THE ROLE OF SCHOOL LEADERS IN SECURING STEM EDUCATION FOR BLACK GIRLS

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by

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APPROVAL OF THE DISSERTATION

This dissertation, The Role of School Leaders in Securing STEM Education for Black Girls, has been approved by the Graduate Faculty of the Curry School of Education in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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ABSTRACT

The cross-case analysis endeavored to examine the perspectives and practices of middle school principals who were leading schools in which a federally-funded, design-based science, technology, engineering, and mathematics (STEM) education grant was being implemented. In the context of a majority minoritized school district, the researcher operationalized the Ontario Leadership Framework (OLF) (Leithwood, 2012) using an intersectional (Crenshaw, 1989, 1991) lens to explore the ways that Black girls′ positionality in the STEM pipeline influenced school leaders.

First, the researcher found evidence of principals guiding the direction of their schools in vision-centered ways that uplifted the needs of historically marginalized student populations. Specifically, school leaders operated from equitable dispositions by creating high expectations among teachers and school staff on behalf of Black girls' academic and social advancement.

Secondly, the researcher identified strategies middle principals used to prioritize the intersectional positionality of Black girls in the STEM pipeline. Principals demonstrated social justice leadership orientations by engaging external partners in their school community including research-focused university experts as well as STEM professionals of color. The work of the school leaders also aligned with, and even exceeded, the stated STEM education goals of the school district.

This study was a situated exploration of leadership that attended to obvious gaps in the educational leadership, Black girlhood, and STEM education literature. The

research aimed to fill the evident lacunae in scholarship focused on the constellation of these important subjects, and simultaneously provide guidance to practicing school leaders regarding ways that they can support and embolden Black girls in educational spaces. To achieve both goals, this research study concludes by proffering an articulated definition of intersectional leadership: to operationalize visionary strategies that privilege the experiences of followers who live the realities of more than one historically oppressed identifier.

DEDICATION

The work and commitment included in this disseration are dedicated to my parents, Alvin O. Nash and LaJeune Miles Nash. The guidance and encouragment you have both provided me from your perch in Heaven above has encouraged me along this path every step of the way. Thank you for being amazing parents to your one and only Black girl, and in doing so, being the quintessential examples of how to advocate on behalf of the countless Black girls who I hope will be emboldened by this work.

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The continuously diversifying nature of the K-12 student populations in the United States creates educational contexts in which administrators are often tasked with the responsibility of leading in ways that embrace the needs of children from a range of racial, cultural, and socioeconomic backgrounds (U. S. Census Bureau, 2012). However, if the institution of American education were to hold a mirror up to the realities of its current students, it would see an image rife with the relegation of certain groups of children to less than an equal education. A reflective image of today's schools clearly consists of tangible examples of unequal treatment of students that are rooted in children's identifiers. This picture includes academic exclusion (Evans-Winters & Esposito, 2010), social segregation (Koonce, 2012), and resultant economic disenfranchisement (Pratt-Clarke, 2010). While inequitable schooling experiences have manifested in students' lives in a host of detrimental ways, the multi-layered impact of racialized and gendered discrimination of Black girls has resulted in an opportunity gap that currently affects their educational and professional advancement with obvious magnitude (Crenshaw, Ocen, & Nanda, 2015). Unpacking the double marginalization of Black girls entails an understanding of both the historical milieus and the contemporary contexts that have shaped their lived experiences.

Black Women and Girls

As to avoid distractions of pigmentocracy, (Sidanius, Peña, & Sawyer, 2001) and to provide clarity in this study, the term Black is used to describe anyone who self-

identifies as having an African diasporic heritage. For example, this can include people who do or do not phenotypically present as Black and, based their ethnic or racial background, identify using terms such as Black, African American, Afro-Caribbean, or other country-based identifiers. This study will focus on the subgroup of Black girls.

A deconstruction of Black girls' current educational positionalities reveals a truth that is refracted by histories of academic inequity and social ostracizing. Empirical research about the state of Black girls in schools has been published in peer-reviewed journals as early as 1935 when Oldham explored the relationship between Black adolescent girls' socio-economic status and their observed behaviors in teacher-student interactions. This early documentation illuminated the intricacies of the perceived academic abilities in the socially-skewed infrastructure that Black girls faced in education, as well as institutional racism that informed these perspectives; these inconsistencies, which inform their schooling, still remain true for students today.

Research focused on Black girls' lives over the decades since the earliest explorations, has revealed that they continue to face hardships in schools (Archer-Banks & Behar-Horenstein, 2012). Consequently, the scholarly discipline of Black girlhood studies has evolved as an interdisciplinary exploration in the social science fields that examines their realities in concrete and constructive ways (Brown, 2009; Owens, Callier, Robinson, & Garner, 2017). The research in this field, which is rooted in a collective commitment to revealing Black girls' truths and articulating ways to improve their lives, has slowly developed. Some of the harsh realities of Black girls include academic achievement differences and disproportionate graduation rates (National Center for Educational Statistics, 2015).

Likewise, their discipline rates illuminate the skewed incarceration and alternative confinement recommendations that schools issue, and the over suspension of this demographic (U.S. Department of Education Office for Civil Rights, 2014, 2016). For example, at very early elementary ages, Black girls are suspended from school at alarmingly disproportionate rates, and in some cases placed in handcuffs in kindergarten (Campbell, 2012; Dakss, 2005; D'Onofrio, 2016). Realities such as these demonstrate the trauma and educational silencing that are too common, and that can lead to schooling challenges that collectively affect their access to further education, and consequently future careers and livelihood.

As 14% of the U. S. female workforce (U. S. Bureau of Labor Statistics, 2016), Black women earn lower wages than their Asian and White contemporaries, grossing a median weekly salary of $611, compared to $1,080 and $734, respectively (U. S. Bureau of Labor Statistics, 2015). Similarly, reporting a 35% likelihood of working in a management or professional occupation, Black women lag in their career progression when compared to their Asian and White female colleagues, who have a 49% and 43% likelihood, respectively (U. S. Bureau of Labor Statistics, 2015).

More specifically, in science, technology, engineering, and mathematics (STEM) fields, where a large portion of professional positions exist, Black women's presence in the management realm is grossly dismal; less than one percent of STEM managerial positions are occupied by Black women (National Science Foundation, 2013). In parallel, and reflective of the condition of the STEM pipeline that proceeds leadership in STEM industries, less than one percent of students who earn doctoral degrees in STEM majors are Black females (National Science Foundation, 2013). These severely low numbers

indicate that, while Black women attend college and select STEM majors, earning 10.7% and 13% of Bachelor's and Master's, respectively, their advancement in the fields as professionals is greatly diminished.

STEM Education

The intentionality of STEM education in the United States is grounded in both societal necessity and critical theoretical dispositions. Workforce competitiveness has long been the oft-stated driving force behind many national efforts to develop scientific knowledge and prepare students. For example, with an annual budget of $7.5 billion dollars (FY 2017), the National Science Foundation (NSF) has maintained its goal

> to initiate and support basic scientific research and programs to strengthen scientific research potential and science education programs at all levels in the mathematical, physical, medical, biological, social, and other sciences, and to initiate and support research fundamental to the engineering process and programs to strengthen engineering research potential and engineering education programs at all levels in the various fields of engineering, by making contracts or other arrangements (including grants, loans, and other forms of assistance) to support such scientific, engineering, and educational activities and to appraise the impact of research upon industrial development and upon the general welfare. (National Science Foundation Act of 1950, 1950)

The research and educational opportunities that the NSF and similar entities have funded, have resulted in scientific advancements and a strengthened K-20 science-based pipeline.

Over time, the NSF's functions have included the establishment of research centers, partnerships with higher education, and investments in Minority-Serving Institutions' undergraduate programs, graduate students, and post-doctoral work. By engaging in their purposeful work, they and comparable funders have sought to diversify research and reform foci in science and technology fields, and the STEM-related job markets that Americans enter with their global contemporaries. Although findings and

evaluations show how professional and educational realms are changing due to these efforts, in each discipline represented in the constellated field of STEM, there are critical articulations regarding the true purpose and societal effects of these policy-based efforts.

Scholarship in math and science education highlights the utility of each to offer liberation (Martin, 2009) and social justice (Barton, 2003), respectively, for students from historically underserved backgrounds. Based in a Critical Race Theory (CRT) (Bell, 1995) perspective, Martin and colleagues (as cited in Bishop & Forgasz, 2007; Frankenstein, 2012) warn against research's propensity to problematize the education of historically underserved children of color. In response, they offer a disposition that instead includes culturally relevant math instruction and practices that engage students and their families in education that empowers them to problem solve in ways that are useful in their communities. This approach combats deficit-based stereotypes and simultaneously offers pedagogical strategies that are inclusive and emboldening.

Likewise, in critical stances towards science education, competitiveness is framed as a force that drives K-12 testing policy in a manner that is not beneficial to students. Barton and her contemporaries argue for science education that is socially just, mediated by feminism, and grounded in the societal needs of students in agential ways. These positions, and similar work focused on technology and engineering education, offer contextual insight into the effects of STEM education. By acknowledging the need to avoid perpetuating negative rhetoric about Black students' education and centering the necessity to provide equitable opportunities to them at the center of efforts, this and other studies of STEM education create an opportunity to better understand how school leaders can improve the outlook for Black girls.

A developing body of literature considers the bleak effects of underrepresentation of Black females in the STEM collegiate and professional pipeline (Foor, Walden, & Trytten, 2007). Likewise, scholarship focusing on the contributory relationship between Black girls' K-12 academic experiences in STEM classes and the resulting dearth of the demographic in STEM majors and professions, is also increasingly published (Bystydzienski, Eisenhart, & Bruning, 2015; Campbell, 2012). However, there is a paucity of research that examines the leadership practices that shape the K-12 schools where Black girls have earlier access to STEM classes. For this reason, this dissertation studied principals in the context of implementing a STEM education program that endeavored to diversify the STEM workforce by positively influencing middle schoolers' experiences in early educational efforts through sustained contact with STEM professionals of color.

Research Study

The cross-case analysis (Schwandt, 2001) presented in the current study is relevant to the work of school leaders because the research, analysis, and subsequent knowledge that it contributes to scholarly literature have the potential to inform the work of school leadership practitioners and educational policymakers. Likewise, this work on behalf of Black girls may lead to developments in educational leadership practices that equitably improve students' schooling experiences based on their unique societal circumstances.

The purpose of this cross-case analysis (Schwandt, 2001) is to examine the nature of the relationship between the intersectional positionality of one specific student demographic, Black girls, and their school leaders' practices to implement a National

Science Foundation (NSF) grant. By specifically studying the thoughts and actions of principals in two public middle schools, this analysis provides insight into whether, and the extent to which, societal factors impacted the leadership practices that shape Black girls' education. In particular, this dissertation focuses on the leadership practices that support the science, technology, engineering, and math (STEM) education to which students have access. The programming includes students engaging with their STEM teachers and STEM professionals with whom they share similar racial and cultural backgrounds.

The qualitative research presented in this dissertation was conducted in a public school district in an urban county of a Mid-Atlantic state in the United States. A cornerstone of the STEM education grant is to contribute to the diversity of the STEM workforce by intentionally establishing meaningful partnerships between STEM teachers and STEM professionals. The school system was purposely chosen, because of the high percentage of students of color (95.8%) in its population of approximately 129,000 students (Facts and figures, 2016; Khalil & Kier, 2016). The school system is one of the United States' largest 25 school districts and serves one of the country's wealthiest Black communities based on per capita income. The grant research and work are being conducted using an emergent, anti-racist methodology, Critical Race Design (CRD) (Khalil & Kier, 2017). Khalil and Kier explain how CRD champions:

> the truths of non-dominant groups who have been oppressed and systematically marginalized in education research [as a result of varying forms of discrimination, and] attends to the historical context of participants' identities via research actions that validate their experiences and voices and counters the positivist euro-centric 'objective' norms of white patriarchal capitalistic supremacy that devalues other

> critical methods, positionalities, and ways of knowing (Denzin & Lincoln, 2008; Donnor, 2013; Gillborn, 2013). (pp.59-60)

Critical Race Design (CRD) uses the ontological, epistemological, axiological, and methodological approaches that Critical Race Theory (CRT) (Bell, 1995) has contributed to educational research over several decades (DeCuir & Dixson, 2004; Ladson-Billings & Tate, 1995). Harper, Patton, and Wooden (2009) cite the seven central CRT tenets that scholars have articulated over the years:

> (a) Racism is a normal part of American life, often lacking the ability to be distinctively recognized, and thus is difficult to eliminate or address (Delgado, 1995; Delgado & Stefancic, 2001; Ladson Billings, 2000; Solórzano, 1998); (b) Critical race theorists continuously critique institutional claims of liberalism, neutrality, objectivity, color blindness, and meritocracy (Crenshaw, 1997); (c) "CRT recognizes that the experiential knowledge of women and men of color is legitimate, appropriate, and critical to understanding, analyzing, and teaching about racial subordination in the field of education" (Solórzano, 1998, p. 122); (d) CRT recognizes interest-convergence (Bell, 2000), the process whereby the white power structure "will tolerate or encourage racial advances for Blacks only when they also promote white self-interests" (Delgado, 1995, p. xiv); (e) "Revisionist history reexamines America's historical record, replacing comforting majoritarian interpretations of events with ones that square more accurately with minorities' experiences" (Delgado & Stefancic, 2001, p. 20); (f) CRT also relies on Racial Realists, or individuals who not only recognize race as a social construct, but also realize that "racism is a means by which society allocates privilege and status" (Delgado & Stefancic, 2001, p. 17); and (g) CRT continuously critiques claims of meritocracy that sustain white supremacy (Bergerson, 2003 (p. 391-392).

