

# Exploring Hip-Hop Pedagogy for the Advancement of Girls of Color in Science

Urban Education

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## Abstract

Female and male students perform equally well on science standardized tests, yet there are disparities in gender in most science-related fields. There are far fewer women from underrepresented backgrounds represented in science-related fields, as they are less likely to enroll in advanced science courses because of a perceived lack of positive science identity. Using a framework of cultural community capital, this study suggests that girls of color are able to develop a science identity and a deeper understanding of science content as a result of the implementation of a hip-hop pedagogy in an urban science classroom.

## Keywords

hip-hop pedagogy, science education, urban education, cultural community capital

## Introduction

Educational debts persist in science and STEM (Science, Technology, Engineering, and Mathematics) education as it relates to urban youth (National Science Board, 2018). Across the nation, there has been a monocultural

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approach to teaching science, which stems from college preparedness standards, dating back to the turn of the 20th century (Turnbull, 2000). Science curricula and instructional practices have historically benefited middle-class White students, particularly men. School systems have failed to provide quality instruction for students who have been socially marginalized and of culturally diverse backgrounds and has contributed to the polarizing ideas around how disenfranchised students should and should not be educated (Melnick & Zeichner, 1998; Tyack & Cuban, 1995). The *Brown v. Board of Education* Supreme Court decision called for schools to be desegregated, but schools took no form of action to integrate the curriculum or instructional practices to support Black students who integrated into schools that historically served only White students and their values.

Research suggests that students from underrepresented ethnic groups traditionally fall behind their White counterparts in major content areas, including science (Quinn et al., 2015). Besides, urban students are less likely to be interested in the sciences partially because educators misunderstand the realities and experiences of urban students, and as a result, they are not able to demonstrate the relevance of science (Kahle, et al. 2000; Seiler, 2001). Research suggests that woman and male students perform equally well in mathematics and science on standardized tests, with women outperforming men in some instances (National Science Board, 2018). Still, gaps continue to exist between students of underrepresented racial and ethnic backgrounds and with White and Asian/Pacific Islander students who score higher than their underrepresented counterparts who are Black, Hispanic, or American Indian/Alaska Native or who are from lower-income families (National Science Board, 2018). While males and females perform equally well on standardized science exams in elementary and secondary school, a substantial gender gap exists in STEM-related fields. Women hold only 16% of the nation's engineering jobs, 21% of computer programming jobs, 25% of math-related jobs, and 38% of jobs in chemistry (Gjersoe, 2018). Studies indicate that the underrepresentation of women and ethnic-racial groups in the sciences is associated with students' personal goals, self-perceptions, lack of science identity (Archer et al., 2013; Adjapong et al., 2016; Downey et al., 2005; Smith, 2016). Despite relative and equal achievement in science education, girls tend to not identify with science, and this implication as it relates to their movement along science trajectories (Brickhouse & Potter, 2001; Carlone, 2004).

Studies show that urban youth lack support and encouragement from science teachers who often have erroneous preconceptions in regard to their ability. This can result in the disparagement of their self-confidence, and frequently discourages and inhibits urban youth from proactively seeking

advanced learning opportunities (Marshall et al., 2011). Further, studies demonstrate that students of color, in particular girls of color, are less likely to enroll in advanced science courses because they are unaware of the opportunities or experience a lack of confidence in their capabilities and possibly identities (Young et al., 2017). Therefore, as many scholars suggest, girls of color in K-12 education, are less likely to identify with science or as scientists regardless of their achievements in science (Archer et al., 2010; Sadker et al., 2009). Tan et al. (2013) suggest the cause for young girls disconnect in science is due to the lack of attention addressing the science identity gap as it relates to girls in science although this topic has been researched extensively (Archer et al., 2012; Brotman & Moore, 2008; Calabrese Barton et al., 2013; Thompson & Windschitl, 2005).

In this study, I draw on Welsh and Swain's (2020) conceptualization of urban education to make sense of and define the urban context that this study was situated in. Welsh and Swain (2020) demonstrate that there is no there is no single quantitative measure that fully captures the nuances and complexity of urban education. Rather, "most definitions of 'urban' identify a set of districts with high concentrations of Black and Latinx students; high levels of racial, ethnic, and socioeconomic segregation; in communities with high income inequality, high poverty, and high educational attainment" (Welsh & Swain, 2020, p. 97). Moreover, an important tenet of Welsh and Swain's (2020) conceptualization of urban education maintains that urban education "rejects deficit perspectives and contends that considerable assets exist within 'urban' communities" (p. 98). In this study, I suggest that engaging students, particularly girls, of underrepresented ethnic backgrounds from urban contexts through an innovative approach to pedagogy can support science achievement and support the development of a science identity, which can in turn encourage them to pursue a career in STEM fields. I offer hip-hop pedagogy as a culturally relevant approach to teaching and learning that is anchored in youth and hip-hop culture. In accordance of Welsh and Swain's (2020) conceptualization of urban education, I argue that utilizing hip-hop to support urban girls' achievement in science leverages an asset that already exists and that is revered within the community.

In this study, I provide a framework for hip-hop pedagogy that offers a way of authentically incorporating the creative elements of hip-hop and encourages students to have a familiar cultural connection with science content. I argue for a pedagogy anchored in youth culture because globally, hip-hop is the most popular genre of music and is a culture that many youth participate regardless of race and background. Urban youth of underrepresented backgrounds, in particular, identify as part of the hip-hop generation (Adjapong and Emdin, 2015).

## Literature Review

### *Hip-Hop Based Education*

There continues to be an ongoing misunderstanding and lack of appreciation of the cultures, experiences, and realities of African American and Latinx students who predominantly populate urban settings (Kahle et al., 2000; Seiler, 2001). Scholars such as Ladson-Billings (1995) and Paris and Alim (2012) have argued for culturally relevant and sustaining pedagogies in order to empower teachers to see beyond their misunderstandings of youth and in turn empower students to maintain an appreciation of their cultures. Arming teachers with an approach to teaching that is anchored in hip-hop provides an opportunity for teachers to develop a more in-depth and authentic understanding of youth culture.

