're doing it, what's the purpose of doing it?" Performing majorette dances was fun for the students and so they had chosen that dance genre to express what they had considered as essential emotional dimensions of their science identity construction. Physics needed to provide students with affirming, positive, and fun experiences to support their engagement, success, inclusion, and membership in that community, as they also showcased their own willingness to engage and their persistence in becoming successful in the physics class. For these three students, their ethnodance became both a medium for, and a product of, their science identity construction as they performed the intersection of who they were and were becoming as dancers and who they were and were becoming as science students.

4 | DISCUSSION

With this study, we sought to expand the methodological repertoire that could be used in science education research by offering a theoretical argument supported by an empirical illustration regarding the role of what we called "ethnodance" in strengthening identity studies. Specifically, we focused on identity studies of Black students in relation to science, a subject they study at school for which the US society has historically positioned them as deficient, uninterested, struggling, and behind other racial and ethnic groups. We argue that ethnodance offers Black youth with dance identities a medium they could use to not only narrate their science identities, communicate meanings, interactions, and emotions—all integral dimensions of identities as positionings of self—but to also construct them further as reified artifacts of their participation in science classroom communities (Wenger, 1998). Dance as an expressive form serves as a medium for Black youth to stake agency over one's own body while establishing/maintaining cultural traditions and moving beyond societal confines (Bakare-Yusuf, 2005; Daniel, 1991; Gittens, 2012; Patton, 2011).

The students' purposeful selection of different genres of dance to represent different experiences and positionings in science revealed the interaction of various identities: Their racial identities and who they were as Black people, their dance identities influenced by what they were learning about, exploring, and affiliating within their Dance Club, and their science identities and how they ebbed and flowed across different science subject classes. Not only did a Black Dance, majorette, emerge as the students' preferred genre to evoke joy, accomplishments, and periods of perseverance, it also exhibited the bonding that students felt with each other as they performed this part

of the ethnodance. This bonding is evident in the intensity of their movement during this segment, which peaked in this portion of the dance performance. The juxtaposition illustrated in Figure 9 shows the stark contrast in intensity as the students transitioned from laying down completely still to jumping in place. The students' dance transitioned from a "survival mechanism…(to a)…network and source of…solidarity and support" (Maulucci, 2012, p. 132) through majorette. Majorette seemed to offer the students a sense of cultural solidarity, a solidarity that is also symbolic of their collective overcoming of the obstacles faced, and the frustration and alienation they felt at the beginning of the physics class. Their collective effort and commitment to rise above the struggle was intertwined with how their competence in physics was constructed, deconstructed, and reconstructed. As the students engaged with their favorite part of science—doing experiments and projects—in their physics classes, and saw their competence to engage in science come back to the level they had experienced in their biology classes, they felt confident they could overcome the challenges they had faced with the more mathematical configurations of ideas for which they were not prepared since they had not taken chemistry. Their competence in, and love for, majorette fueled the energy of their whole dance performance and together with the earlier ballet, lyrical, and contemporary dances captured how their positioning in science classes ebbed and flowed with experiences and contextual factors.

As Alexander (1999) noted, "we all exist between the lines of our narrated lives, the stories we tell and the stories that are told about us" (p. 310). With the ethnodance, the students explored the "in-between-ness" of their narrated lives producing stories they wanted to tell about their identity authoring throughout the physics class, stories that push back on the master narratives that accompany Black science students. The ethnodance gave them the opportunity to "dig in" the narrative they were composing about themselves as science people and develop a new a collective commitment to persist in physics and to both learn and have fun.