Of the seven articulated CRT tenets, CRD specifically subscribes to three because they resonate with the programmatic intentionality of the conceptual design. Khalil and Kier (2017) explain the CRT tenets that their design-based framework, CRD, align with are: (a) the critique of liberalism; (b) interest convergence; and (c) counter-storytelling.

The ways that CRD expounds upon CRT tenets are operationalized in the current study and articulated throughout this dissertation. For example, the purposeful

recruitment and inclusion of STEM professionals of color demonstrate the programmatic intentionality of creating opportunities for students to engage with adults with whom they can racially, culturally, or ethnically identify. This establishes a critique of liberalism and color blindness. Likewise, the narratives that the STEM professionals share with students provide counter-stories to those that students might typically associate with people who work in the STEM fields.

This dissertational research, as does the grant of which it is a component, seeks to dismantle the deficit lens with which Black students and their communities are often viewed in educational and societal contexts (Clonan-Roy, Jacobs, & Nakkula, 2016; Valencia, 2012; Yosso, 2005). This research provides insight into the ways that Black girls are emboldened in their middle school STEM curricular experiences by principals who specifically consider the girls' needs. The approach to this investigation was based on the researcher's belief, and the evidence-based assertion, that principals' actions influence all of their students' academic and social livelihood and development in indirect (Hallinger & Heck, 1998), yet meaningful ways.

Problem Statement

While the United States predicts a need for one million STEM professionals by the year 2022, and the U. S. government has made concerted efforts to strengthen the STEM workforce, Black women are still grossly underrepresented in the field (Handelsman & Smith, 2016). The National Science Foundation (2017a) reports that Black women's share of bachelor's degrees has declined in STEM fields such as computer science, mathematics, statistics, and engineering. Similarly, at the doctoral

level, Black women attain less than one percent of the degrees awarded to U. S. citizens, while they make up approximately six and a half percent of the U. S. population (National Science Foundation, 2017b, 2017c).

The longstanding dearth of STEM professionals of color has prompted higher education institutions, corporations, and governmental agencies to increase their training and recruiting initiatives to prepare students and employees to fill the jobs that companies have (Carlson & Sullivan, 2004; The White House, 2015). The attempts to strengthen the workforce not only reach people who are closest to pursuing available careers; there also exists intentional efforts to prepare people for professional opportunities during the time when potential employees initially have access to the STEM training – that is, when they are students in K-12 settings (DeJarnette, 2012). Fortifying the pipeline continues to be a priority for many societal entities that are interested in the United States' commercial and technological sustainability, however, there are still many acknowledged "leaks" in the system that result in significant attrition challenges throughout the field (Metcalf, 2014).

The approaches that schools take to increase access to STEM education range in philosophy and implementation. STEM education research details the varying levels of autonomy that teachers, schools, and leaders are given to develop educational experiences that can influence students' interests and skills in STEM-related work (Brophy, Klein, Porsmore & Rogers, 2008; Carr, Bennett, & Strobel, 2012; Sadler, Coyle, & Schwartz, 2000). Even with the increased access to STEM education, there is still a stark difference in the number of students of color who enter and remain in the field. For example, in fields like mathematics, Black girls are 800% less likely to attain a

degree than their White contemporaries (Scriven, 2013). The historical differences in access to education that teaches the skills and promotes the competencies needed in the field contribute to the disproportionalities that exist throughout the STEM pipeline (National Science Foundation, 2006; Perna, Lundy-Wagner, Drezner, Gasman, Yoon, Bose, & Gary, 2009). Furthermore, the double bind that Black women find themselves in, as both Black and female, creates magnified barriers that significantly impact their success in the field (Hanson, 2004; Ong, Wright, Espinosa, & Orfield, 2011). Research that illumines Black girls' position in society writ large, and in educational pipelines, specifically, brings awareness to school leaders who decide how to improve students' educational trajectory.

The experiences that shape Black girls' access to educational opportunities, and the benefits that follow, including healthy socialization and career options, begin with early elementary school-aged exposure to enrichment (Posner & Vandell, 1999). As Black girls matriculate through school, they continue to take part in learning communities in which they have to navigate the academic and social issues that shape their experiences. School leaders are responsible for shaping and maintaining the school cultures in which Black girls learn about themselves, other students, and members of society. Consequently, it is important to investigate the nature of principals' thinking and practices, and if and how they consider the impact each will have on Black girls in their schools.

Significance of Study

The two aims that motivated this dissertation research were: (a) filling a gap in educational leadership literature by investigating the ways that the agential and

contextual experiences of Black girls can influence school leaders' practices, and (b) contributing to the nascent research base of Black girlhood studies in educational leadership literature by describing how school leaders' thinking and practices influence Black girls' access to education in a field in which they are disproportionately under-represented. The empirical research that was conducted in this dissertation is important because Black girls have been historically underserved in schools. Their lack of access to equitable schooling over time has impacted their educational opportunities (Evans-Winters & Esposito, 2010; Morris 2007), which has affected their career trajectories and financial livelihood. While there are varying opinions about the necessity of providing specialized support for underserved populations (Arcidiacono, 2005; Hinrichs, 2012), educators who recognize both the historicity of their disadvantage and its impact on their current status, will benefit from research that highlights the ways that they can positively and equitably influence Black girls' lives.

This dissertation fills the lacunae that exist in educational administration literature and Black girlhood studies. Centering the attention of this study on a demographic that has been marginalized both in academic (Evans-Winters & Esposito, 2010; Muhammad & Dixson, 2008), social (Grant, 1984; Morris, 2007), and disciplinary (Blake, Butler, Lewis, & Darensbourg, 2011; Annamma, 2016) ways, and the administrators who lead their schools, contributes to both research genres. While there is some research that focuses on Black girls and offers implications for educational administrators (Watson, 2016), there is still a need for critical analysis of the ways that school leaders influence their experiences. Likewise, while much of the Black girlhood literature examines their interactions with teachers (Crenshaw, Ocen, & Nanda, 2015;

Gholson & Martin, 2014), less addresses the impact of school leaders on their academic lives. By conducting a study of the reciprocal relationship of Black girls' positionalities and leaders' decisions, this dissertation intentionally and bi-directionally informs both fields. Both contributions have the potential to improve the practice of educators at every level of engagement with Black girls, and potentially all students.

Purpose

The purpose of this dissertation is to examine the reciprocal relationship between Black girls' contextual and educational experiences and school leaders' practices during the implementation of a STEM education grant. While the quality of teachers has the greatest impact on student achievement, school leaders also influence students' educational experiences and learning (Leithwood, Patten, & Jantzi, 2010; Robinson, Lloyd, & Rowe, 2007; Seashore Louis, Dretzke, & Wahlstrom, 2010). School leaders are responsible for establishing safe learning environments for students and staff, leading staff in their teaching and nurturing of students, and maintaining accountability to districts, parents, and communities. As all of these practices impact students' lives, there is a need to further understand what affects the thinking of leaders as they complete these tasks.

This research specifically examines the influence of school leaders' decisions on Black girls in STEM classes and adds to the contextually-based research in educational administration literature and Black girlhood studies. This work critically analyzed leadership practices by qualitatively observing what influenced them and how they affected students access to STEM education. There is a dearth of literature that focuses

on the extent to which there is culturally and societally-based reasoning that specifically considers the needs of Black girls when educational administrators lead in their schools.

Research Questions

Considering the purpose of this dissertation, and the critical nature of the analysis, this dissertation examined the learning conditions of Black girls and school leadership practices by answering the following research questions:

1. What is the nature of leadership practices that support Black girls in the context of implementing a federally-funded STEM education grant?
2. How does the intersectional positionality of Black girls in the STEM pipeline influence school leaders' thinking about practices to support the implementation of a federally-funded STEM education grant?

The researcher operationalized the research questions by analyzing data from observations of, and interviews with, STEM teachers, interviews conducted with principals, and documents from the school district that specify plans and implementation of STEM education initiatives. The researcher acknowledged that the positive position of the research questions was intentional. The primary reason for this disposition was the fact that there is an emphasis on the lived experiences of Black girls in education that assumes a deficit perspective and the researcher wishes to engage in counter story-telling. Also, of the scholarship published in the top-tier journals in the educational leadership and related fields (i.e., *Educational Administration Quarterly, Journal of Research on Leadership Education, Journal of Educational Administration, Educational Management Administration & Leadership, Review of Educational Research, and the Handbook of*

Research on Educational Administration) over five recent volume years (2011-2016), only one article of over 800 pieces (Winkle-Wagner, 2015) included a focus on the education of Black female students. This current study was intended to highlight the education of Black girls in a manner that does not problematize them in any way and instead highlights how educators uplift, prioritize their academic success, and use their positionality as a means of motivating them.

Conceptual Framework

This study operationalizes two theoretical perspectives in an investigation of the practices of the Ontario Leadership Framework (OLF) (Leithwood, 2012): social justice leadership (Furman, 2012; Gewirtz, 1998; Theoharis, 2007; Young & Laible, 2000) and intersectionality (Crenshaw, 1989; 1991). Conceptually, the study integrates the three to establish a framework that adapts the existing domains of OLF by approaching them through social justice and intersectional lenses. Figure 1 depicts a conceptual model of this relationship.

Conceptual Framework

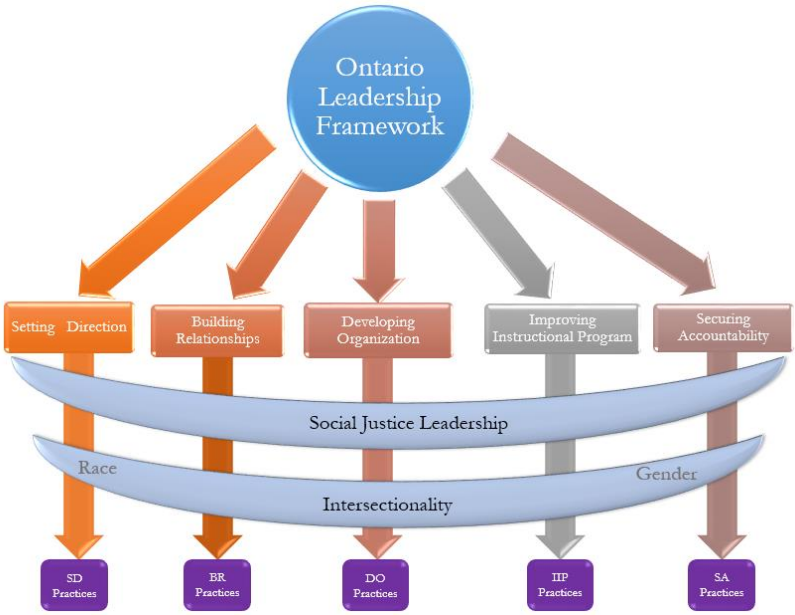

Figure 1. Conceptual model for school-level leadership practices operationalized through social justice and the racialized-gendered lens of intersectionality. Adapted from *Ontario Leadership Framework 2012 with a Discussion of the Research Foundations*, by K. Leithwood (2012).

Understanding the details of each element further illumines the usefulness of combining the three. The OLF specifies five school-level leadership domains of practice that influence student learning. The five domains of practices that Leithwood outlines are: (a) setting directions; (b) building relationships and developing people; (c) developing organizations to support desired practices; (d) improving instructional program; and (e) securing accountability. Leithwood concludes that these specific domains impact the organization and effectiveness of schools.

Leithwood's framework guided this examination of school leaders' work during the grant implementation. The site locations and contexts affected the implementation.

Therefore, it was necessary to observe the leadership practices from a perspective that considered the possible influence of the societal milieu of which the schools are a part.