Much research that has been published in the field of hip-hop based education (HHBE) centers on how to incorporate hip-hop culture across school-based curricula. Hill (2009) defines HHBE as a term that refers to educational research that uses the elements and sensibilities of hip-hop culture to inform formal and non-formal educational spaces. While HHBE is still considered an emerging field within educational research, scholars have and continue to interrogate how hip-hop can be used and incorporated across all educational spaces. Petchauer's (2009) review of hip-hop education research gathered that hip-hop based curricular approaches, addressing a variety of academic outcomes, have been present in educational literature since the early 2000s. Many scholars have revealed the benefits of incorporating hip-hop in educational spaces, but often focus their studies on English classroom settings and rarely focus on its impact on girls. For example, Morrell and Duncan-Andrade (2002) discuss using hip-hop to promote youth literacy in an English classroom. In their study, students developed written and oral debate skills, learned how to critique hip-hop songs and poems critically, and created and presented formal presentations based on their critiques. This study provides insight on how hip-hop can be incorporated into teaching and how an educator interacts with students in a science classroom. Scholars have advocated for the analysis of hip-hop texts in classrooms to support students in developing critical literacies (Morrell & Duncan-Andrade, 2002; Morrell, 2004). For the last decade, approaches to incorporating hip-hop as a form of pedagogy have become a topic of increased interest across educational curricula (Hill & Petchauer, 2013). For example, in the English Language Arts classroom, Belle (2016) explored the creation, implementation, and students' perceptions of a hip-hop literacy curriculum and found that the curriculum had a profound impact on both teaching and students' learning. Belle (2016) shared that "students were

able to re-envision the English classroom and the literary canon while learning that their opinions are valuable in and outside the classroom” (p.7). In the science classroom, Emdin et al. (2016) studied the use of hip-hop as a tool to engage urban youth in science by encouraging students to create science-themed songs that demonstrate their understanding and conceptualization of science content. Further, Graves et al. (2020) explored the use of hip-hop to support the development of critical consciousness of students. The overall argument for the use of hip-hop based approaches is mostly the same – to address concerns regarding the lack of culturally responsive approaches to teaching and learning to support students academically as well as to encourage and critically interrogate systems and structures that directly impact them (Adjapong, 2017; Petchauer, 2009).

While there are a plethora of conceptual studies that focus on the potential impact of hip-hop based education, there is little scholarship that specifically interrogates the impact of the use of hip-hop as it relates to pedagogy. Further, there are gaps in the literature that lacks the exploration the experiences of girls’ perceptions of hip-hop pedagogy. Love (2016) posits that women and girls have been viewed as consumers and spectators of hip-hop culture and their contributions to hip-hop have been disregarded as a result of male dominance in hip-hop culture. Morgan (2017) in her book *When Chickenheads Come Home to Roost: A Hip-Hop Feminist Breaks it Down*, presents a feminist perspective to hip-hop through analyzing the experiences of Black women, feminist politics, and the nihilist misogynist culture of hip-hop. The term hip-hop feminism, coined by Joan Morgan, “brought to bear herstories of women who love, embrace, and are hip hop” (Love, 2016, p. 420). In response to hip-hop feminism, many scholars (Brown & Kwakye, 2012; Richardson, 2007, 2009) explored studies that centralized the lives of Black and Brown girls in the field of HHBE. The goal and intent of this study is to also center the lives and perceptions of Black and Brown girls. Therefore, I argue that anchoring pedagogy in hip-hop culture offers opportunities for all students, but specifically for Black and Brown girls to see authentic representations of themselves in science content, in turn affirming their science identity and supporting their understanding of science content.

## **Hip-Hop Pedagogy Framework for Teaching and Learning**

### *Hip-Hop Pedagogical Approaches*

Hip-hop pedagogy is an approach to teaching and learning that is rooted in hip-hop culture, which urban youth identify with (Adjapong and Emdin,

2015). Hip-hop pedagogy provides practical strategies and approaches to teaching, and learning can be utilized across any content area. In subsequent sections, I have outlined and made specific connections between each of the five creative elements of hip-hop (MCing, graffiti art, breakdancing, DJ, and knowledge of self) (Chang, 2007) and pedagogical approaches, which educators can utilize to engage urban youth in science (Adjapong, 2017).

*MCing (master of ceremonies).* Traditionally, the master of ceremonies (MC) is known as the host of an event, and their responsibilities consist of introducing speakers and maintaining the flow of an event. In hip-hop, the MC is the artist who is responsible for delivering musical content to an audience. Often, when an MC is performing to an audience, they are accompanied by a fellow MC whose essential purpose is to be a professional in terms of knowing and understanding the musical content to provide support to showcase meaningful performance for the audience successfully.

*Co-Teaching.* Co-teaching is defined as “two or more professionals delivering substantive instruction to a group of students” (Cook & Friend, 1995, p. 25). The goal of implementing this approach in a classroom is to allow the responsibilities for instruction to be shared between two masters of content—the student and the teacher. As the responsibilities for instruction are shared between both the student and teacher, who is normally viewed as the main authority figure of the classroom and a student, the student feels a sense of empowerment and excitement that can allow them to take responsibility for their own learning and participation to enhance their science content knowledge (Lave & Wenger, 1991; John-Steiner & Mahn, 1996). Co-teaching between a student and teacher increases instructional options, provides students the opportunity to showcase their mastery of the content as they support their peers in developing that same mastery. Also, co-teaching in itself is a culturally relevant approach as the student who is now deemed the professional is a part of the same population that is receiving the instruction. In hip-hop pedagogy, co-teaching occurs with a student and the teacher who both identify as the masters of content, similar to hip-hop where two MC’s deliver musical content to an audience and is supported by utilizing the following steps:

Before class:

- A student who volunteered to be a co-teacher is given a lesson plan to review for homework in preparation to teach the class the following day.

- The teacher performed a quick review of the lesson plan with the co-teacher to ensure that content is reflected accurately.
- The student was responsible for enhancing that lesson plan so that it can reflect their “teaching style.”