Emotions were a natural part of the students' ethnodance. As Maulucci (2012) noted, emotions "include cognitions, bodily responses, and actions" (p. 124), and ethnodance seemed to offer students affordances to engage in all three—their bodies performed actions that made them feel what the experiences, positionings, interactions, and knowledge construction meant for them in their science classes. The modal ensemble of dance provided space for students to more extensively express frustrations and triumphs than using words. This was primarily accomplished through their choice of music and their facial expressions. The students choose slow-tempo melodies to set the mood for experiences that were frustrating or challenging, and upbeat, fast-tempo melodies or dance-mixes to establish moments of triumph. This allowed them to convey the emotionality of their narratives in ways that could evoke deeper feelings of their experience "that oppressed voices could not" (Gittens, 2012, p. 51). Similarly, facial expressions also conveyed the emotional mood of their experiences. Throughout the performance, the students' facial expressions shifted as the emotionality of their experiences shifted. Moments of frustration were filled with frowns, blank faces, and looks of confusion, whereas open and close-mouthed smiles were embedded in moments of triumph. As Tiffany tended to be more facially expressive than other dancers in the Dance Club, her moments of frustrations were filled with eye squints and deep frowns, a stark contrast to moments of triumph that were filled with open mouth smiles with her tongue stuck out. Learning is an embodied activity; the human body as a whole is involved in how we understand the world (Merleau-Ponty, 2002). The ethnodance offered the students an opportunity to represent who they were becoming as science people and to narrate their science identities beyond words. Thus, in this paper we have shown theoretically and empirically how ethnodance has the capacity to engage students in representing science identities and further shaping them because all representation involves construction and development of new understandings. The ethnodance was a multimodal form of what Bamberg and Georgakopoulou (2008) called small stories, opportunities to construct a sense of who people are vis-à-vis particular contexts, interactive practices, and roles, capturing identity as a process of constant change.

Because identities are an essential part of learning, embodied representations of meanings, interactions, and emotions that are integral to identities, and that the ethnodance sanctioned, need to be seriously considered and sought after. Varelas, Martin, and Kane (2012); Varelas, Menig, Wilson, and Kane (in press); Varelas, Tucker-Raymond, and Richards (2015) have argued that learning in any discipline, including science, should be viewed as both content learning and identity construction and that explicit attention should be given to both knowledge

production and identity production in science classrooms. The illustration provided by the empirical exploration of the present study provides an example of an arts-based artifact, namely a dance performance, which offered the participating students an opportunity to explicitly engage with their science identities in a meaningful way and to represent how they were positioning themselves in the midst of their science content learning albeit outside of their science classroom. Thus, this arts-based artifact expanded and extended the discourse and linguistic narratives that the Black youth was creating about who they were and were becoming in science spaces that the present study also documented.

The creation of such identity artifacts not only allows students to explore and stitch together meanings of who they are and are becoming in science but they also elevate the significance and value of the representational genres they chose to embrace. The Black youth in the study unapologetically used Black Dances to communicate their positive experiences and sense of pride and affiliation with the work they were doing in the physics class. In this way, they not only positioned themselves in science against the master narrative of Black educational underperformance, deficit, and achievement gap, they also positioned Black Dances against the master narrative of Black Dances' lower prestige relative to western dances.

Moreover, similarly to what Leander and Boldt (2012) highlighted regarding youth identities and literacy research, the body movements and expressions that the young people included in their dance performance captured much more than predetermined meanings of who they were and were becoming in science. The students' dance enactments did not only represent predefined ideas about their science identity construction that they had thought about ahead of time; they were sites "where affect, imagination, passion, and energy are constantly being produced…opening toward new possibilities that cannot be determined in advance" (Leander & Boldt, 2012, p. 32). Body movement in a performance, including a dance performance, has potential to capture identity construction in emergent ways with an "ongoing flow of affective intensities that are different from the rational control of meanings and forms" (p. 36). Thus, a dance, or a theatrical performance, provides a unique tool for engaging with identity construction, from a research and a pedagogical perspective, in more unbounded, emergent, in continuous flux, and liberatory ways, consistent with the spirit of Black Dances, and, thus, fruitfully support and explore Black youth's science identity construction and meaning-making.