The work in schools labeled as social justice leadership includes forms of anti-oppressive leadership that are centered on disruption and subversion of systems and practices that perpetuate marginalization and exclusion of historically underserved students (Gewirtz, 1998). Forms of social justice leadership have included efforts to respond to inequities embedded in society, including racism, sexism, ableism, and classism, for many years (Young & Laible, 2000). Though the tenets of social justice leadership have been defined using a diverse range of qualifiers, as Theoharis (2007) explains in an articulation of the theory of social justice leadership, its major components are rooted in "support [of] a process built on respect, care, recognition, and empathy" (p. 223). The praxis and systemic-level policy that school leaders enact can often be recognized as socially just when they are "exercise[s] of altering institutional and organizational arrangements [that are] actively engaging in reclaiming, appropriating, sustaining, and advancing inherent human rights of equity, equality, and fairness in social, economic, educational, and personal dimensions" (Goldfarb & Grinberg, 2002, p. 162). This study, therefore, used a social justice leadership lens as a method of identifying school leaders' actions and thoughts that were socially just and student-centered.

Based in the work of critical legal studies, intersectionality emerged from Crenshaw's (1989) scholarly determination to demarginalize the intersection of race and gender by offering a "Black feminist critique of antidiscrimination doctrine, feminist theory, and antiracist politics" (p. 139). Over the course of time, intersectionality has

been espoused and utilized in many academic arenas, including education. Similar to other critical and contextualized approaches, intersectionality holds that race and gender are not mutually exclusive components of Black girls' and women's identities. Quite the opposite, intersectionality acknowledges the multifaceted, and inseparable nature of Black girls' and women's experiences in schools and society as a whole.

This conceptual framework and study posited that examining the extent to which a school leaders' consideration of Black girls' intersectional experiences influenced their thoughts and practices to shape the school instructional and social culture, could result in a more informed understanding of how administrators can further improve student learning. Viewing the OLF with a critical perspective deepened researchers' and practitioners' knowledge of the needs of Black girls as well as other student populations.

Ontario Leadership Framework

Setting directions. The responsibility of setting directions for a school rests largely on the shoulders of school leaders. They are tasked with establishing vision and maintaining the work and productivity that accomplish the goals for their school. In his explanation of OLF, Leithwood (2012) details the manner in which short-term goals can be affected by factors such as community contexts, school culture, and the capacities of the teachers and staff. Leithwood directly declares, "the practices outlined in the OLF leave considerable room for adaptation to local circumstances and assume considerable problem-solving expertise on the part of those exercising leadership" (p. 6). This statement acknowledges the potential application of additional lenses, social justice and intersectionality, with which to analyze if, how, and the extent which Black girls' positionality in society and their local context influences school leaders' decisions and

work. Correspondingly, the social justice and intersectionality lenses were also employed to analyze how the leaders' practices influenced Black girls' school experiences. For this study, the local circumstances consisted of a community that is predominantly comprised of people of color. This distinctive context supported an investigation of whether school leaders acknowledged the need to strengthen the STEM pipeline when they engaged with the grant implementation, as the majority of their students are from demographics that are largely underrepresented in the field (e.g., students of color).

Building relationships and developing people. In describing the capacity of leaders to build relationships and develop people, Leithwood (2012) argues, "the practical value depends on leaders enacting them in ways that are sensitive to the specific features of the circumstances and settings in which they work and the people with whom they are working" (p. 13). Essentially, Leithwood is saying that a leaders' ability to build relationships and develop people is hinged on their awareness of the particular organizational context. Possessing a keen understanding of the positionality and needs of the communities they serve and their school's professional staff facilitates better relationship building and development of people.

There is a connection between leaders' commitment to developing school personnel and their effectiveness in achieving the school's goals. In particular, the resources that leaders allocate to advance the professional capacity of their schools' teachers can be important indicators of their investment in their school's vision. Leaders are also responsible for providing individual support to professional staff (Leithwood & Jantzi, 1990).

It is likewise vital that leaders develop relationships with families, which calls upon administrators to establish school environments in which families feel safe, valued, and included. Much like the sensitivity that Leithwood suggests leaders should have when working with professional staff, they should also understand the context of the school's local community, the ways families view education, the needs of families, and the extent to which the families and students trust them (Adams, Forsyth, & Mitchell, 2009). Knowledge of these important facets of relationships can help leaders improve and sustain genuine partnerships with the broader school community. Additionally, engagement with the broader school community can help leaders recognize the cultural wealth that exists in historically underserved communities (Yosso, 2005). Yosso asserts that by respecting cultural wealth, such as aspirational, navigational, social, linguistic, familial, and resistant capital that exists in communities, school leaders can ground their practices in the spaces they create that value all stakeholders.

Developing organizations to support desired practices. Leaders are also tasked with building school cultures that foster collaboration. Leithwood (2012) explains, "For leaders striving to make their schools more inclusive, creating more positive collaborative and achievement-oriented cultures is a key task" (p. 21). The OLF asserts that collaborative communities can be developed and sustained when administrators distribute leadership responsibilities to other school professionals. Student learning is enhanced by distributed leadership (Hallinger & Heck, 2009). Fostering environments in which teachers are encouraged to work together motivates productivity towards shared goals. Likewise, supporting collaboration by offering resources, such as time and funding to achieve goals, positively impacts schools and their students.

Leaders operating with an intersectional lens might include Black girls amongst constituents whom they trust to make decisions about interests within their scope of influence. For example, principals may consider the extent to which Black girls' agential voices have been absent or squelched due to the historicity of gender-based and race-based discrimination, and implement informed practices that purposively include them in collaborative initiatives to improve schools (Mirón & Lauria, 1998).

Improving instructional program. It is essential that leaders recognize the needs of instructional programming in their schools. Attending to the curricular strength of a school and the instructional capacity of the staff who educate students, gives leaders access to shaping the pedagogical infrastructure of the school (Marks & Printy, 2003). Leaders should consistently explore and assess the quality of the teaching staff (Harris & Sass, 2009). They should also seek and support access to curricular resources that are available to the schools (Newmann, King, & Youngs, 2000). Providing time for professional development helps improve the instructional program, as does monitoring student learning (Youngs & King, 2002).

An intersectional lens, when applied to instructional leadership practices, may empower principals to consider the needs of Black girls. Doing so can prompt principals to expand the scope of curricula to include historically underrepresented subjects and practices in schools that are culturally relevant to Black girls. Likewise, a social justice lens can motivate principals to institute initiatives that provide equitable access to previously inaccessible opportunities. This work can take the form of developing educational programs that address the curricular needs of students and providing opportunities for students to access community resources.

While there is a dearth of research that explores such possibilities in educational leadership to date, scholarship focused on Black girls' education in classrooms asserts the ways that they effectively connect with academic material that reflects their lives (Sutherland, 2005). Employing constant comparative analysis (Glaser, 1965), and critical discourse analysis (Gee, 1999), Sutherland studied Black girls' use of literature by and about Black girls and women. Using an intersectional lens for the study, Sutherland observed that literacy and identity were indivisibly entwined for the students. The Black girls in the study found it critical to read about and discuss literary characters who (a) were similar to them; (b) faced issues that mattered to them; and (c) reflected their realities as Black girls.

Securing accountability. In the current educational climate, accountability policy has resulted in a heightened level of responsibility placed on educators and, especially, administrators, to demonstrate their effectiveness through students' standardized test scores. Robinson, Hohepa, and Lloyd (2009) explained that leaders can and should establish and encourage an internal and collective sense of responsibility to the accountability measures for student achievement and overall well-being. Leithwood (2012) outlines that leaders can also improve their practices by "assessing one's own contributions to school achievements and taking account of feedback from others" (p. 30). Self-reflection can help leaders identify ways that they can improve their practices to be more supportive and inclusive.

Principals can more systematically empower teachers to hold themselves and the school accountable for making sure that all students, including Black girls, have access to well-rounded curriculum (Bustamante, Nelson, & Onwuegbuzie, 2009). In the realm of

accountability, school leaders can establish systems of responsibility, and in doing so, create cultures that transparently and collectively examine and respond to school culture discrepancies that affect student learning.

Limitations of Study

One limitation of this study was that the bulk of the data the researcher collected was self-reported. Relying solely on participants as sources could be perceived as problematic, as the practice could affect reliability and validity. For this reason, the researcher also included observations and textual analysis of district curricular documents to triangulate (Goffman, 1989) the data and to better inform the data analysis.

The researcher's personal identifiers and specialized perspectives could also be viewed as introducing bias and thus becoming a limitation of this study. As a Black woman with professional experiences in both the educational leadership and STEM fields, the researcher's positionality could be perceived as beneficial; however, they could also be viewed as a source of bias in the context of this study of STEM education for Black girls. The researcher accounted for the possibility of this perceived bias by assuming the disposition of an *outsider within* (Collins, 1990) – that is, the researcher grounded her investigation in a Black feminist epistemology that "suppl[ies] Black women with self-representations that enable them to resist the demeaning racist and sexist images of Black women in the wider world, and to take pride in their identities" (Anderson, 2015, para 41). This act of privileging a doubly conscious (DuBois, 1903) perspective was a form of empowerment that the researcher purposely used. To address this issue, the researcher used a team of coders and member checking to add to the rigor of the study.

Delimitations of the Study

One delimitation was the reliance on data from participants' responses to represent the full scope of the nature of the principal's thinking and practices in the context of the grant implementation. Other indicators that affected principal practices were not all be considered because they did not relate to the STEM education program that was under study.

Another potential consequence of focusing on a very specific area of research was the risk of not being able to replicate the study in the future. This is a general limitation because of the nature of qualitative studies. By limiting this research to the principals, teachers, and Black girls in the school sites at which the STEM education program was being implemented, this study did not explicate other units of analysis that could affect the successful implementation of the grant. Furthermore, the influence of factors such as school leaders' dispositions, teachers' goals, and Black girls' experience in schools and communities, could vary over time based on unpredictable societal and programmatic climate. This could affect the generalizability of the findings over time. Another delimitation of this study is the purposeful approach of focusing only on Black girls and thereby excluding the perspectives of other historically underserved students of color groups. This could also be perceived as an advantage of the study because it established research that could inform investigations of other demographics in STEM education.

Methodological Approach

The methodological approach employed for this research was a cross-case analysis (Schwandt, 2001) that compared two school sites in which an NSF grant is being

implemented (Collier, 1993). Data collection included: (a) document analysis of district-level and school-level STEM education plans and standards; (b) school-site observations of classrooms, teacher meetings, focus groups, and district STEM events; and (c) interviews with teachers, teacher leaders, school principals, and district leaders. Using the three types of data permitted triangulation of findings and corroborated the trustworthiness of the study (Goffman, 1989). The aforementioned collection processes provided data that was analyzed in an effort to proffer an explanation of the relationship between school leaders' practices in the context of STEM education program, and Black girls' positionality, and their educational needs. The data collection took place during the fall and winter of the 2017-2018 academic school year, and it was analyzed using a priori and posteriori coding and a computer-assisted qualitative data analysis software (CAQDAS) program. The CAQDAS program, Dedoose, offered the researcher several methods of data analysis and organization including coding infrastructure. Dedoose features a code co-occurrence function that enabled the researcher to identify the components of the OLF that overlapped with the social justice and intersectional leadership practices that were enacted. The exploration of these intersections was at the heart of this study.

Organization of Dissertation

This dissertation is organized in the following structure: Chapter one – Introduction; Chapter two – Literature Review; Chapter three – Methodology; Chapter four – Findings; and Chapter five – Discussion, Conclusions, and Recommendations. The current chapter, Chapter one, has outlined the problem, significance, purpose,

research questions, conceptual framework, school site context, limitations, delimitations, methodological approach, and organization of the study. Chapter two is a literature review of research detailing school leadership, the use of intersectionality in Black girlhood studies, and Black girls' academic experiences in STEM education. Chapter two synthesizes these empirical literature bases to establish a scholarly framework that was used to analyze the results of the data collection in the STEM education grant implementation. Chapter three details the methodology that was utilized for this research. Chapter three is twofold: It includes the epistemological disposition that substantiates the methods used in the field, and it explains the data collection procedures and analyses employed to address each research question. Chapter four includes the synthesized findings of this investigation. Lastly, Chapter five offers an integrative exposition of the ways that this study's findings expand upon the literature in educational leadership and thus the practices of school leaders, particularly in the area of intersectionality.

Chapter 2: Literature Review

The literature reviewed in this chapter examines the theories and research that were used to develop the conceptual and analytical frameworks for this study. It is essential to understand the theory-based and practical underpinnings of this study because both grounded the work that this dissertation accomplished. The three bodies of literature that inform this study, school leadership, intersectionality, and Black girlhood studies, are all important facets of scholarship. This study combined the important elements from each realm to posit a comprehensive framework with which school leaders can use to lead in inclusive and emboldening ways for Black girls.

Ontario Leadership Framework

Educational leadership scholarship spans a dynamic range of foci that detail and inform the work of school leaders at every level of administration. The conceptual framework for this study is grounded in the work of Kenneth Leithwood, who developed the Ontario Leadership Framework (OLF) (2012). Specifically, this study highlights and expounds upon the flexibility that Leithwood emphasizes in the OLF's five domains. Leithwood's establishment of the OLF is built upon an extensive investigation of educational leadership practices at the school and district levels.