During class:

- The teacher sits in a student’s seat in a place that is prominent in the classroom and in the view of the co-teacher.
- The teacher pays close attention to parts of the lesson where the content delivered and guides the instruction (by raising a hand as a traditional student would) only when there are issues with the content (Emdin, 2011).

*Call-and-response.* Smitherman (1977) defines call-and-response as “spontaneous verbal and non-verbal interaction between speaker and listener in which all of the statements (‘calls’) are punctuated by expressions (‘responses’) from the listener” (p. 104). Responses from the audience can follow from a speaker specifically requesting them, or they can be unsolicited and spontaneously interjected into the ongoing interaction (Foster, 1989). Call-and-response is a popular teacher approach and is commonly used in music and dance produced by African Americans. Several studies show call-and-response to be effective in teaching students in urban communities (Foster, 2002; Piestrup, 1973). Call-and-response is considered integral to communicative behavior and functions as an expression of identity and as a means of conveying cognitive information among African Americans (Cazden, 1988). In hip-hop, to engage the audience, the MC traditionally uses call-and-response during their performance as a way for audience members to have an opportunity to be active participants during the performance. This exchange between the MC and the audience generates high energy and allows every audience member to participate in the exchange. When utilizing hip-hop pedagogy, call-and-response can be used to review and reinforce science content information, as a classroom management tool and to generate positive emotional energy among students.

Review and reinforce content information: To review and reinforce potential and kinetic energy.

Teacher: Kinetic energy is the energy that an object has

Students (in unison): When it’s in motion

Teacher: Potential energy is the energy that an object has

Students (in unison): When it’s in the position to do work

Classroom management: To gain the attention of students when necessary.

Teacher: If you can hear my voice clap once

Students (in unison): [Clap]

Teacher: If you can hear my voice clap twice

Students (in unison): [Clap] [Clap]

Teacher: No music

Students (in unison): [Clap]. . .[Clap] [Clap]. . .[Clap]

The clapping rhythm used in this call and response pattern originated from a classic HipHop dance song entitled “No Music” by a Harlem rapper named Voice of Harlem.

*Graffiti art.* Graffiti art is an aspect of hip-hop culture that has not been as popularized as rap music. The graffiti movement found its way to New York City in the late 1960s. Urban youth who participated in tagging their street alias on the walls of urban neighborhoods, train cars, etc. enjoyed the attention their art received because it made them feel like a celebrity (Chang, 2007). Graffiti artists find it liberating to climb tall gates and slip under fences to create murals that represent them. Gregory Tate identified this a reverse colonization; graffiti artists created murals of their street names across New York City to reclaim their communities when have been taken away from them due to gentrification and New York City’s planning efforts led by Robert Moses Cross Bronx Expressway in the Bronx (Bronx Museum of the Arts, Walker Art Center, & Spelman College. Museum of Fine Art, 2001). Graffiti art provides urban youth an opportunity to be expressive in their communities. In recent years, educators have been focusing on incorporating the arts into the STEM acronym, changing it to STEAM (Science, Technology, Engineering, Arts, Mathematics). Educators (Alberts, 2008) suggest that “art and science are intrinsically linked” and students are able to better their understanding of science content by creating their artistic representations of the science content. In support of incorporating art in the teaching and learning of science, science educators note that the “visual arts just seems to really be able to hone in on the concept, taking it from the abstract to the concrete, so students are really able to understand it” (Robelen, 2011). When utilizing hip-hop pedagogy, students are charged with tasks where they engaged in the visual arts, similar to graffiti artists, to work through and demonstrate their understanding of science content. Using visual art as a pedagogical approach to support students understanding of science content also allows students to “make representations to express their thoughts, feelings, and perceptions; show relationships and changes; and make explanations and predictions”



(Nelson & Chandler, 1999, p. 41). Teachers are encouraged to create tasks where students can visually demonstrate science concepts and make connections between science and the real-world. For example, if students are learning about the law of conservation of energy, they can be tasked to illustrate a real-world example of objects that transfer energy and explain with evidence and reasoning how energy is transferred.

### *B-boying/B-girling*

Like in many cultures, there is a performance aspect of hip-hop where many participants of the culture communicate through dance. Many indigenous African tribes have dances that serve many social purposes, such as communicating with the Gods to ask for rain (rain dance) to prepare for the harvest, to prepare for war, and to welcome a newborn baby into the world, to name a few. In the early days of the formation of hip-hop, breakdancing began as a direct response to the social factors that urban youth experienced in the late 1960s and during the 1970s in the South Bronx. During that time, the development of the Cross Bronx Expressway abruptly displaced over 5,000 families in the South Bronx and destroyed neighborhoods, amid high crime rates and gang violence that consumed the Bronx (Shapiro, 2005). Instead of fighting, gangs formed breakdancing crews where their best b-boys/b-girls would battle one another on the dance floor. B-boys/b-girls would dance to the rhythm of the beat played by the neighborhood Disc Jockey (DJ). As time progressed, b-boys/b-girls took the art of dancing more seriously and always strived to perfect their moves. They danced faster, developed more complex moves, and improved their form. Although b-boying is not currently as popular as it once was in the 1970s, I argue that this style of dancing has evolved into contemporary hip-hop dance, which continues to be a pivotal part of hip-hop culture. The intricate, well thought out and well-performed dances that hip-hop dancers perform demonstrates a kinesthetic aspect of hip-hop culture. There are four stages of cognitive development, which Bruner et al. (1966) and Piaget (1951) describes as how humans assimilate knowledge about their surrounding environment through four sensory modalities, one of which is kinesthetic learning. Kinesthetic learners prefer “learning achieved through the use of experience and practice. In other words, the kinesthetic learner has to feel or live the experience in order to learn it” (Murphy et al., 2004). Kinesthetic learning involves the physical manipulation of objects or the body, like a dancer (Gardner, 1993). Through breakdancing and contemporary hip-hop dance, urban youth learn how to manipulate their body. In doing so, youth who follow hip-hop culture, communicate well through body language and can be taught through physical activity, hands-on learning, acting out, role-playing

(Lane, 2008). When utilizing hip-hop pedagogy, students engage in kinesthetic learning activities, which allow them to physically manipulate objects and their bodies alike, similar to hip-hop b-boys/b-girls, with the goal of better understanding and engaging in science content. For example, when discussing the various states of matter, students can conceptualize themselves as particles and move around the classroom as particles would when energy increases and decrease. When energy decreases, students should be moving closer to one another to the point where they are huddled in a fixed position (solid), and when the energy increased, students should move around the classroom at a faster rate.