In this study, we explored how and why ethnodance can be considered as a methodological tool to expand the repertoire of science education researchers pursuing identity studies. Questions, though, arise such as: Who can use this tool and how? Is it a meaningful tool for students who are not dancers? What expertise is needed by the researcher and the students? Is it only a research tool, or does it also have potential uses in the teaching of science? To answer these questions, we first need to reiterate some important elements of the empirical exploration of this study. For the Black students who created an ethnodance of their science identities, dance was part of their lives. The students were members of their school Dance Club, which, although gave them opportunities to study various dances, had mostly as its focus majorette dances that the Black students identified with. One of the researchers who analyzed the ethnodance was both a science and a dance teacher, shared with students the same racial identity, and had an understanding of Black Dances. We believe these are essential aspects of the study that allowed us to both theorize about ethnodance and to develop an empirical illustration of how it could capture and support identity construction. The fact that both the study participants and the lead researcher were insiders of the multiple communities that were involved in this exploration, not only increased the trustworthiness of the interpretations but was essential in coming to see how dance allowed for representing science identities. Although such configurations are necessary for continuing to develop the value and impact of ethnodance as a tool for educational research, expanding the use of the tool with students who are not dancers but willing to try expressing themselves through any forms of dance they prefer, can contribute to developing a deeper understanding of how valuing and accepting art-based practices and embodied performances provide pathways to meaningful engagement with science identities. Though ethnodance as an arts-based identity narrative does not belong exclusively to those who are already insiders to the dance community, participants and researchers will need to

spend some time immersed in the discourse and practice of dance (McFee, 2003) to collectively negotiate the meaning of ethnodance as a tool for capturing and supporting identity construction.

Given the potential of ethnodance to involve Black students in sophisticated contemplations of their relationship with science in science classes and in crafting a niche for themselves in challenging classes, such as physics, and bolstering their sense of belonging in such classes, ethnodance could also serve as a teaching tool. Ethnodance aligns with Darder and Cronin's (2018) critical pedagogy of dance where "the dance becomes a shared space of cultural release and expression of one's individual and collective being, connected to all those who have danced before us and all those who will dance in the future" and where knowledge created by "decolonizing dance pedagogy…can function as important forms of both, resistance against and healing from cultural oppression" (pp. 33–34). Engaging students in periodic and systematic attention to science identity construction in their science courses via facilitating their design and performance of an ethnodance would offer students who are dancers and students who are not dancers opportunities to use their bodies to process how they see themselves being and becoming in science classes, and adjust such conceptions along the way. As students become free to express themselves and use their own cultural ways of being to make sense of their developing identities, they will be provided with opportunities to see themselves as legitimate participating members of science communities, align their practices with them or identify and work on areas of misfit, and imagine themselves in the future doing science in the form that appeals to them (Wenger, 1998). Thus, allowing and encouraging students to use their own arts-based ways to make sense of who they are and are becoming in science spaces, even though the teacher may not have an understanding of these ways, may be valuable for the students' science learning.

Reflecting on identities, by producing tangible artifacts that are meaningful to young people themselves, allows them to make their identities an object of inquiry. For Black youth in the US who has been historically positioned by others as people who struggle with science, and for whom science is an inaccessible domain, doing this "identity reflection" in spaces where they engage with and learn science sends the message that their construction of who they are as Black people doing science is essential and desirable. Explicitly reflecting on pondering, analyzing, and synthesizing, who they are and they are becoming vis-à-vis science could allow them to craft their voices in ways that may force others to pause, question settled expectations, and consider Black youth as the creative, brilliant, competent, and expressive people they are who seek to create their own niches in science spaces. Freire (1970) wrote about liberation being a praxis defined by the dialectical relationship of action and reflection. If young people are engaged in science classrooms in the praxis of identity construction (i.e., both authoring identities in the process of experiencing science and science education which happens by default as they engage in science learning and reflecting on this authoring by developing modal ensembles that express and interrogate that authoring), they are allowed to work further toward liberation, freeing themselves from the narratives of despair, deficiency, and underperformance, and creating ways to transform their realities and the world. For Black youth, this is long overdue (Jackson & Howard, 2014). The present study suggests that research focused on studying how this can be achieved in science classrooms is worth pursuing.

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REFERENCES

Alexander, B. K. (1999). Performing culture in the classroom: An instructional (auto) ethnography. *Text & Performance Quarterly*, *19*(4), 307–331.

Archer, M. S. (2004). Emotions as commentaries on human concerns. In J. H. Turner (Ed.), *Theory and research on human emotions–Advances in Group Processes* (21, pp. 327–356). England: Emerald: Bingley.