In the OLF, Leithwood (2012) examines the work of school administrators (i.e., principals and assistant principals) and details the ways in which they enact his definition of leadership: "the exercise of influence on organizational members and diverse stakeholders toward the identification and achievement of the organization's vision and

goals" (Leithwood, 2012, p. 3). Leithwood's deeper description of leadership as: (a) reciprocal, as opposed to unidirectional; (b) multi-sourced by the influence of different stakeholders; (c) and exhibited as a function of individuals' and groups' relationships, further pinpoints the ways school administrators operate with their student's well-being and progress at the forefront. With the OLF, Leithwood details the importance of the influence of context and stakeholders in the actualization of leadership. Rooted in the intentional flexibility of OLF, this study's conceptual framework correspondingly draws upon a theory that accentuates the unique needs of one group of stakeholders in schools, Black girls, -- that is, intersectionality (Crenshaw, 1991).

Intersectionality Theory

Intersectionality is one of several racialized-gendered theories that are used in research focused on Black girls. It, and many similarly-aligned theories, including Black Feminist Thought (Collins, 1990), Critical Race Feminism (Wing, 1997), Black Feminism (King, 1988), and Afrocentric Feminist Epistemology (Collins, 2003), highlight the unique positionality of Black girls in society. Intersectionality was developed by Kimberlè Crenshaw as a manifestation of her "efforts to develop a Black feminist criticism" as she noted the "problematic consequence of the tendency to treat race and gender as mutually exclusive categories of experience and analysis" (1989, p. 139). Over years, Crenshaw's development of an intersectional analytical lens has unequivocally disrupted the single-axis approaches regarding race and gender that she and many other scholars (Austin, 1989; McDowell, 1980; Scales-Trent, 1989) witnessed and decried during the theory's nascent years.

Crenshaw further defined the need for intersectionality by acknowledging that, "the experiences of women of color are frequently the product of intersecting patterns of racism and sexism [that are not] represented within the discourses of either feminism or antiracism" (Crenshaw, 1991, pp. 1243-4). Crenshaw problematized both feminist theory and antiracist discourse because neither fully captured what Black women poignantly experienced when they were doubly marginalized. The theory that Crenshaw further articulated and named clarified the difference in, and the necessity of, analyzing Black females' lives with a co-joined lens.

Intersectionality is a meaningful lens with which to examine the practices of school leaders because it not only highlights the specific contextual effects that influence leadership practices, but it also acknowledges those effects in the complex and multifaceted ways that they impact Black girls. Crenshaw's earlier works have informed more recent scholarship that captures Black girls' experiences in schools (Blake, Butler, Lewis & Darensbourg 2011; Crenshaw, Ocen, & Nanda, 2015; Moore & Padavic, 2010; Sutherland, 2005). This research shows how intersectionality can be used as an illustrative lens that magnifies the ways that understandings of Black girls' lives influence educators at every level (e.g., teachers, administrators). The purpose of this literature review and the resulting conceptual framework is to illuminate the ways that school leaders can lead with purposeful consideration of Black girls' societal positionality.

Methods for Literature Review

The literature reviewed in this chapter spans relevant research in the educational leadership and the Black girlhood fields. Specifically, within educational leadership, the

OLF and corroborating research, as well as scholarship focused on students of color, are presented. In the realm of Black girlhood, studies examining their educational experiences, particularly in STEM education, are included.

This dissertation is simultaneously a culmination and a genesis; it marks the final step in a long-term doctoral study of educational leadership and Black girlhood, and simultaneously, it is the beginning of a professional research agenda focused on those very same topics. The literature base used to write this chapter results from three years of research on the aforementioned subjects within the context of graduate coursework focused on education, diversity in education, minority psychology issues, the civil rights of education, the politics of difference in education, Black girlhood, and intersectionality. Further, experience gained while participating in the University of Pennsylvania Summit on Black Girls and Women in Education, the Columbia Law School /African American Policy Forum Research Collaborative, the University of Virginia Global History of Black Girlhood Conference, and the Collaborative to Advance Equity through Research Conference, all informed the multi-year development of this research commitment.

Literature Sources

This review of literature includes journal articles, books, government documents, and agency reports with a heavy emphasis on peer-reviewed journal articles. A total of 193 sources were examined for this study. The literature was acquired through the University of Virginia library's online catalog, EBSCO Information Services databases, and Google Scholar. The search terms used to conduct a thorough review of literature included "Black girls," "educational leadership," "STEM K-12 education," "intersectionality," and combinations of associated words such as African American,

school administration, science education, technology education, engineering education, and mathematics education.

As the subject of Black girlhood is underdeveloped in educational leadership literature, the search also included a focus on other historically underserved populations including Black boys and Latino student populations. This approach helped undergird the research and provided insight into the process of establishing a framework that specifically privileged the unique needs of one student demographic. The literature reviewed included research that utilized both qualitative and quantitative research methods. It also included studies of students' experiences in different educational disciplines. Lastly, it investigated the work of educational professionals at every level (e.g., teachers, principals) to identify multiple practices that positively impacted Black girls' educational outcomes and experiences.

Literature Review Objectives

This literature review provides a detailed examination of the school leadership, Black girlhood, and STEM education research from which the conceptual framework of this dissertational study of leadership was constructed. The research collectively informs the resulting framework which identified the leadership thinking and practices that were influenced by Black girls' historical experiences in the STEM pipeline. The research also identified the ways that leadership influences Black girls' STEM educational experiences.

The objectives of this literature review are to: (a) detail educational leadership research that explains principals' influence on student learning; (b) describe intersectionality theory's utility in educational context; (c) circumstantiate the use of

intersectionality in educational leadership by synthesizing the literature of both in a conceptual framework; (d) outline empirical studies of Black girlhood in education; (e) substantiate the study of school leadership and Black girlhood in STEM education. This literature review accomplished the outlined goals by synthesizing the research-based scholarship that explored each topic.

The resulting amalgam of literature that this review includes underpinned this study. In particular, the leadership dispositions that were included, and the educational research focused on students' experiences, were chosen to establish a conceptual framework that outlined an optimum educational experience for Black girls. As a result of the embryonic nature of Black girlhood studies in the educational leadership field, it was critical to develop a framework to analyze educational leadership from a different, multiple-lens perspective. Through extensive research on each subject matter, it became evident that this dissertation needed a foundation that preserved the fidelity of leadership studies, while simultaneously allowing for the diversity of thought that studying different populations requires. Therefore, the Ontario Leadership Framework (OLF) and intersectionality were selected as the appropriate structure and theory, respectively, to undergird this dissertation. The model is represented in Figure 2.

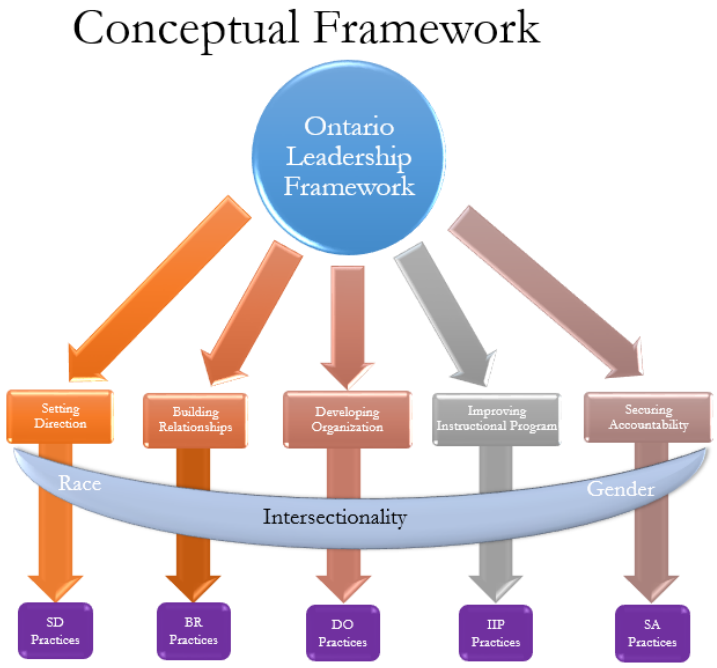

Figure 2. Conceptual model for school-level leadership practices operationalized through the racialized-gendered lens of intersectionality. Adapted from *Ontario Leadership Framework 2012 with a Discussion of the Research Foundations*, by K. Leithwood (2012).

The Ontario Leadership Framework (OLF)

Based in the large body of research focused primarily on school-level leadership, the Ontario Leadership Framework (OLF) (Leithwood, 2012) presents both individual and small groups of leaders' practices, as well as organizational endeavors, that have been evidenced as effective in improving student outcomes in many contexts (Leithwood, Strauss, & Anderson, 2007; Ogawa and Bossert, 1995). The 2012 OLF is an updated version of earlier iterations. The revised OLF purposefully highlights the role of practices in leadership, as a noted distinction from what was previously included as leadership competencies. Leithwood and other researchers (e.g., Bolden & Gosling, 2006) highlighted the shortcomings of competencies such as: (a) the supposition that a

general set of abilities is appropriate in all contexts; (b) the prominence placed on calculable actions to the exclusion of more understated temperaments and interpersonal characteristics valued by constituents at every level of the organization; and (c) the dearth of empirical evidence connecting competencies to better outcomes within the structures (e.g., schools) they exist. Leithwood accordingly presented the strengths of practices by outlining the ways that:

Invoking the concept of "practices", in contrast to "competencies", aimed to acknowledge:

- The situated and social context in which leadership is exercised;
- The central nature of relationships in leadership work;
- The importance of leaders responding flexibly to the situations, events and challenges which present themselves in order to accomplish important goals;
- The shared nature of leadership work in virtually all organizations (p. 5).

The shift to emphasize practices in the revised OLF resulted in a reduction of scope to only focus on literature that was corroborated by empirical evidence of school-level leadership that improved student outcomes.

The five domains of OLF, (a) setting directions, (b) building relationships and developing people, (c) developing organizations to support desired practices, (d) improving instructional program, and (e) securing accountability, were expounded upon to include specific practices that highlighted the activities and actions in which leaders engage. The added practices were derived from: (a) a systematic review of literature that

was a part of the original OLF research base; (b) eleven similar research reviews; and (c) five years of published research in nine educational leadership journals (Leithwood, 2012). Leithwood noted that while the identified practices from the 38 studies that were included in the framework did not cohesively adhere to any one leadership model, they did instead best align with the "integrated" leadership model that was identified as an emerging best practice during the time. Integrated leadership was an amalgamation of the practices of instructional leadership models and those of transformational leadership models (Marks & Printy, 2003; Printy, Marks, & Bowers, 2010). Leithwood used the research and evidence that appropriately aligned with his intentions by including the tenets that were viewed as necessary for and beneficial to the development of the OLF.

Leithwood (2012) also clearly defined the OLF as contingent in nature. He explained that although the practices have been identified as successful in a range of contexts, "their practical value depends on leaders enacting them in ways that are sensitive to the specific features of the circumstances and settings in which they work and the people with whom they are working" (p. 13). This acknowledgment indicated a conceptual flexibility in the practical application of the OLF domains which was mirrored in the conceptual situating of this dissertation. Corroboratively, research that highlights the ways that one specific leadership model, namely social justice leadership, aligns with the five OLF domains, underpin this study. Further, the extent to which two secondary leadership models, distributed leadership, and instructional leadership, are embedded in social justice leadership and the OLF, is also highlighted.

Conceptual Framework Development Approach

A full depiction of the OLF school-level leadership and corresponding practices is featured in chart form (See Table 1) and offers a comprehensive view of the framework. For the purposes of developing a framework that specifically addresses the intersectional realities of Black girls, this study focuses on the OLF's multiple subdomains, termed strands in this dissertation, and the leadership practices that are included in each that are believed to be of most service to and influence on their needs. Furthermore, within each of the OLF's five major domains detailed in this study, the educational leadership models that aligned with each and concurrently Black girls' needs, were employed as guidance for identifying systematic and meaningful ways to approach the focus of this study, that is, principal practices that empower Black girls. This resulting constellated approach provided an accessible model that was both steeped in empirically-based literature and inclusive of illustrative practices that serve the educational needs of Black girls.

Setting Directions

A portion of educational leadership research focuses on the role of administrators in improving measured student outcomes. Several studies within this domain have concluded that principals influence schools' effectiveness by setting directions (Hallinger, Bickman, & Davis, 1996; Hallinger & Heck, 1998). Hallinger et al. (1996) developed and tested a multilayered leadership effectiveness framework by examining the results from questionnaires administered to teachers and principals, as well as students' reading assessments. Based on the results from a sample of 87 elementary schools, Hallinger et al. explored the connection between variables of the school context, the instructional leadership of the principal, the instructional climate, and the student

population's reading achievement. Operating from the premise "that a comprehensive framework for viewing the principal's role in school effectiveness must locate principal leadership within both organizational and environmental contexts" (p. 530), Hallinger et al. employed an antecedent-effects model (Pitner, 1988) that examined the direct and indirect effects of principal leadership (p. 530). The antecedent variables that the study included were school and community context, and the background, experiences, and personal characteristics of the principal, and the beliefs and dispositions of staffs and students towards teaching and learning.