*Disc jockey.* The disc jockey (DJ) is arguably the most important creative element of hip-hop culture. At its core, the DJ is responsible for supporting other creative elements, including the Master of Ceremonies (MC) and the b-boys/b-girls. The DJ's primary duty is playing and controlling the music, the rhythm, and the beat to which the MC adds their lyrical content to produce a completed song. The DJ is also responsible for finding the break in the beat, the moment in the song where only the drums are present, to provide an optimal rhythm for the b-boys/b-girls to showcase their best dance moves.

Chang's (2007) depiction of the conception of hip-hop describes DJ Kool Herc, "[L]ike any proud DJ, he wanted to stamp his personality onto his playlist. But this was the Bronx. They wanted the breaks. So, like any good DJ, he gave the people what they wanted, and dropped some soul and funk bombs. [People] were packing the room. There was a new energy" (p. 85). Chang describes DJ Kool Herc as a DJ who incorporated his personality into his playlist while playing songs to the crowds' preference. Chang also explains that DJ Kool Herc was responsible for harnessing new energy that was attractive to a crowd of people. When utilizing hip-hop pedagogy, students will be in charge of being the DJ of the classroom and harnessing energy among their peers by creating playlists that are played during class. Teachers allow students to curate a class playlist of their favorite music instrumentals. The student-curated playlist should be played during class as background music when students are completing individual and group tasks. The goal of utilizing a playlist curated by students is to harness the same form of energy as a traditional DJ within the classroom. Also, a student-curated playlist provides an opportunity for teachers to gain knowledge about student's interests that they would not have learned otherwise.

*Knowledge of self.* Knowledge of self is the last and most unknown creative element of hip-hop culture. Afrika Bambaataa is best known for creating the first sounds that first influenced the creation of hip-hop Hop music. Bambaataa

defines knowledge of self as a central component of hip-hop culture. In support of the knowledge of self as a creative element of hip-hop, Bambaataa states, “we got to get people back to the knowledge. Too many are caught up on the partying. . . they are not dealing with all the elements of hip-hop; they’re just dealing with the rap side of hip-hop. We got to let them know that it’s a culture, and come back to the knowledge, because this is what controls and holds everything together” (Conzo et al., 2007, p. 57). Bambaataa argues that the hip-hop generation has been overly consumed in rap music and is not engaging in hip-hop as a culture. Rap music is a small fraction of hip-hop culture, which is known to have been commercialized and, therefore, slightly removed from being nested in the authenticity of hip-hop culture. Bambaataa, along with many hip-hop purists, believes that knowledge of self is central because participants of hip-hop culture must remember that hip-hop was created as a social-political movement. Essentially, knowledge of self is central to hip-hop as it encourages participants of hip-hop culture to be aware of who they are, be authentic to themselves, and be confident in themselves to make a positive social-political change for their communities. At its core, hip-hop culture was birthed as a means to push back against the existing systemic inequalities in the 1970’s post-industrialized South Bronx community to provide an outlet and voice for urban youth.

## **Conceptual Framework**

### *Culture, Capital and Community Cultural Wealth*

This study is rooted in a sociocultural framework that explores the concepts of culture and social capital as they relate to the experiences of Black and Brown girls in a science classroom. Vygotsky states, “human activities take place in cultural context, [and] are mediated by language” (John-Steiner & Mahn, 1996, p. 191). Most urban students’ experiences outside of school are rooted in hip-hop culture (Emdin, 2010). The ways urban students dress, their language, dance, as well as other non-verbal forms of communication, are rooted in hip-hop culture. Vygotsky posits, “everything that is cultural is social. Culture is the product of social life and human social activity.” (Vygotsky, 1981, p. 164). In other words, one’s culture is influenced by the social environment and circumstances that may be experienced. Hip-hop was birthed in the South Bronx, an urban community, during the 1970s as a direct response to the social and economic injustice that Black people faced which include. Hip-hop has evolved from a community-based practice that began in the South Bronx, to a multi-billion-dollar industry and culture that is now practiced globally. Since its inception, hip-hop culture has promoted

authenticity, social justice, and innovation, as well as various forms of engagement. The realities of many urban communities and inner-cities have not drastically changed since the inception of hip-hop. Many of these communities continue to face similar social and economic challenges. Nearly 50 years later, hip-hop culture continues to play a dominant role in urban communities for the same reasons it was created, to resist social injustices and to promote socially marginalized groups' culture. As a result, urban youth and their communities continue to actively engage and identify as part of hip-hop culture (Adjapong and Emdin, 2015). Vygotsky (1981) posits that all actions performed by individuals are shaped by cultural influences. Therefore, I argue that the ways of engagement and actions of urban youth who identify as a part of the hip-hop generation are informed by hip-hop culture. I also argue that utilizing a pedagogy that draws from the creative elements and sensibilities of hip-hop culture supports urban youth, specifically Black and Brown girls understanding of science content and the development of a science identity. Further, utilizing hip-hop as a form of pedagogy demonstrates to students that their community cultures are valued within school structures and systems, which historically are rooted in racism and continue to perpetuate inequalities against socially marginalized groups (Gillborn, 2008).