Avraamidou, L. (Ed.). (2016). *Studying science teacher identity: Theoretical, methodological and empirical explorations*. Rotterdam, Netherlands: Sense Publishers.

Bakhtin, M. M. (1981). Forms of time and chronotope in the novel. In M. Holquist (Ed.), *The dialogic imagination: Four essays by M.M. Bakhtin (C. Emerson & M. Holquist, Trans.)*. Austin, TX: University of Texas Press.

Bakare-Yusuf, B. (2005). 'I love myself when I am dancing and carrying on': Refiguring the agency of black women's creative expression in Jamaican dancehall culture. *International Journal of Media & Cultural Politics*, *1*(3), 263–276.

Bamberg, M., & Georgakopoulou, A. (2008). Small stories as a new perspective in narrative and identity analysis. *Text & Talk*, *28*, 377–396.

Bezemer, J., & Kress, G. (2008). Writing in multimodal texts: A social semiotic account of designs for learning. *Written Communication*, *25*, 166–195.

Bochner, A. P., & Ellis, C. (2003). An introduction to the arts and narrative research: Art as inquiry. *Qualitative Inquiry*, *9*, 506–514.

Brown, B. A., Parsons, E., Miles, R., & Henderson, J. B. (2013). Exploring the alignment of Black scientists with the American scientific community: Does race still matter? *Journal of Women and Minorities in Science and Engineering*, *19*(2), 95–120.

Calabrese Barton, A., & Tan, E. (2010). We be burnin'! Agency, identity, and science learning. *Journal of the Learning Sciences*, *19*, 187–229.

Calabrese Barton, A., Tan, E., & Rivet, A. (2008). Creating hybrid spaces for engaging school science among urban middle school girls. *American Educational Research Journal*, *45*, 68–103.

Carlone, H. B., & Johnson, A. (2007). Understanding the science experiences of successful women of color: Science identity as an analytic lens. *Journal of Research in Science Teaching*, *44*, 1187–1218.

Carlone, H. B., Johnson, A., & Scott, C. (2015). Agency amidst formidable structures: How girls perform gender in science class. *Journal of Research in Science Teaching*, *52*, 474–488.

Clandinin, D. J., & Connelly, F. M. (2000). *Narrative inquiry: Experience and story in qualitative research*. San Francisco: Jossey-Bass.

Conquergood, D. (1998). Beyond the text: Toward a performative cultural politics. In S. J. Dailey (Ed.), *The future of performance studies: Visions and revisions* (pp. 25–36). Washington, DC: National Communication Association.

Craighead, C. (2006). Black dance': Navigating the politics of 'black' in relation to 'the dance object' and the body as discourse. *Critical Arts*, *20*(2), 16–33.

Craine, D., & Mackrell, J. (2010). *The Oxford dictionary of dance*. New York, NY: Oxford University Press.

Daniel, Y. (1991). Changing values in Cuban Rumba, A lower class Black dance appropriated by the Cuban revolution. *Dance Research Journal*, *23*(2), 1–10.

Darder, A., & Cronin, S. (2018). A critical bicultural pedagogy of dance: Embodying cultural literacy. *Revista Portuguesa de Educação*, *31*, 26–41.

DeFrantz, T. F. (2016). Bone breaking, Black social dance, and queer corporeal orature. *The Black Scholar*, *46*(1), 66–74.

Deleuze, G., & Guattari, F. (1987). *A thousand plateaus: Capitalism and schizophrenia (B. Massumi, Trans.)*. Minneapolis, MN: University of Minnesota Press.

Delgado, R. (1989). Storytelling for oppositionists and others: A plea for narrative. *Michigan Law Review*, *87*, 2411–2441.

Denzin, N. K. (1997). *Interpretive ethnography: Ethnographic practices for the 21st century*. Thousand Oaks, CA: Sage Publications.

Denzin, N. K. (2003a). *Performance ethnography: Critical pedagogy and the politics of culture*. Thousand Oaks, CA: SAGE Publications.