Using structural modeling to examine the fit of principal effectiveness models, Hallinger, Bickman, and Davis (1996) determined that there was a positive statistically significant relationship ($r = 0.354$, $p < .01$) between principal leadership and the school climate variables they measured. Particularly, the model specified a notable relationship between the articulation and presence of a distinct school mission and the degree of the principal's instructional leadership. The causal linkages revealed that a clear and distinct mission, subsequently, affected students' opportunities to learn as well as teachers' outlooks on student academic performance. Hallinger et al.'s results were consistent with the findings of related research focused on principals' leadership in framing and promoting clear goals (Goldring & Pasternak, 1994; Heck, 1993). Leithwood's (2012) subsequent inclusion of the principal's ability to set forth organizational directions in the OLF as a result of his extensive review of empirical literature, reflects a critical function of the role of school leaders.

Leithwood (2012) outlined a subset of four practices within the setting directions domain that further defined the role and importance of its function in leadership. The

three practices that are of interest from the four outlined within this particular domain, include the utility of (a) building a shared vision; (b) identifying specific, shared, short-term goals and; (c) creating high-performance expectations. Each strand (subdomain) contains practices, based on empirical research, that are uniquely vital to a principal's ability to succeed in establishing the direction of the school.

Role of social justice leadership. Of particular note, Leithwood (2012) highlighted how direction setting can be difficult in certain circumstances. He states, for example, "Forging directions for the school which also reflect local community aspirations is typically more challenging, particularly for schools serving highly diverse communities, given the province's [district's] commitment to inclusive education. There are clear indications that the socio-historical dynamics of a school and school's external community can play a fundamental role in its diversity (Moody, 2001). One model of school leadership that directly considers these types of contextual factors is social justice leadership. Multiple definitions of social justice leadership, which include descriptions of it as an emancipatory (Boyles, Carusi, & Attick, 2009), distributive, cultural, and associational (Gewirtz & Cribb, 2002) begin to address diversity that is characterized by historical inequities that shape the culture of a school setting.

Furman (2012), developed a social justice conceptual framework based on a review of 14 case studies examining social justice leadership. Furman used her findings to describe in detail the ways that social justice leadership is "action oriented and transformative, committed and persistent, inclusive and democratic, relational and caring, reflective, and oriented toward a socially just pedagogy" (p. 195) and addresses injustices based on identifiers such as race, gender, class that have occurred. The characteristics

that she outlined mirror the practices that are explained in the OLF's setting directions subdomain of practices.

Within the *building a shared vision* strand, the OLF details how principals should "encourage the development of organizational norms that support openness to change in the direction of that purpose or vision" (p. 15). This aligns with Furman's (2012) explanation that social justice leadership should be action oriented and transformative. In the *identifying specific, shared, short-term goals* strand, the OLF includes the need for principals to "regularly encourage staff to evaluate their progress toward achieving school goals [and] encourage staff to develop and periodically review individual professional growth goals, as well as the relationship between their individual professional goals and the school's goals" (p. 15). This aligns with Furman's assertion that social justice leaders are reflective and build a culture of the same nature in their schools. In the *creating high performance expectations* strand, the OLF outlines that leaders "devote additional effort to creating high expectations among staff for the achievement of students who have traditionally struggled to be successful at school" (p.16), which calls for principals to be what Furman describes as committed and persistent. Likewise, this strand explains that leaders should "encourage staff to assume responsibility for achieving the school's vision and goals with all students" (p. 16). Leading in this way, which Furman refers to as "inclusive and democratic," demonstrates principals' abilities to empower staff to contribute to creating a socially just school.

It is critical to highlight a connection noted between the last two OLF strands and the corresponding social justice leadership dimensions. Leithwood (2012) describes a population of students as "students who have traditionally struggled to be successful at

school" (p. 16). Given the sociohistorical background of historically underserved students, including Black girls, it is essential to acknowledge the multiple facets of oppression that have affected their learning and their lives. In an effort not to perpetuate false depictions of Black girls, and a group of historically underserved students, one must be careful not to subsume rhetoric that has been used in research to problematize Black girls' positionality, without unpacking the societal inequities that impacted them. Subsequently, this truth makes it even more pressing to include and champion the voices of Black girls, and others who advocate for them, in the creation of a schools' set directions. Therefore, Furman's (2012) assertion that social justice leadership should be "inclusive and democratic," in turn, rings even truer and becomes more important for students whose abilities and successes have been traditionally, and oft-times grossly misrepresented. This reality is also one of the many reasons that support the necessity of principals in building relationships and developing people, Leithwood's second domain in the OLF.

Building Relationships and Developing People

Many scholars assert that principals influence student learning through their interactions with teachers and by determining the organizational structures of the school (Hallinger & Heck, 1998; Heck, 1993; Witziers, Bosker, & Kruger, 2003). The nature of this indirect relationship (Hallinger & Heck, 1998) suggests the importance of principals developing and maintaining healthy working relationships with the professionals with whom they share school environments and organizational cultures. The positive engagement between principals and teachers can reinforce teacher self-efficacy (Hipp, 1996), influence collective efficacy (Kurt, Duya, & Calik, 2011), establish the working

and learning community, which is indicative of teachers' professional satisfaction (Anderman, 1991), and develop the trust needed for teachers to engage in the ways principals' lead (Tschannen-Moran & Hoy, 1998; Wahlstrom & Seashore Louis, 2008). When principals build positive interpersonal relationships with the teachers and educational personnel with whom they work, their leadership is more likely to be trusted (Tschannen-Moran & Hoy, 1998).

Consequently, as principals seek to guide teachers in new organizational directions, they are more likely to get buy-in when they have built relationships with their colleagues. Similarly, when principals demonstrate encouragement of or investment in teachers' instructional abilities and leadership capacities, by involving teachers in development, teachers are more likely to be affected in their approaches to lesson design and delivery (Bredeson & Johansson, 2000). With this level of autonomy-centered influence in mind, it is clear that a leadership model that includes the voice and perspectives of people in a school community, namely distributed leadership (Spillane, Halverson, & Diamond, 2004), can be employed by principals.

The role or distributed leadership in social justice leadership. Social justice leadership accomplishes principals' goals for working with faculty, students, and families in a diverse array of ways. Educational administration researchers have studied the unique facets of different leadership modes to determine how they accomplish the goals of creating a socially just school. For example, to proffer an exploratory conceptual framework, distributed leadership for social justice, Brooks, Jean-Marie, Normore, and Hodgins (2007) investigated the ways that leadership practices that promote socially just educational settings are "stretched across" (p. 387) organizations. The researchers

conducted a phenomenological study of an urban public high school in the Southeastern region of the U. S. and used their empirical findings to corroborate their articulation of a leadership framework that combined the assets of two theories: distributed leadership and social justice leadership. They acknowledged some previously-stated criticisms of distributed leadership, including its lack of attention to contextual sociopolitical climates (Maxcy & Nguyen, 2006). Conversely, Brooks, Jean-Marie, Normore, and Hodgins (2007) argued that the perceived deficit in distributed leadership was, in fact, an opportunity for researchers to combine it with another practice-based approach. This flexibility allowed for an articulation of an enhanced framework, much like the nature of the conceptual scaffolding of the current study.

In their study, Brooks, Jean-Marie, Normore, and Hodgins (2007) conceptualized their integrative leadership approach by empirically investigating the acts of school leaders and followers. The researchers explored the ways that social justice leadership was exercised across the many facets (i.e., leaders, followers, situations, time) of an urban high school. They expounded upon the manner in which the two leadership models complement each other by acknowledging the diverse forms of social justice leadership that were evident in different components of the school. The researchers created a scaffold that outlined how social justice leadership practices, when distributed amongst leaders, followers, and situations over time (Spillane, 2006) could impact a specific context in a transformational manner.

Brooks, Jean-Marie, Normore, and Hodgins (2007) utilized the flexibility inherent in distributed leadership to explain how social justice leaders serve as *bridge people*, who demonstrate their knowledge of and dedication to establishing and maintaining bridges

between themselves and the community members in their schools with the intention of advancing the lives of everyone with whom they work. (Merchant & Shoho, 2006). From their activist perspectives, leaders are able to share the responsibility of creating socially just schools with other school-level leaders and followers.

Distributed leadership in building relationships and developing people. Attributed to leadership disciplines that have emerged in the field which focus on the range of influences in schools, researchers have extensively investigated how people contribute to and within the direction of educational communities. Distributed leadership was conceptualized as an effort to understand and name the school administration dynamics that involve the multiple leaders who work to guide schools such as teacher-leaders (Smylie & Denny, 1990; Spillane, Halverson, & Diamond, 2004). Like Liethwood's (2012) OLF, Spillane et al. emphasized the significance of leadership *practices,* and established what they then referred to as the "conceptual framework [for] a *distributed* perspective on leadership" as a foundation from which explorations of the internal sources of leadership could be conducted (p. 4). The framework that Spillane et al. developed was based on distributed cognition and activity theory. By conceptually grounding their framework in theory that recognized "how social context is an integral component of, not just backdrop or contain for, intelligent activity," (p. 8) Spillane et al. sought to fashion a framework that would guide examinations of how leaders carried out their actions in schools in ways that acknowledged the influence of the context in which it existed. The researchers' focus on the way leaders think and act *in situ* demonstrated their commitment to capturing interactions as they happened in their natural environment.

Spillane, Halverson, and Diamond's (2004) recognition of the significance of context was clear in their foundational work. The authors explained,

> a distributed perspective on human activity presses us to move beyond individual activity to consider how the material, cultural, and social situation enables, informs, and constrains human activity. In this view, activity is a product of what the actor knows, believes, and does in and through particular social, cultural, and material contexts. (p. 10)

The intentionality of including the context of leadership was carried out from the foundation of their concept to the final development of the distributed leadership practice framework. The four central ideas of the Spillane, Halverson, and Diamond's (2004) distributed leadership frame – leadership tasks and functions, task-enactment, social distribution of task-enactment, and situational distribution of task-enactment – have been used to explain the expectations and actions of principals.

In the building relationships and developing people domain, Leithwood (2012) outlined a subset of four practices that illuminate the usefulness of this component of leadership. The following three were deemed the most pertinent to the education of Black girls: (a) stimulating growth in the professional capacities of staff; (b) modeling the school's values and practices; and (c) building trusting relationships with and among staff, students, and parents.

The *stimulating growth in the professional capacities of staff* strand explains that principals should "encourage staff to pursue their own goals for professional learning [and] encourage staff to try new practices consistent with their own interests" (p. 18). These practices align with Spillane, Halverson, and Diamond's (2004) synthesis of leadership functions and tasks, which include "supporting teacher growth and development, both individually and collectively" (p. 13). The *modeling the school's*

values and practice strand includes the call for principals to "exemplify, through their own actions, the school's core values and many of its desired practices" (p. 19). This practice is similar to Spillane et al.'s notion of task-enactment, as it hearkens the call for principals to go beyond identification of goals to a level on which they actually carry out tasks that will move their schools forward. The *building trusting relationships with and among staff, students, and parents* strand details several ways that principals should include the larger school community in the procedures of leadership. In particular, it states that principals should "demonstrate respect for staff, students, and parents by listening to their ideas, being open to those ideas and genuinely considering their value" as well as "encourage staff, students and parents to listen to one another's ideas and genuinely consider their value" (p. 20). The OLF's acknowledgment of the importance of including school constituents in leadership planning and practices directly aligns with Spillane et al.'s concept of social distribution of task-enactment. The researchers explain that this second type of enactment, is not a dissection or replication of work tasks amongst different people or levels of leadership, but it is instead multiplicative in nature as it "consider[s] the enactment of leadership tasks as potentially *stretched over*" or "'in-between' (Salomon & Perkins, 1998) the practice of two or more leaders" (p. 16). This feature of distributed leadership also considers the perspectives of those who would traditionally be considered followers (i.e., staff, students, parents) as active leaders. All of the constituents can work collectively to accomplish the goals of the school and bring about change.

Developing the Organization to Support Desired Practices

The OLF's third domain highlights the importance of infrastructure. Including the perspectives of a range of community members can help strengthen the infrastructure of a school (Leithwood, 2012). Intermittently checking the status of the school's structure, including the state of teacher's collective efficacy, the extent which goals can be achieved with the current tasks and functions in place, the well-being and respect of the school constituents, and the policies that are established and upheld to maintain order in schools, can help sustain best practices. These responsibilities can and should include the input of multiple members of the school community as school leadership expands past the people in formal administrative positions (Heller & Firestone 1995; Ogawa & Bossert 1995). It can also help ensure that any changes that occur in any essential components of schools are addressed in a reasonable amount of time. As the maintenance of a school's infrastructure is an expansive undertaking, having the input and assistance of a school's larger community of participants (e.g., staff, students, parents) in areas that are relevant to their domain of influence, can help accomplish the work. Spillane et al. (2004) assert that their "distributed perspective focuses on how leadership practice is distributed among positional and informal leaders as well as their followers" (p. 16). For this reason, distributed leadership would be an appropriate model for principals to employ as they fine tune their school's infrastructure.