For this study, I also draw from Yosso and Solórzano's (2005) articulation of cultural community capital to demonstrate the importance of utilizing the cultures of students of color, such as hip-hop culture, as a form of pedagogy to nurture and empower them. Yosso's theoretical construct of cultural community capital is grounded in critical race theory (CRT), which has been used to explore, interrogate and make sense of the experiences of women of color writ large, but also in science (Mensah, 2019; Rolón-Dow, 2005; Rosa & Mensah, 2017). CRT is a framework that can be used to theorize, examine and challenge the ways race and racism implicitly and explicitly impact social structures, practices, and discourses as it accounts for the historic dominance of Whiteness and White supremacy within the United States (Yosso & Solórzano, 2005). Yosso and Solórzano's (2005) theoretical construct of cultural community capital argues that a traditional view of cultural capital (Bourdieu & Passeron, 1977) is narrowly defined by White, middle-class values. CRT expands this notion and centers the research lens on the experiences of people of color in critical historical contexts and reveals accumulated assets and resources in the histories and lives of communities of color, such as hip-hop culture (Yosso & Solórzano, 2005). Community cultural wealth speaks to the knowledge, skills, abilities, and contacts possessed and utilized by communities of color to survive and resist operations (Yosso & Solórzano, 2005). Students predominantly participate and engage in hip-hop culture in their communities and with family, friends, and peers (Kitwana, 2003). Urban

youth possess knowledge, skills and abilities from engaging in hip-hop culture within their communities, which can be harnessed through pedagogy to support students' understanding of science content, and development of science identities.

Finally, I explore the theory of social networking, specifically the conceptualization of "weak ties" and "strong ties" to interrogate the relationships between educators and students when students' cultures are thoughtfully incorporated into pedagogy. There are links between individuals and groups within every social network that are categorized as "strong ties" or "weak ties." "Strong ties" correspond to the links or connections individuals or groups who are *friends* and have frequent interactions or have a lot in common. Students in an urban school who are a part of the same community and who participate in hip-hop culture would theoretically share a "strong tie" connection with one another. On the other hand, weak ties correspond to *acquaintances* who do not have much in common that would generally connect them (Easley & Kleinberg, 2010). The connections between teachers who are often outsiders to students' cultures and their students would be identified as a "weak tie." The social system of a classroom is composed of the patterned network of relationships between the educator and students. Enacting a pedagogy that is anchored in hip-hop serves as the catalyst to allow "weak ties" that already exist between teachers and students to develop into "strong ties" overtime. Coleman (1998) refers to these connections as dense networks and describes them as close-knit networks that facilitate trust and cooperative exchanges. The creation of these dense networks between students, particularly girls and the science educator, can allow for a positive exchange of science content to students and encourage educators to learn about the culture of their students.

## Methodology

As urban students' interest in STEM continues to decrease (Munce & Fraser, 2012), it is essential that urban students, particularly girls of color, begin viewing the field of STEM as visible and accessible, counter to what Basu and Barton (2007) have described. Through the implementation of hip-hop pedagogy in an urban science classroom, I suggest that students increased their engagement as it relates to STEM as well as increased their cultural capital in the science classroom, which will allow them to be more comfortable navigating STEM spaces outside of the science classroom. Students would be confident in their skills and abilities as related to STEM and be increasingly confident to pursue a career in STEM if they chose to, rather than not wanting to pursue a career in STEM because they are not engaged or have no enjoyable experience.

### *Positionality*

I have multiple and varied positions, roles, and identities that are inextricably related to hip-hop based research, specifically as it relates to utilizing hip-hop as pedagogy and utilizing hip-hop to support the overall development of urban youth. I am a teacher educator, a product of urban schooling, and with years of urban middle school science teaching experience. I developed a framework for hip-hop pedagogy (Adjapong, 2017), which is derived from personal experience as a member of the hip-hop generation and research focused on developing innovative teaching strategies that utilize urban youth culture. As a former middle school science educator, who identifies as a male, I recognize that I have perpetuated the same systems and structures that have historically oppress girls of color during my career, before gaining a deep understanding of collective oppression that girls and women of color, particularly Black women, face. I hope to use my research and focus of interrogating the experiences of girls of color to not only highlight the challenges that girls of color face, but also present possible solutions that can aid in the support and development of the advancement of girls of color in science.

### *Research Questions*

1. How does the implementation of hip-hop pedagogical approaches in an urban middle school science classroom influence teaching and learning as it relates to girls?
  - a. Do hip-hop pedagogical approaches support urban girls' learning of science content?
2. Does the implementation of hip-hop pedagogical approaches increase urban girls' interest in science as perceived by students?

### *Participants and Setting*

The primary site of this study was sixth-grade science classrooms in a public urban middle school located in the most densely populated city in the north-east region of the United States. The school is located a few miles from the affluence of a large economic hub, yet streets away from areas of extreme poverty. This research site because the principal investigator served as a science educator enacted the hip-hop pedagogical approaches in the middle school science classroom in the role as a classroom teacher. Participants in this study were selected from four sixth-grade science classes that participated in the implementation of hip-hop pedagogy as an intervention. This study focuses on girls of color; therefore, all participants self-identified as a

girl of color. There was a total of 55 girls of color who participated in this study. Participants opted to participate in the study with consent from their legal guardians and received no incentive for participation. Participants had the opportunity to opt-out of the study at any moment. The school enrolls 464 students in grades 6 to 8. The ethnic breakdown of the school is described on the school's website as follows: 67% African American, 28% Latinx, 3% Asian, and 1% White. When I refer to urban students in this study, I am referring to African American and Latinx students who mostly populate urban spaces. All students qualify for free or reduced lunch.

### *Data Collection*

The primary data sources for this study include student focus group interviews, video vignettes, and the Increasing Students' Interest in STEM Survey. Secondary data sources include participant observations and field notes. Two focus group interviews were conducted during the duration of this study, one consisted of three participants, the other consisted of four participants. Participants were selected from different sixth-grade science classes to offer varying perspectives. Students participated in focus group interviews to offer qualitative responses that demonstrated their experiences and perceptions as it relates to hip-hop pedagogical approaches implemented in their science. During focus group interviews, students were asked to discuss their perceptions of the hip-hop pedagogy activities that they engaged in and how content was delivered through questions such as: what did you like about today's activity? what is the difference between the way this year's science class is taught compared to other science classes? and do you feel like this science class prepares you to become a scientist in the future? All focus groups were video recorded and transcribed in their entirety, and reflective field notes were taken during and after each focus group. Videotaping of 6th-grade science classes throughout the data collection period provided additional means of making classroom observations. All participants in the study selected pseudonyms that are used in the results and findings section.