Denzin, N. K. (2003b). The call to performance. *Symbolic Interaction*, *26*(1), 187–207.

Durden, M. (Director). (2009). History and concept of hip-hop dance: the street culture that became a global expression (video edition). Dallas, TX: Dancetime Publications. Retrieved from Dance Online: Dance in Video, Volume I database.

Freire, P. (1970). *Pedagogy of the oppressed*. New York, NY: Continuum.

Gee, J. P. (1990). *Social linguistics and literacies: Ideology in discourses*. London, UK: Taylor and Francis.

Gee, J. P. (2000–2001). Identity as an analytic lens for research in education. *Review of Research in Education*, *25*(1), 99–125.

Gittens, A. F. (2012). Black dance and the fight for flight: Sabar and the transformation and cultural significance of dance from West Africa to Black America (1960-2010). *Journal of Black Studies*, *43*(1), 49–71.

Gottschild, B. D. (2003). *The Black dancing body: A geography from coon to cool*. New York, NY: Palgrave Macmillan.

Gresalfi, M., Martin, T., Hand, V., & Greeno, J. G. (2008). Constructing competence: An analysis of student participation in the activity systems of mathematics classrooms. *Educational Studies in Mathematics*, *70*(1), 49–70.

Gutierrez, K., & Calabrese Barton, A. (2015). The possibilities and limits of the structure-agency dialectic in advancing science for all. *Journal of Research in Science Teaching*, *52*, 574–583.

Halliday, M. A. K. (1978). *Language as social semiotic: The social interpretation of language and meaning*. London: Edward Arnold.

Harrop, P. & Njaradi, D. (Eds.). (2013). *Performance and ethnography: Dance, drama, music*. Newcastle upon Tyne, UK: Cambridge Scholars Pub.

Holland, D., Lachicotte, W., Skinner, D., & Cain, C. (1998). *Identity and agency in cultural worlds*. Cambridge, MA: Harvard University Press.

Holstein, J. A., & Gubrium, J. F. (2000). *The self we live by: Narrative identity in a postmodern world*. New York, NY: Oxford University Press.

Hope, E. C., Skoog, A. B., & Jagers, R. J. (2014). "It'll never be the White kids, it'll always be us": Black high school students' evolving critical analysis of racial discrimination and inequity in schools. *Journal of Adolescent Research*, 1–30.

Jackson, T. O., & Howard, T. C. (2014). The continuing legacy of freedom schools as sites of possibility for equity and social justice for black students. *Western Journal of Black Studies*, *38*(3), 155–162.

Jewitt, C. (Ed.). (2009a). *The Routledge handbook of multimodal analysis*. New York, NY: Routledge.

Jewitt, C. (2009b). An introduction to multimodality. In C. Jewitt (Ed.), *The Routledge handbook of multimodal analysis* (pp. 14–27). New York, NY: Routledge.

Jewitt, C., & Kress, G. (2003). *Multimodal literacy*. New York: Peter Lang.

Kane, J. M. (2012). Young African American children constructing academic and disciplinary identities in an urban science classroom. *Science Education*, *96*, 457–487.

Kane, J. M. (2016). Young African American boys narrating identities in science. *Journal of Research in Science Teaching*, *53*, 95–118.

Kress, G., Jewitt, C., Ogborn, J. & Tsatsarelis, C. (Eds.). (2001). *Multimodal teaching and learning: The rhetorics of the science classroom*. New York, NY: Continuum.

Kress, G., & van Leeuwen, T. J. (2006). *Reading images: The grammar of visual design*. New York, NY: Routledge.

Kwan, S. (2017). When is contemporary dance? *Dance Research Journal*, *49*(3), 38–52.

Ladson-Billings, G. J., & Tate, W. F. (1995). Toward a critical race theory of education. *Teachers College Record*, *97*(1), 47–68.

Leander, K., & Boldt, G. (2012). Rereading "A pedagogy of multiliteracies": Bodies, texts, and emergence. *Journal of Literacy Research*, *45*(1), 22–46.

Leavy, P. (2009). *Method meets art: Arts-based research practice*. New York, NY: Guilford Publications.