Distributed leadership in developing the organization to support desired practices. The developing the organization to support desired practices domain (Leithwood, 2012) contains six practices that outline steps that principals can take to improve their leadership and make it more inclusive of school and community members.

Of the six, there exist four practices that could improve school cultures for Black girls. Those four practices identified are: (a) building collaborative cultures and distributing leadership; (b) building productive relationships with families and communities; (c) connecting the school to its wider environment and; (d) allocating resources in support of the school's vision and goals.

The *building collaborative cultures and distributing leadership* strand calls on principals to "nurture mutual respect and trust among those involved in collaborating" (Leithwood, 2012, p. 22). The capacity to build respect among many parties with a range of priorities in an effort to accomplish tasks across the many responsibilities represented within is an example of Spillane et al.'s social distribution of task-enactment.

The *building productive relationships with families and communities* strand encourages principals to expand the reach of the leadership by engaging students' families and their school's external community. In the OLF description of this subdomain, Leithwood (2012) explains that

> This practice is an especially important part of what leaders do who are attempting to create more inclusive schools because, enacted skillfully, it brings school staffs into closer contact with many of those parents whose students have traditionally been underserved by their schools; it opens up 'spaces" in which the values, understandings, expectations, and challenges faced by these parents can become better known and appreciated by staff. (p.22)

In acknowledging the differences in experiences, opportunities, and societal challenges that students' families have had, the OLF aligns with Spillane et al.'s (2004) situational distribution of task-enactment. This facet of the distributed leadership model matches Leithwood's practices because Spillane et al. acknowledge that situation is not external to leadership activity but is instead one of its essential foundational elements. The OLF

suggests that principals should "assist staff to better use the social and intellectual capital of students from diverse family backgrounds for instructional purposes in their classrooms" (p. 23). By acknowledging the potential impact of the socio-historical context of a school, Leithwood makes room for meaningful interpretations of the plausible influence of students' backgrounds, namely Black girls in the STEM pipeline, on principals' thoughts and actions.

The *connecting the school to its wider environment* strand also mirrors the intentions of the social distribution of task-enactment element of distributed leadership because it considers the broader external school community as a resource. The OLF suggests that principals should "develop and maintain connections with other expert school and district leaders, policy experts, outreach groups, and organizations and members of the educational research community" (p. 24). Recognizing the value in the outside community can help principals increase the capacity of their school program and leadership.

The *allocating resources in support of the school's vision and goals* strand is focused on the equitable apportionment of funds, privileges, and assets. The practices it includes, namely "distribut[ing] resources of all types in ways that are closely aligned with the school's improvement priorities," (Leithwood, 2012, p. 25) demonstrate the need to utilize situational distribution of task-enactment. Financial and asset management demonstrate the necessity for principals to adjust to the needs of the constituents and the context as they think about and execute their plans for success on behalf of all of their students.

Improving the Instructional Program

The instructional program of a school directly affects students and teachers as the receivers and disseminators of knowledge, respectively. In a school setting, the methods by which students are taught are influenced by the instructional climate, which consists of teachers' commitment to developing accessible lessons, the students' willingness to participate in the learning process, the leaders' instructional example and direction, and the investment of the broader school community (Leithwood, 2012).

Marks and Printy (2003) explained that instructional leadership "replaces a hierarchical and procedural notion with a model of *shared* instructional leadership" (p. 371). In their study of 24 public schools that were all then recently restructured, the researchers employed hierarchical linear modeling (HLM) to measure the school's performance. Marks and Printy found that shared instructional leadership, when paired with transformational leadership, resulted in substantial student achievement and quality academic experiences. The researchers noted that schools with integrated leadership have a pedagogical quality that is 0.6 SD ($p \leq .05$) higher than the other schools, and that the measured authentic achievement was higher by nearly 0.6 SD ($p \leq .01$). In both cases, Marks and Printy asserted that the differences were likely influenced by the stronger administrator and teacher prioritization of curriculum, instruction, and assessment. This integrated approach to leadership proved to be beneficial for the students and staff who implemented it in the eight elementary, eight middle, and eight high schools across the United States. The commitment to partnership that transformational leadership helped foster is a critical component to engage teachers in the planning and execution of the instructional innovation (Conley & Goldman, 1994).

Blase and Blase (2000) described effective instructional leadership as an amalgamation of 11 strategies and two distinct themes. Analyzing the open-ended questionnaire responses of 800 teachers across the United States, the researchers determined two important features of instructional leadership: a principal's capacity to promote reflection by conversing with teachers about their performance, as well as their commitment to actively promote professional growth in the school community.

The role of instructional leadership in social justice leadership. As school leaders establish and maintain the instructional goals of their schools, they are involved in decision making regarding what students have access to. Shields (2004) offers an articulation of social justice leadership that calls on leaders to overcome pathologies of silence in ways that provide teachers and students with access to empowering educational resources. Shields expounds on previous educational administration scholarship to promote leaders who create spaces for moral dialogue amongst teachers, students, and families that supports the creation of empowering academic environments. By speaking up and actively engaging in what and how students are learning, principals are able to positively influence the instructional capacity in ways that can make their education socially just. Shields offers:

> If educational leaders want to transform the educational experiences and achievement of all students in their schools, we will need to help teachers overcome these pathologizing silences and understand that learning is situated in relationships in which students need to be free to bring their own realities into the conversation to "make sense of things." (p. 117)

Shields contends that instruction should be more inclusive so that students have a greater understanding and build more genuine relationships, all in an "effort to enhance social justice for all students" (p. 117). The ways that principals work to acknowledge

the backgrounds and experiences of students help in establishing learning communities where all students feel like they are valued and can learn.

Instructional leadership in improving instructional program. In the improving instructional program domain of the OLF, Leithwood (2012) outlined four suggested practices for principals to consider. Of the four, two are most relevant to the work of school leaders who are committed to empowering Black girls: (a) providing instructional support and; (b) monitoring student learning and school improvement progress.

In the *providing instructional support* strand, the two most pertinent practices are "observing in classrooms and providing constructive feedback that is useful to teachers" and "participating with staff in their instructional improvement work" (Leithwood, 2012, p. 28). The formerly identified practice aligns with Blase and Blase's (2000) assertion regarding reflection in effective instructional leadership and the latter mirrors Blase and Blase's discussion of promoting professional growth. Specifically, when principals personally engage in teacher's professional development with their staff, it demonstrates an increased level of commitment and immersion in mutual learning.

Within in the *monitoring student learning and school improvement progress* strand, the OLF posits that principals should "use multiple sources of evidence when diagnosing student progress" Leithwood, 2012, (p. 29) and provide conditions for teachers to use data effectively, such as time, professional development support, partnership with field experts, and a culture in which the use of data is valued. The first practice is again reflective in nature, and the second promotes professional growth of school staff. As principals lead in the development and maintenance of instructional

culture in a way that values and empowers each member of the professional community, they can affect positive student outcomes. Increased levels of involvement from staff members prompt the need for accountability among the professionals involved.

Securing Accountability

What some refer to as the accountability movement in education has slowly changed the instructional climate of schools. Through educational policy requirements, educators at every level have been required to answer for the achievement, most specifically the test performance, of their students in heightened manners. Likewise, public school systems have shifted their approaches to establishing and using standards of student learning (Harris, Ingle, & Rutledge, 2014).

Instructional leadership in securing accountability. The OLF consists of two practice strands: (a) building staff members' sense of internal accountability and; (b) meeting the demands for external accountability. Both strands contain practices that align with the tenets of instructional leadership. The *building staff members' sense of internal accountability* strand suggests that principals "assess one's own contributions to school achievements and take account of feedback from others" (Leithwood, 2012, p. 30). This practice of self-reflection on the part of the principal is essential to both model for teachers, and to refine leadership thinking and practices. The *meeting the demands for external accountability* strand prompts principals to "align school targets with board and [district] targets" and "provide an accurate and transparent account of the school's performance to all school stakeholders (e.g., [Department of Education], [School] board, parents, community)" (p. 31). Both practices represent public-facing actions of reflection by the principal and members of the school.

Application to Study

The many OLF domains, subdomains, and practices reviewed in the literature review, the supporting social justice leadership model, and the secondarily embedded distributed leadership and instructional leadership, clearly demonstrate the usefulness of each in the concerted aim to create school contexts where all students are academically successful (See Table 3 for comprehensive chart detailing OLF domains, the overlapping leadership theories, and the practices identified using an intersectional lens). The purpose of this study was to determine whether these practices created learning environments where Black girls were empowered. A detailed look at the lens that clearly names their reality, intersectionality, provided a deeper understanding of the need for a specific approach to leading with Black girls in mind.

Intersectionality Theory

As the OLF (Leithwood, 2012) and the three highlighted leadership models articulate, it is essential for principals to consider the context, socio-historical dynamics, and external communities of schools when leading their direction, organizational culture, instructional ethos, and accountability structuring. Consideration of these facets offers insight and informed perspective that can help principals effectively work on behalf of students from different backgrounds. Leading with a lens that adjusts to the personal, cultural, and educational experiences of students requires an awareness of and sensitivity to the range of privilege, oppression, empowerment, and opportunity that shapes students' experiences. In the lives of Black girls, who make up 8% of the school population (U. S. Department of Education Office for Civil Rights, 2016), one such influential lens is intersectionality.

Conceptual Foundations of Theory

"Intersectionality," Crenshaw (1991) penned in her seminal articulation of the concept, "is not being offered here as some new, totalizing theory of identity" (p. 1244). In her early explanation of the theory, Crenshaw acknowledged the many facets that contributed to the challenges that Black females faced. Yet, with laser-like focus, she meticulously detailed the ways that racism, sexism, and particularly, the multi-layered oppressive effect of the two, shaped the unique lived experiences of Black females. Grounded in legal studies, Crenshaw's (1989) initial development of intersectional studies was necessitated to highlight how Black females were excluded from both feminist theory and antiracist politics. In her subsequent work, Crenshaw (1991) outlined a framework that explained the social underpinnings and consequences of structural, political, and representational intersectionality. Structural intersectionality pronounces that the societal position of Black females equates to qualitative differences in the ways they experience challenges. Political intersectionality analyzes how feminist and antiracist politics have caused inconsistencies in the treatment of issues Black females endure. Representational intersectionality problematizes the creation of images of Black females in the hegemonic context of popular culture. Intersectionality studies have explored the ways that different, and sometimes conflicting systems of subjugation, have influenced Black females' lives.

Further defining intersectionality. Intersectionality theory has been expounded upon by researchers in a range of disciplines. While some have criticized the theory's foundational principles as overly complex (McCall, 2005), others have further explained

the layers that constitute its intertwined nature. Smooth (2010) asserted four principles of intersectionality:

1. identities (e.g., race, gender, ethnicity, class) are relationally and mutually constitutive;

2. the interconnected nature of social identities offers flexibility in the ways they are experienced;

3. status categories and power systems have and continue to change over time resulting in shifts in marginalized experiences; and

4. acknowledgment of the coexistence of privilege and oppression illumines the reality that a person can benefit from privilege(s) while simultaneously enduring oppression.

Institutional reality of intersectionality. Bedolla (2007) highlighted the institutional facets associated with intersectionality by describing how it affects individuals at the micro and macro levels. At the macro-level, Bedolla acknowledged, intersectionality scholars situate individuals' lived experiences in the milieu of history and social structures of power and oppression. As this principle relates to Black girls' lives, the historicity of their marginalization based on the intersecting components of identities, has located them amidst societal practices and structures that manifest disadvantaged hierarchies (Bilge, 2010). Subsequently, amidst the continuous devaluation of Black females in professional, community-based, and educational contexts, intersectionality has been employed to name and investigate the scope of idiosyncratic challenges that they face in society. In educational research, it is articulated

as a framework used to identify the ways that students who live in the intersections of multiple identities live.

Intersectionality in Educational Studies of Black Girls

Intersectionality is accredited as a lens and theory to view and examine, respectively, the lived experiences of Black girls as well as girls of different racial, ethnic, and socio-economic backgrounds. Bruning, Bystydzienski, and Eisenhart (2015) employed intersectionality as a framework to understand diverse girls' commitment to pursuing STEM education, majors, and potential careers during their years in high school. The researchers explored the cases of three high school girls, one Black, one Latina, and one White, and outlined their engagement in and feelings towards a STEM enrichment program. A co-aligned study by the same authors, which is reviewed in detail later in this literature review, elaborated on the programs' perceived subsequent influence on the participants' decisions to pursue STEM majors in college. Of particular note in this article was the extent to which the researchers thoroughly recognized and explored the importance of the intersectional influences on the girls' experiences in and after the program. The researchers relied heavily on an intersectional lens because they asserted that it provided "the means to examine an intertwined group of social markers such as gender, social class, race, and ethnicity to begin to explain young women's commitment or lack thereof to non-traditional and unfamiliar field like engineering" (p. 17). To demonstrate how the girls' decisions could not simply be examined on the basis of race, gender, or class solely, Bruning et al. detailed how intersecting influences such as family socio-economic standing, perceived positioning based on race, and ethnic distinctiveness established circumstances in which the two girls of color's commitment to a STEM major

was not sensible nor sustainable. Even with well-resourced schools and encouraging families, the girls did not envision STEM as a feasible education and career path for themselves.