*Increasing students' interest in STEM survey.* All 55 participating students in this study completed a pre and post-survey to measure their interest in STEM. The survey was adapted from the Massachusetts Department of Higher Education (Bouvier & Connors, 2011) to measure middle school students' interest in STEM who participated in a long-term STEM out-of-school program. In addition to the Increasing Students' Interest in STEM Survey (Bouvier & Connors, 2011), additional questions from a hip-hop culture questionnaire from a previous study that focused on hip-hop pedagogy (Adjapong and Emdin, 2015)

were added to provide data on students' interest in hip-hop. The purpose of a pre and post-survey was to determine if girls' interest in STEM increased as a result of the use of hip-hop pedagogical strategies. The goal of administering this survey is to provide quantitative data regarding students' identities, engagement, and interests, as it relates to STEM, specifically science, before, and after students, engage in hip-hop pedagogical approaches.

### *Data Analysis Methods*

A variety of data analysis strategies were used to analyze anticipated data collected during this study. Observations and field notes produced in the natural setting of this study were coded and used as a guide to select video vignettes that showed students interacting with the hip-hop pedagogical teaching approaches being studied. Focus group interviews were transcribed in their entirety. Qualitative coding techniques, including member checking and coding for recurring themes, were used to analyze the data generated from this study (Guba & Lincoln, 1989; Creswell and Poth, 2016). All focus groups and observation data were entered into a Microsoft Word document for word-by-word coding and initial coding for categories. Then, the data that was selected for categories were entered into Nvivo to organize and then combined into recurring themes.

### **Results and Findings**

The purpose of this study is to uncover the effect that hip-hop pedagogy has on teaching and learning as it relates to girls of underrepresented backgrounds in the area of STEM. To study the effects of hip-hop pedagogy on teaching and learning, a variety of qualitative and quantitative data analysis strategies were used to efficiently and effectively analyze data collected during this study. The themes that emerged from the qualitative data analysis include: (1) students developing a deeper understanding of science content through hip-hop pedagogical approaches, (2) students identifying as a scientist as a result of engaging with hip-hop pedagogical approaches, and (3) deconstructing traditional classroom spaces through the implementation of hip-hop pedagogical approaches. Exemplary moments were taken from recurring themes that individually and collectively reflect students who participated in this study to provide insight on student's experiences while engaging in hip-hop pedagogy and, in turn, the effect that hip-hop pedagogy has on the teaching and learning of girls. I define exemplary moments and include excerpts from the interviews that are included in subsequent sections that are designed to represent key themes that emerged.



Quantitative data analysis strategies were used to analyze student responses to the Increasing Students' Interest in STEM survey. Student responses to the Increasing Students' Interest in STEM Likert survey were collected, sorted, and organized in a Microsoft Excel spreadsheet. An online Wilcoxon test calculator was used to compare the responses of students before and after engaging in hip-hop pedagogical approaches.

### *Analysis of Increasing Students' Interest in STEM Survey*

All participating students responded to the Increasing Students' Interest in STEM Survey before (pre-intervention) and after (post-intervention) being engaged using hip-hop pedagogical approaches. The results of the Increasing Students' Interest in STEM Survey were analyzed using the Wilcoxon paired  $t$ -test, a nonparametric test, to understand the impact and influence of hip-hop pedagogical as an intervention on middle school girls. Using the  $p$ -value (significance of .05) calculated for each Likert item, I was able to identify whether students' responses to the intervention were statistically significant in influencing participants' interest in STEM, particularly science. Likert items 1–7: (1) Science is fun, (2) Science is interesting, (3) I enjoy science, (4) I am a scientist, (5) I enjoy this science class, (6) I enjoy the way that my science teacher teaches me, and (7) I enjoy and listen to hip-hop music all have a calculated  $p$ -value of less than .05, demonstrating that hip-hop pedagogy as an intervention influenced students' responses and positive attitudes towards science (Table 1). Data from the Increasing Students' Interests in STEM Survey (Table 1) demonstrated that through the implementation of hip-hop pedagogical approaches, students were more likely to find science to be fun and interesting, students found increased enjoyment in science and in the way in which their science class was taught. Students also self-reported an increase in developed science identities. Lastly, there was not a significant statistical shift in hip-hop pedagogical approaches as an intervention having any effect on students' perceptions of their education creating future opportunities for them ( $p$ -value of .7508) and whether what they are learning in their science class will be important for their futures ( $p$ -value of .9681). This demonstrates that regardless of pedagogy and engagement in science, the students always recognized the importance of science education in creating future opportunities for them.

### *Students Developing a Deeper Understanding of Science Content through Hip-Hop Pedagogical Approaches*

Through engaging in focus group discussions with participants of this study around the effect of hip-hop pedagogical approaches, the one theme that

**Table 1.** Statistical Data on Students' Responses for Selected Likert Items from Increasing Students' Interests in STEM Survey.

Likert item	<i>n</i>	Mean	<i>P</i> -Value
1. Science is fun			<.00001
Pre hip-hop pedagogy	55	3.85	
Post hip-hop pedagogy	55	4.36	
2. Science is interesting			0.00044
Pre hip-hop pedagogy	55	4.09	
Post hip-hop pedagogy	55	4.44	
3. I enjoy science			<.00001
Pre hip-hop pedagogy	55	3.85	
Post hip-hop pedagogy	55	4.31	
4. I am a scientist			<.00001
Pre hip-hop pedagogy	55	2.55	
Post hip-hop pedagogy	55	4.04	
5. I enjoy this science class			0.00044
Pre hip-hop pedagogy	55	3.85	
Post hip-hop pedagogy	55	4.35	
6. I enjoy the way that my science teacher teaches me			0.0002
Pre hip-hop pedagogy	55	4.24	
Post hip-hop pedagogy	55	4.6	
7. I enjoy listening to Hip-Hop music			0.00096
Pre hip-hop pedagogy	55	4.32	
Post hip-hop pedagogy	55	4.67	
8. My education will create many future opportunities for me			0.7508
Pre hip-hop pedagogy	55	4.67	
Post hip-hop pedagogy	55	4.8	
9. What I am learning in my class is important for my future			0.9681
Pre hip-hop pedagogy	55	4.48	
Post hip-hop pedagogy	55	4.45	

Note. All participants (*n*) self-identify as girls of color.

emerged from student responses was that participants developed a deeper understanding of science content as a result of engaging with hip-hop pedagogical approaches. Two students, Leila and Hyam, shared how participating in a breaking activity where students acted and imagined themselves as molecules that were gaining and losing energy allowed her to gain a deeper understanding of the science concept phase change. This breaking activity

represents the element of b-boying/b-girling as it provided students an opportunity to physically act out science concepts similar to how b-boys/b-girls physically act out dance moves in dance battle competitions.