Lee, Y.-J. (2012). Identity-based research in science education. In B. J. Fraser, K. Tobin & C. McRobbie (Eds.), *Second international handbook of science education* (pp. 35–45). Dordrecht, Netherlands: Springer-Kluwer.

Lewis, A., & Diamond, J. B. (2015). *Despite the best intentions: How racial inequality thrives in good schools*. New York, NY: Oxford University Press.

Marshall, C., & Rossman, G. B. (2016). *Designing qualitative research* (6th Edition).). Los Angeles, CA: Sage Publications.

Massumi, B. (2002). *Parables for the virtual: Movement, affect, sensation*. Durham, NC: Duke University Press.

Maulucci, M. S. R. (2012). Exploring linkages between identity and emotions in teaching for social justice in science teacher education. In M. Varelas (Ed.), *Identity construction and science education research: Learning, teaching, and being in multiple contexts* (pp. 123–139). Rotterdam, Netherlands: Sense Publishers.

McFee, G. (2003). *Understanding dance*. New York, NY: Routledge.

Mensah, F. M., & Fleshman, R. (2017). Drawings as identity data in elementary science teacher education. In P. Katz (Ed.), *Drawing for science education* (pp. 219–225). Rotterdam, Netherlands: Sense Publishers.

Merleau-Ponty, M. (2002). *Phenomenology of perception*. New York, NY: Routledge.

Mutegi, J. W. (2011). The inadequacies of "science for all" and the necessity and nature of a socially transformative curriculum approach for African American science education. *Journal of Research in Science Teaching*, *48*, 301–316.

Nasir, N. S., & Shah, N. (2011). On defense: African American males making sense of racialized narratives in mathematics education. *Journal of African American Males in Education*, *2*, 24–45.

Olitsky, S. (2007). Facilitating identity formation, group membership, and learning in science classrooms: What can be learned from out-of-field teaching in an urban school? *Science Education*, *91*, 201–221.

Owens, T. J., Robinson, D. T., & Smith-Lovin, L. (2010). Three faces of identity. *Annual Review of Sociology*, *36*, 477–499.

Parsons, E. C. (2008). Learning contexts, Black cultural ethos, and the science achievement of African American students in an urban middle school. *Journal of Research in Science Teaching*, *45*, 665–683.

Parsons, E. C., Simpson, J., & Cooper, J. (2009). Low status and positionality of African Americans: A critique of science education reform and research. In K. Tobin & W. -M. Roth (Eds.), *The world of science education: Handbook of research in North America* (pp. 331–351). Rotterdam, Netherlands: Sense Publishers.