Bruning, Bystydzienski, and Eisenhart (2015) also thoughtfully explained how support should not be approached from a monolithic perspective, but should instead be differentiated to reflect the needs of each girl in her context categorized by her unique intersectionality. Specifically, regarding the Black girl highlighted in their case study, the researchers emphasized and elucidated the reasons for and effects of her propensity to express her individuality. They stated that she had a heightened sense of awareness about her racial positioning, which drove her to want to "excel in school as a means of resisting negative stereotypes" (p. 16). Bruning et al. also noted that she, like other Black girls who were one of few Black students in advanced academics (Fordham & Ogbu, 1986; Tyson Darity, & Castellino, 2005), may have sought to avoid being assumed as any one stereotype, and that "in this complex identity context, [she] wanted to be seen as smart and capable and as a person who could make decisions for herself, form her own opinions, and go her own way" (p.16). Her expressions of independence, and her desire to be in an academic and social space that was more representative of her background manifested itself in the girl's college choice. She did not seek the assistance of educators in her school to help her navigate her college major selection process as she pursued a college experience and location that would provide her access to more people who racially identified the same way that she did.

Application to Study of Principals' Influence on Black Girls Education

Both observations about Black girls' dispositions and preferences (Bedolla, 2005; Bruning, Bystydzienski, & Eisenhart, 2015) suggest ways that educators could help facilitate empowerment for students who identify in this way. Black girls may thrive better in environments in which they have access to educators who initiate and are persistent in their efforts to support Black girls, offer opportunities for Black girls to participate in shaping their own educational experiences and provide academic and community resources that include positive influences from people with whom their students identify. This study researched the ways that principals engaged in thinking and practice that supported Black girls' intersectional lives. This investigation was situated in a body of research that specifically focuses on the influence of societal and educational structures on Black girls.

Black Girlhood Studies

The matrices of domination of age, race, and gender (Collins, 1990) that Black girls experience have been investigated from social and educational perspectives for decades (Damico & Scott, 1985; Fordham, 1993; Lightfoot, 1976; Morris, 2007; Oldham, 1935). The noted gap in research on and with the demographic (Grant, 1984; Lawrence-Lightfoot & Carew, 1976; Henry, 1998; Wun, 2016), has been attended to by researchers whose work has established the Black girlhood studies field over time. Black girlhood studies center the constellation of racialized, gendered, and psychological developmental effects resulting from Black girls' societal positionality (Owens, Callier, Robinson, & Garner, 2017). Reflective of society as a whole, educational settings are microcosmical subunits that mirror similar status-based challenges that Black girls face (Berger,

Rosenholtz, & Zelditch, 1980). Their schooling experiences are marked with educational and social inequities which impact their academic access and social development. In the next sections, the educational experiences of Black girls in schools and their participation in STEM programs, more specifically, are examined as a backdrop for this study.

Educational Experiences of Black Girls

Black girls have been historically marginalized in schools as a collective result of racial discrimination (Crain & Mahard, 1978) and gender bias (Fordham, 1993) at every level of schooling. Scholarship detailing the condition of Black girls during critical points in history, including segregation, desegregation (Grant, 1984), and more recent policy climates that have affected schools (Morris, 2016) have demonstrated the ways that Black girls have fared in educational contexts. As noted by the aforementioned researchers and their colleagues in the field, throughout the recent history of significant changes in education, Black girls have cumulatively faced hardships, including academic and social ostracizing, that have impacted their access to post-secondary opportunities and career choices (Smith, 1982).

Current academic status in U.S. schools. As Black girlhood studies have developed, research in the field has become more focused in nature. Studies that focus on Black girls' educational experiences in distinct disciplines provide insight on the ways they learn in specific academic spaces. Gholson and Martin (2014) conducted a qualitative study of Black girls' performance in mathematics. The researchers pinpointed the significance of social networks in the academic lives of the eight- and nine-year-old participants by analyzing student interviews, and classroom observations and interactions. Specifically, Gholson and Martin determined that social networks greatly

influenced the Black girls' mathematical and racial identities. The girls openly expressed their desires to be included, respected, and relevant in their mathematical community of practice. For example, Gholson and Martin recounted the observations and interviews with Black girls in the class that they observed, to unpack the reasoning behind and impact of their choices. These instances included times during which the Black girls were actively and happily involved with group activities on the rare occasions they were invited to be a part. Likewise, the researchers also acknowledged the decisions that the Black girls made. On several occasions, a Black girl chose to stay at her desk when the teachers instructed the class to move to a space where they could sit as a group. When asked about her choice, the Black girl explained that she was often bothered when she joined the class in that space and that she chose to stay away from the group because it made her more comfortable. Gholson and Martin interpreted the girl's choice as her individualistic assertion to be respected. The researchers did not problematize the Black girl's action but instead viewed it as one of her many "campaigns for relevance, respect, and inclusion" (p. 30). The nuanced interpretation of the Black girl's activities in a classroom setting demonstrated the researchers' ability to use intersectional and emic views to properly situate her behavior in a way that was not negative but instead reflected her individualistic position in her context. It is important that Black girls are not exclusively stereotyped and vilified, but that they are alternatively highlighted in ways that do not always and automatically assume a deficit perspective.

Amid the problematized rhetoric about Black girls, some researchers endeavor to shift the discourse by highlighting the many ways that Black girls are excelling. Muhammad and Dixson (2008) disseminated a much-needed statistical snapshot of Black

girls' educational success by analyzing data from the Educational Longitudinal Survey of 2002. The sample population consisted of 21,757 tenth-graders, of which 2,074 were Black students, and 946 were Black girls (National Center for Education Statistics, 2002). Muhammad and Dixons used independent t-tests, and chi-square analysis where appropriate, to compare results from the Black girls to the remaining respondents. The researchers analyzed the students' assessment of their school environment; academic recognition, opportunities, and achievement and; future orientation and college plans. Their findings corroborated claims that Black girls are academically competitive and highlighted that having support in their academic experiences can empower them to excel in school (Morris, 2007; Ricks, 2014). Muhammad and Dixson's results indicated that Black girls were "just as likely as [their] peers to receive academic honors and recognition for good attendance and service to their community" (2008, p. 176). This positive reflection of Black girls' experience is a noticeable juxtaposition to reports of the negative interactions they face in schools. The oft-cited realities of their discipline referrals (U. S. Department of Education, Office for Civil Rights, 2014) demonstrate a continued need to determine ways that educators and leaders can make school environments more welcoming and nurturing for Black girls.

Current social status in U.S. schools. Recent data from the U. S. Department of Education's Office for Civil Rights (OCR) that describes the current educational experiences for Black girls is unequivocally alarming. Of the 50 million students enrolled in public school in 2013-14, the Civil Rights Data Collection (CRDC) reports, 6% received one or more out-of-school suspensions (U. S. Department of Education Office for Civil Right, 2014). An estimated 16% of the enrolled students were Black, however,

32% of in-school suspensions, 33% of out-of-school suspensions (single), 42% of out-of-school suspensions (multiple), and 34% of expulsions, were Black students. These figures capture an overrepresentation in disciplinary sanctions in each of the discipline categories. The figures also indicated that Black children were 3.8 times more likely to receive one or more out-of-school suspensions than White students. The same students were 2.3 times more likely to receive law enforcement referrals, which receive even harsher punishments. Unfortunately, the trends started at young ages: 47% of Black preschoolers received one or more out-of-school suspensions, as opposed to 28% of White preschoolers.

For Black girls, the outlook is worse. Though Black girls make up 8% of the student population, they were 14% of the out-of-school suspension population (U. S. Department of Education Office for Civil Rights, 2016). Likewise, they were 9% of the students who received expulsions from school. Like the larger Black student populations, Black girls' detrimental involvement in the discipline pipeline starts early. They were 54% of the preschool girls who receive out-of-school suspensions while making up only 20% of the preschool enrollment.

Implication for leadership. It is clear that Black girls' positionality in school discipline is unfortunate. They have historically been marginalized in detrimental ways that have affected their access to and presence in educational settings. In many cases, this has led to an increased relegation to punitive confinement spaces such as juvenile detention centers and alternative education placements (Morris, 2016). As principals help set, and to a larger degree, enforce the disciplinary procedures at the school level, it is important that they question and work to eradicate these discrepancies. A commitment to

minimizing discipline disparities may help keep Black girls in classrooms where they can learn and flourish academically in classes that empower them, such as STEM disciplines.

Black Girls in STEM Education

Scholarship on Black girls' experiences in the STEM pipeline include research on their early access to the specialized curriculum, as well as the effects of academic and social influences such as access to advanced courses, historic gender-based stigma regarding the STEM field (Halpern, Benbow, Geary, Gur, Hyde, & Gernsbacher, 2007), and stereotypes of girls' academic ability (Frome & Eccles, 1998). These and related factors have influenced Black girls access to education and careers in the STEM field. Their experience in the STEM pipeline is explored in empirical literature and indicates a need to empower them and strengthen their opportunities.

Exposure in the pipeline. Bystydzienski, Eisenhart, and Bruning (2015) studied the effects of STEM educational access for adolescent girls as they progressed through high school and into college. Acknowledging that girls of color engage in STEM professions at an alarmingly low rate (Foor, Walden, & Trytten, 2007), the researchers investigated a STEM education intervention program that was a component of a 7-year longitudinal study. In their report of the 3-year intervention program aimed at increasing the interests of high-performing high school girls (n = 131) in STEM college majors and careers during their 10^{th}, 11^{th}, and 12^{th} grade-year, the researchers qualitatively analyzed the girls' engagement and interest in STEM education initiatives and majors. The program included guided career exploration (e.g., research and field trips), engineering project development, interactions with mentor engineers. Bystydzienski et al. used a priori codes including "manifestations of interest in engineering, constructions of

engineering as gendered, [and] position-taking with regard to engineering" as well as in situ codes such as "fit with girls' lives, future plans, [and] confidence in academic abilities" (p. 90) to analyze the girls' experiences and the influence of the program . The study sample included girls from diverse backgrounds and the researchers aggregated by demographics (i.e., 36% were Latina, 33% were White, 12% were Black, 7% were Asian, 7% were multiracial, and 4% were Native American).

In Bystydzienski, Eisenhart, and Bruning's (2015) evaluation of the program, they determined that exposure to the engineering design process helped raise the girls' awareness of the impact of engineering on their everyday lives. Equally importantly, their participation in the program resulted in a substantial increase in the percentage of girls who were interested in pursuing STEM majors and careers; initially, 18% expressed interest about entering the STEM field as opposed to 51% of the participants after being engaged in the program for three years. In their succeeding investigations of the study's participants, the researchers found that 54% of the girls actually enrolled in STEM majors. It is helpful to note that, of the students who transferred from their STEM majors, the lack of academic support and social ostracizing in their department resulted in their decision to seek an environment that was more supportive. While the empowerment and awareness that the STEM education intervention program offered led to success for many of its participants, the realities of the STEM pipeline climate reflected the potential benefit of girls receiving encouragement from educators. Academic and social motivation can and should come from the community of educators with whom girls interact at every level of education. This empowerment can result in resilience that helps

Black girls overcome the challenges they face as they pursue an education and careers in STEM fields.

Black girls in STEM classes. Campbell (2012) explored Black girls' experiences in STEM K-12 education by looking at the reasons that they are not engaged in advanced courses. In the study, which relied on a nationally representative survey administered to 15,362 high school tenth graders, Campbell examined the ways that teachers influenced Black girls' access to advanced courses. Specifically investigating the Black girls' cognitive and non-cognitive behaviors, such as demonstrated interest in math, the researcher focused on Black girls' feelings towards, and teachers' decisions to recommend, the Black girls for advanced math class. Campbell used a logistic regression to approximate the probability of a Black girl's teacher recommendation for an advanced class.