Leila: Here (current science class), it's easier. At first, I couldn't understand it. I actually learned it in my old school, and I had no idea. I was one of those kids, I didn't know what those (molecules) are. We were the only three in the back and we always used to be like, "Huh?" And we also used to tell the teacher . . . The teacher never did this activity with us. He did stuff like explaining in harder words, but when we act it out, it seems easier to understand.

Hyam: I couldn't imagine it when we were talking about it, I couldn't imagine it, but when we acted as molecules it, I learned more.

Both Leila and Hyam attended the same elementary school where they were both assigned to the same science class and educator. Leila shares that they learned about molecules as they relate to phase change a year prior in their old school but left elementary school without a clear understanding of what molecules were or behaved. Considering that molecules are composed of a number of atoms, which exist in everyday life, but cannot be seen with the naked eye or with middle school science equipment, it is challenging to teach students what molecules are and how they behave (Kessler & Galvan, 2007). Leila explains that she was one of those students who "had no idea" about what the elementary science teacher was explaining when discussing molecules. Further, Leila shares that both she and Hyam were two of three students that would be "sitting in the back of the classroom like 'huh,'" suggesting that they were confused and did not understand the content because their teacher used "harder words," or science vocabulary words that students have yet to understand, to explain the content. But, when Leila had an opportunity to physically act (move) as a molecule in the science classroom she felt like it "seem[ed] easier to understand," how molecules behave demonstrating her ability to gain a deeper understanding of molecules as it relates to phase change through a hip-hop pedagogical approach. In the same focus group interview, Hyam shared that she "couldn't imagine" molecules or how they behaved when her elementary science teacher taught this concept. But when she acted as molecules, she "learned more," deepening her understanding of how molecules behaved.

### *Students Identifying as a Scientist as a Result of Engaging with Hip-Hop Pedagogical Approaches*

The focus group discussions with participants of this study uncovered another theme of students identifying as scientists as a result of engaging with the

hip-hop pedagogical approaches outlined in this study. Focus group interviews and the Increasing Students' Interest in STEM Survey were used to distinguish if students were able to develop identities as scientists as a result of hip-hop pedagogy as an intervention. Through focus group interviews, I found that most students felt that they could become scientists if they decided to pursue that career path. When interviewing Anika, she shared that sentiment of often engaging in an authentic science lab,

Interviewer: Do you feel like my class, this science class, prepares you to become a scientist in the future?

Anika: Yeah, if you want to.

Interviewer: Why do you think you could become a scientist if you wanted to be a scientist?

Anika: It seems fun because the way you teach us, it makes it not boring and because you prepare us with the tools and stuff that we need to become a scientist

Anika was engaged in a number of lab safety lessons at the beginning of the school year to prepare her and her peers for the number of kinesthetic science lab opportunities that they would later participate in throughout the academic year. Students were encouraged to create memorable raps/songs about the lab safety rules with the goal that students will retain lab safety rules throughout the school year. Although only a sixth-grade middle school student, Anika was taught lab safety rules that apply in any science lab from secondary school to higher education. Anika expressed that learning science lab safety rules in her sixth-grade science class could prepare her to be a scientist in the future. Anika further explains that she feels that she could pursue a career in science because science “seems fun” because of how it is taught—utilizing hip-hop pedagogical approaches. In addition, Anika feels that she is being prepared with the tools that she would need to be a successful scientist.

In a different focus group interview, Leila shared similar sentiments as Anika, as it relates to identifying as a scientist from engaging in science through hip-hop pedagogical approaches.

Leila: When we did the phase change lab and used beakers, hot plates, and stuff, and I can imagine myself when I'm grown up doing it because I'm never going to get bored with it. It seems like fun to me. Also, seems cool that it's advanced learning and having fun at the same time.

Through a breaking lab activity where students were able to use authentic science equipment, such as beakers, thermometers, goggles, and hot plates,

Leila was able to engage in an authentic science experience, which she enjoyed. After participating in a breaking lab activity Lelia was able to realize that engaging in science, particularly this lab experience, can be very fun and engaging. Furthermore, she was able to imagine herself engaging in similar authentic science experiences when she grows up because she had “fun” and will “never going to get bored with it.”

Most participants demonstrated that they felt that their sixth-grade science class prepared them to be scientists in the future, which I suggest, encourages students to develop a science identity. Prior to the intervention (hip-hop pedagogy), 30% of participants agreed or strongly agreed to the “I am a scientist” item from the Increasing Students’ Interest in STEM survey, while post-intervention 83% of participants agreed or strongly agreed to the “I am a scientist” item (Table 1). The data demonstrates that when comparing students’ pre- and post-survey responses for the “I am a scientist” item of the Increasing Students’ Interest in STEM Survey, the difference was considered to be extremely significant with a two-tailed  $p$  value of less than .0001.

### *Deconstructing Traditional Classroom Spaces through the Implementation of Hip-Hop Pedagogical Approaches*

Through engaging in focus group discussions with participants of this study, another theme that emerged was the deconstruction of traditional classroom spaces that students experienced in recent years while participating in urban public schools. Participants of this study were sixth-grade students who were new to the middle school and, therefore only previously experienced science in an elementary school setting. Through discussions, students shared their experiences of participating in science during elementary school. One student stated:

Shemaya: Well, in my old school, I always thought the teacher was boring. He did all the experiments; he didn’t tell us what it was about. He didn’t explain to us. He didn’t do anything. He told us to write down stuff. Mr. A, he explains stuff. He makes us do hands-on experiments too, and he makes learning better and fun.