Patton, T. O. (2011). Final I just want to get my groove on: An African American experience with race, racism, and the White aesthetic in dance. *Journal of Pan African Studies*, *4*(6), 104–125.
Perillo, L. J. (2017). Embodying modernism. *Amerasia Journal*, *43*(2), 122–140.
Polman, J. L., & Miller, D. (2010). Changing Stories: Trajectories of identification among African American youth in a science outreach apprenticeship. *American Educational Research Journal*, *47*, 879–918.
Rahm, J., & Moore, J. C. (2016). A case study of long-term engagement and identity-in-practice: Insights into the STEM pathways of four underrepresented youths. *Journal of Research in Science Teaching*, *53*, 768–801.
Rolling, J. H. (2010). A paradigm analysis of arts-based research and implications for education. *Studies in Art Education*, *51*(2), 102–114.
Roth, W.-M. & Tobin, K. (Eds.). (2007). *Science, learning, and identity: Sociocultural and cultural-historical perspectives*. Rotterdam, Netherlands: Sense Publishers.
Saldaña, J. (Ed.). (2005). *Ethnodrama: An anthology of reality theatre*. Walnut Creek, CA: AltaMira Press.
Saldaña, J. (2011). *Ethnotheatre: Research from page to stage*. Walnut Creek, CA: Left Coast Press.
Sfard, A., & Prusak, A. (2005). Telling identities: In search of an analytic tool for investigating learning as a culturally shaped activity. *Educational Researcher*, *34*, 14–22.
Solorzano, D. G., & Yosso, T. J. (2001). Critical race and LatCrit theory and method: Counter-storytelling. *International Journal of Qualitative Studies in Education*, *14*(4), 471–495.
Sosa, F., & Poncin, M. (Director). (2015). Cosmic Ass (video edition). Retrieved from YouTube Online.
Springgay, S., Irwin, R. L., & Kind, S. W. (2005). A/r/tography as living inquiry through art and text. *Qualitative Inquiry*, *11*, 897–912.
Stets, J. E., & Burke, P. J. (2003). A sociological approach to self and identity. In M. R. Leary & J. P. Tangney (Eds.), *Handbook of self and identity* (pp. 128–152). New York, NY: Guilford Press.
Stevenson, A. (Ed.). (2010). *Oxford Dictionary of English*. New York, NY: Oxford University Press.
Stryker, S. (1980). *Symbolic interactionism: A social structural version*. Menlo Park, CA: Benjamin-Cummings.
Sullivan, G. (2010). *Art practice as research. Inquiry in visual arts*. Thousand Oaks, CA: Sage Publications.
Tan, E., & Calabrese Barton, A. (2008). Unpacking science for all through the lens of identities-in-practice: The stories of Amelia and Ginny. *Cultural Studies of Science Education*, *3*, 43–71.
Tan, E., Calabrese Barton, A., Kang, H., & O'Neill, T. (2013). Desiring a career in STEM-related fields: How middle school girls articulate and negotiate identities-in-practice in science. *Journal of Research in Science Teaching*, *50*, 1143–1179.
Toth, L. (2017). Praising twerk: Why aren't we all shaking our butt? French. *Cultural Studies*, *28*(3), 291–302.
Tucker-Raymond, E., Varelas, M., Pappas, C. C., with Korzh, A., & Wentland, A. (2007). They probably aren't named Rachel": Young children's scientist identities as emergent multimodal narratives. *Cultural Studies of Science Education*, *1*(3), 559–592.
Varelas, M. (Ed.). (2012). *Identity construction and science education research: Learning, teaching, and being in multiple contexts*. Rotterdam, Netherlands: Sense Publishers.
Varelas, M., Kane, J. M., & Wylie, C. D. (2011). Young African American children's representations of self, science, and school: Making sense of difference. *Science Education*, *95*, 824–851.
Varelas, M., Kane, J. M., & Wylie, C. D. (2012). Young Black children and science: Chronotopes of narratives around their science journals. *Journal of Research in Science Teaching*, *49*, 568–596.
Varelas, M., Martin, D. B., & Kane, J. M. (2012). Content learning and identity construction: A framework to strengthen African American students' mathematics and science learning in urban elementary schools. *Human Development*, *55*, 319–339.
Varelas, M., Menig, E., Wilson, A., & Kane, J. M. (in press). Intermingling of identities: A Black student in a middle-school science class. *Cultural Studies of Science Education*.
Varelas, M., Settlage, J., & Mensah, F. M. (2015). Explorations of the structure-agency dialectic as a tool for framing equity in science education. *Journal of Research in Science Teaching*, *52*, 439–447.
Varelas, M., Tucker-Raymond, E., & Richards, K. (2015). A structure-agency perspective on young children's engagement in school science: Carlos's performance and narrative: Young children's engagement in school science. *Journal of Research in Science Teaching*, *52*, 516–529.
Wenger, E. (1998). *Communities of practice: Learning, meaning, and identity*. New York, NY: Cambridge University Press.
Yin, R. K. (2003). *Case study research: Design and methods*. Thousand Oaks, CA: Sage.

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APPENDIX: KEY FOR SYMBOLS USED IN EXCERPTS OF TRANSCRIBED DISCOURSE

//	Repetitions, false starts, abandoned language replaced by new language structures
~	Short pause
|	Break of a speaker's turn due to the next speaker's turn
==	A speaker's pause at the end of uncompleted utterance, seemingly to encourage another speaker to talk
# #	Overlapping language spoken by two or more speakers at a time
[]	Identifies what is being referred to or gestured and other nonverbal information
Underline	Emphasis