Here, Shemaya describes her science experience in her previous elementary school. She clearly expresses her disengagement in her elementary science class as she found her teacher to be “boring.” She also explained that her teacher only modeled/demonstrated experiments/labs and kinesthetic/hands-on experiences rather than allowing students to participate in experiments/labs to engage and experience science for themselves. In my

experience as a science educator in urban schools, teachers oftentimes do not “trust” students with the science tools to engage in experiments/labs on their own under supervision with a fear that students may misuse or damage science equipment (King et al., 2001). In addition to not being provided an opportunity to participate in hands-on science experiments, Shemaya felt that her elementary school science teacher did not explain science content effectively. Shemaya juxtaposes her elementary science experience to her middle school science experience where she was engaged using hip-hop pedagogical approaches and expresses that she is provided with the opportunity to engage in hands-on experiments and experience science for herself, which she describes “makes [science learning] better and fun.”

## **Discussion and Conclusion**

The purpose of this study is to uncover the effects that hip-hop pedagogy, a culturally relevant approach to teaching, has on girls of color from underrepresented backgrounds in an urban science classroom. The researcher found that utilizing an approach to teaching that is anchored in hip-hop culture and youth culture had a positive influence on teaching and learning in an urban classroom. Hip-hop pedagogy being grounded in the five creative elements of hip-hop allowed the educator to utilize innovative teaching approaches that are more engaging than the monolithic teaching approaches, such as copying notes and lecturing, that are traditionally found in science classrooms. Further, the implementation of a hip-hop pedagogy recognizes, highlights, and directly draws connections between students’ cultures and science content. The findings of this study indicate that students enjoyed their current sixth-grade science class, which implanted a culturally responsive approach to teaching as compared to their previous fifth-grade science class. The researcher concluded that students enjoyed and preferred their current science class mainly due to the hip-hop pedagogical approaches that were utilized. The autonomy of this approach gives way for students to engage in practices in the classroom that they normally engage in outside of school. This allowed and supported students in developing an increased level of comfortability and even identity as it relates to learning and engaging in science content. The researcher also found that through the implementation of hip-hop pedagogical approaches, an increased interest in science was projected. Results from the Increasing Students Interest in STEM also demonstrate that a majority of students self-reported the increase of science identity. The findings of this study showed that through hands-on experiences in the science

classroom, students felt more prepared and knowledgeable about engaging in science practices in the real world, contributing to the development of their science (Smith, 2016).

Further, this study intentionally centers the perception and voices of Black and Brown girls as it relates to HHBE. Implementing an intervention anchored in hip-hop culture provides Black and Brown girls an opportunity to draw positive connections between science content, their multiple identities, and a culture that they participate, and engage in. Using community cultural wealth (Yosso, 2005) as a theoretical underpinning to center the knowledge, skills, and abilities that communities of color intuitively harness in teaching and learning encourages girls of color to also recognize the power and potential that they already possess through their culture and community knowledge. Further, through a CRT lens, this study allows scholars to challenge the ways race and racism implicitly and explicitly impact social structures (DeCuir & Dixon, 2004). By incorporating students' cultures in the pedagogy of the science classroom supports positive science identity development of Black and Brown girls who have historically and systemically been excluded from science disciplines and career fields.

Ultimately, I argue that executing a hip-hop pedagogy in the urban science classroom provides an opportunity for educators to effectively and authentically incorporate youth culture into teaching and learning in a culturally relevant manner. Hip-hop is one of the most widely consumed genres of music, and studies demonstrate that urban youth identify as belonging to the hip-hop generation (Adjapong and Emdin, 2015). Bringing hip-hop culture into the science classroom provides an opportunity for students to engage in cultural practices that they engage in outside of school. By learning science through these practices that are anchored in students' culture creates spaces and opportunities for students to gain cultural capital as it relates to science, be critical of the school system, engage in positive cultural effervescence and ultimately see themselves as scientists. Further, through the understanding of social networks, through implementing a pedagogy that is anchored in the culture of students, educators who are often outsiders to the cultures and experiences of their students are provided an opportunity to learn about and engage with students' cultures (Easley & Kleinberg, 2010). During this study, this was done authentically as students, on numerous occasions, shared their specific interests as it relates to hip-hop culture, which helped the educator in drawing connections between hip-hop culture and science content. By providing opportunities for students to share specific interests as it relates to their culture, the educator was allowed to increase their understanding students' interest and build increasingly positive relationships with students.

Through gaining a deeper understanding of students' over time, the "weak tie" connection that inherently exists between educator and student can develop into a "strong tie" connection, which is necessary to facilitate the highest follow of information (i.e., culturally responsive science content) between parties (Friedkin & Noah, 1982).

The implications of the study suggest that incorporating hip-hop culture into the teaching and learning in the science classroom has a positive effect on students' understanding of science content, engagement in science and science identity, which I argue can be used to address the institutional educational debts as it relates to science education. Otherwise, if science educators do not consider incorporating students' culture into the pedagogy, we will continue the trend of students, particularly girls of color, of diverse backgrounds interest in science decreasing, which can be detrimental to our global economy as careers in STEM are expected to grow by 17% over the next few years (Langdon et al., 2011).

### *Limitations*

As for any research project, there are limitations that may place restrictions on the possible conclusions. In this study, not using any quantitative methods to quantify how the enacted hip-hop pedagogical approaches support students learning can be viewed as a limitation. Critics of this study might suggest that middle school students cannot gauge the effect of different teaching strategies have on the acquisition of science content. Further, there is a lack of existing empirical research studies that focus on the effects of a hip-hop based pedagogy on girls of color. Therefore, there is little to no prior research on the same topic to draw from to support or contradict my conclusions. The goal is to perform future research that focuses on the implications of hip-hop pedagogy on girls of color in STEM contexts.

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