Campbell (2012) found that 36% of the Black girls surveyed felt that math was a fun subject, while 56% saw math as an important academic subject. Remarkably, 91% of Black girls felt that students could indeed learn how to be good at math, while only 53% felt that they could perfect the methods taught in their classes. Interestingly, Black girl's math test scores were not predictors of teachers' recommendations for participation in advanced classes. A Black girl's demonstrated interest in math, however, was a statistically significant factor in the likelihood that a teacher would recommend a student. Also, Black girls who indicated higher confidence in their math abilities were less likely to be recommended to the class than girls who expressed less or no confidence. Although Campbell could not pinpoint the reason for this discrepancy, she acknowledged that teachers may misunderstand Black girls' intentions. Specifically, she noted,

> misinterpretations of students' behaviors may be influencing this finding. For example, if Black girls routinely overwhelm teachers with questions to ensure their mastery, teachers could understand this to mean that the student does not fully understand the material and not yet ready to progress to more challenging courses. (p. 399)

Connection to current study. It is critical to consider Black girls' thoughts, feelings and expressed actions about their academic efficacy when making decisions that can largely determine their academic trajectory. This notion supported this dissertation's intention of identifying the ways that principals shape Black girls' educational experiences in the STEM pipeline.

Implications for Leadership Studies

Principals lead from perspectives that are shaped by their personal and professional experiences. These facets of life constantly and cyclically influence their leadership beliefs, dispositions, and practices in meaningful ways (Goldring, Huff, May, & Camburn, 2008). Understanding the intersectional realities of Black girls, and accordingly responding to them in educational leadership practices, could enable Black girls to develop in spaces where they are valued. Likewise, developing and sustaining instructional cultures in which Black girls can engage in their own academic experiences in empowering ways, could embolden them beyond the margins in which they been traditionally situated. Grounded in the beneficial addition of intersectionality to educational leadership practices and research, this study investigated whether and the extent to which principals' knowledge of Black girls' positionality influenced their thinking and actions.

Conclusion

The scholarship examined and synthesized in this literature review had three foci: educational leadership, intersectionality, and Black girlhood studies in STEM education. This study constellated all three literature bases to present a conceptual framework that submitted a specialized way of leading in educational contexts. The conceptual framework, visually represented in Figure 3, begins with the OLF in its original form. Then, based on the contextual sensitivity expressed by Leithwood (2012) throughout the OLF, the conceptual framework includes the addition of social justice leadership and Crenshaw's intersectional lenses. In doing so, the conceptual framework situates the practical approaches of social justice leadership and the intersectional realities of Black girls in ways that acknowledge leaders' work, and the positionality of Black girls, to champion their agency. Finally, the conceptual framework highlights the educational leadership practices that are believed to be best suited for the empowerment of Black girls in the STEM educational pipeline.

Conceptual Framework

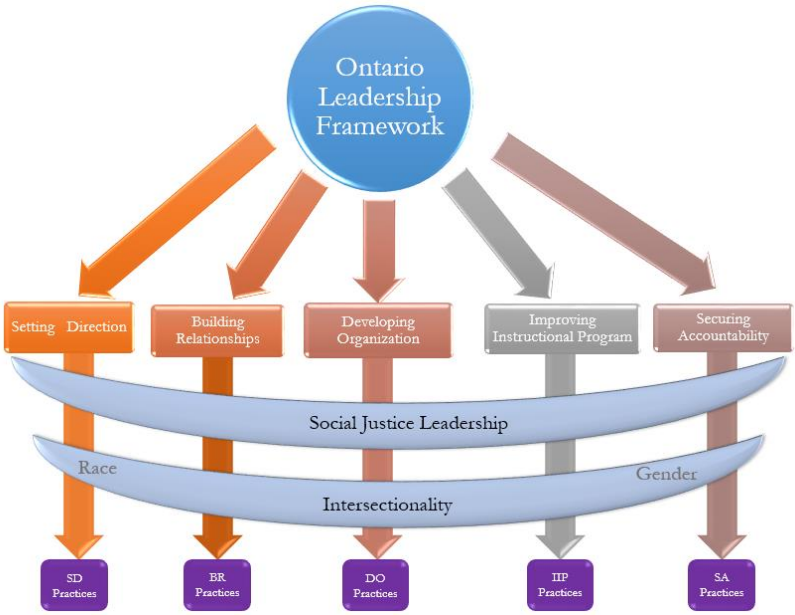

Figure 3. Conceptual model for school-level leadership practices operationalized through social justice and the racialized-gendered lens of intersectionality. Adapted from *Ontario Leadership Framework 2012 with a Discussion of the Research Foundations*, by K. Leithwood (2012).

Given the nascent nature of Black girlhood studies in educational leadership, the researcher acknowledges a need for a foundational, practice-based way to articulate the educational conditions in which the needs of Black girls will be served. Subsequently, the researcher has developed a framework of educational leadership practices that are believed to best serve Black girls. The accompanying table, Table 1, depicts the framework in juxtaposition to the OLF, on which it was based. The researcher employed a methodology, featured in the next chapter, which sought to answer the research questions that informed the confirmation of the framework.

Chapter 3: Methodology

The research in this study was intended to develop a thorough understanding of the relationship between principals' thinking and practices and Black girls' STEM educational experiences. In order to explore these facets of educational leadership and Black girlhood studies, this study used a cross-case analysis (Schwandt, 2001). This research design enabled the researcher to compare the thinking and practices of principals in different school settings in which a STEM education program was being implemented. Identifying and comparing these dimensions of each school's leadership also enabled the researcher to investigate these topics from an interpretive paradigmatic disposition.

Purpose of Study

The purpose of this study was two-fold. The researcher examined principals' practices as they related to the implementation of a STEM education program and elucidated the thinking that supported their actions. Exploring and chronicling these critical elements of principals' work included the ways they engaged with members of their school communities as well as their schools' external communities. Secondly, the researcher explored if, and to what extent, Black girls' lives informed the practices of principals. This study deepens our understanding of the ways that principals consider the socio-historical realities of their students' lives when shaping the instructional and social culture of their school. In an effort to add to the body of literature that focuses on Black girls' schooling experiences, the research sought to answer the following research questions:

1. What is the nature of leadership practices that support Black girls in the context of implementing a federally-funded STEM education grant?
2. How does the intersectional positionality of Black girls in the STEM pipeline influence school leaders' thinking about practices to support the implementation of a federally-funded STEM education grant?

The study of practicing principals' work also included an aim of informing the preparation practices of those who educate aspiring school administrators.

Qualitative Research Strategy

The methodological design of this dissertational study was rooted in both the theoretical foundation of this study as well as the researcher's epistemological disposition. From the theoretical perspective, the research was reliant upon and established in perspectives that framed the quality and nature of educational leadership (Furman, 2012; Leithwood, 2012; Spillane, Halverson, & Diamond, 2004), and intersectional experiences (Crenshaw, 1989; 1991) of Black girls. The nature of both theoretical foci describes an ethos of experience that can best be examined from a qualitative perspective, as they include nuances, meaning, and knowledge that is not adequately represented quantitatively. Furthermore, given the nature of the chosen leadership framework, the OLF (Leithwood, 2012), which allows for the flexibility and consideration of the context of practice, the qualitative methods allowed the researcher to make meaning of the school sites' influence on the principals' work.

Epistemologically, the researcher believes that knowledge is created by deep investigations of the topics of interest and that qualitative methodologies offer such

thorough examination and, subsequently, accurate understanding of the considerations that influence principals' practices. Qualitative methods allow for in-depth research processes and engagement with and about the foci of the study (Travers, 2001). Furthermore, qualitative methodologies are advantageous in the pursuit of subjective explanations of cultures and people's experiential views (Lincoln & Guba, 1985; Marshall, 1987).

Methods for Study

To answer this study's research questions, the researcher utilized a cross-case analysis (Schwandt, 2001) research design. This method consists of collecting and analyzing data from multiple sources and subsequently comparing the data. This enabled the researcher to identify distinct themes within each context before emphasizing the comparative analysis within the larger domain of the STEM education program that was being implemented in multiple school sites. Working in the school site also enabled the researcher to develop understandings based on interactions, reflections, and operations that informed the context of the study (Denzin & Lincoln, 2003). This, in turn, allowed the researcher to make meaning of the work of principals and their effect on Black girls.

Cross-case analysis. A cross-case analysis (Schwandt, 2001) method offers utility in comparing several cases in the context of a larger project. Specifically, since this research was aimed at understanding the leadership at the schools that were implementing a STEM education program, the unit of analysis was the principals. This type of qualitative analysis was also beneficial because it allowed for the collection of rich, thick description at a macro and micro-level of investigation.

Context of study. The study was situated in a county public school system located in the Mid-Atlantic region of the United States. The school system serves an estimated population of 908,000 residents (U. S. Census Bureau, 2016) who live in the United States' richest Black majority county. The county was selected as a site for implementation of the grant program due to its well-suited alignment with the program's goal to provide STEM education enrichment and resources to students of color. As Figure 4 shows, the school system serves over 128,000 students, of which 61.4% are Black, 29.6% are Latinx, 4.2% are White, 2.8% are Asian, 0.4% are American Indian/Alaska Native, 0.2% are Native Hawaiian or Other Pacific Islander, and 1.5% are two or more races.

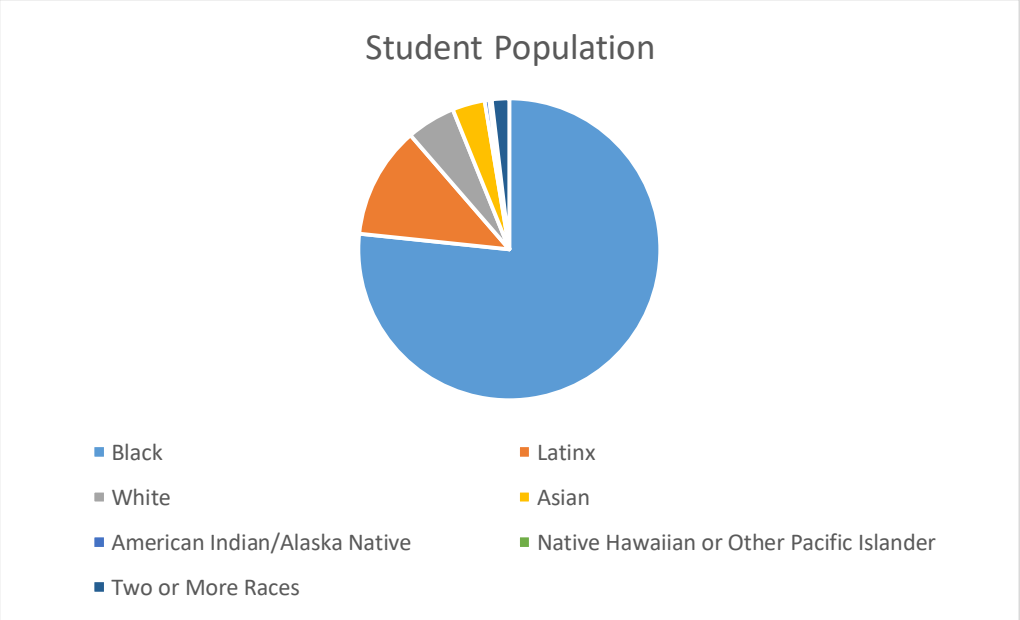

Figure 4. School system student population
Note. STEM education program is being implemented in four schools in system

The school system employs 19,000 people, and it includes several STEM academic programs including the Academy of Health Sciences at the county community

college, the Academy of Aerospace Engineering and Aviation Technology, a Science and Technology initiative, and Career and Technology Education. Students can also participate in career academies focused on Health and Biosciences, Engineering and Science, Architecture and Design, Environmental Studies, Aviation and Transportation, and Information Technology.

Study participants. The participants in this study included principals and teachers from two of the middle schools at which the STEM education program was being implemented. The two middle schools were selected from the four schools that have enrolled in the program in its second year of implementation. Principals and teachers were invited to host the STEM education program in their schools and classes. Teachers who agreed to participate and fulfill preliminary professional development expectations were offered monetary compensation for each part of the program they completed. Principals were not paid for their involvement in the program. As this research focuses on the influences and actions of principals, the research used sampling criteria to select the schools based on previous engagement in the program.

Principals. Principals were selected for participation in this study based on their previous engagement in the STEM education program and their demonstrated commitment to supporting the program. As this is the second year of implementation of the grant, the researcher deemed it important to select one participant who had previous experience in the program and one participant who was new to the program. Both principals had knowledge of the purpose of the program in their schools. As principals have the authority to engage their schools in community and university partnerships, collecting data from school leaders who have an understanding of the possible influence

of the program on their school was also helpful and therefore worth trying to accomplish in selection processes. The researcher also maintained the flexibility to interview other STEM leaders at the school site (e.g., STEM discipline district department chairs, school STEM coordinators, etc.) as deemed useful to better understand how the program was implemented.

Teachers. As the STEM education program was a professional development opportunity for teachers to engage with STEM professionals as they develop design-based lesson plans, the researcher interviewed and observed teachers. At the stage of data collection stage, 42 teachers across the four schools had agreed to be a part of the program. The researcher chose teachers by using a stratified-purposeful method of participant selection (Miles & Huberman, 1994). The first criterion was to identify teachers who were in their second year of the program. The reason for this preference was the researchers' interest in interviewing teachers who had a better sense of the inner workings of the program in the context of their school. The second criterion was based on the teachers' demonstrated levels of program engagement during the initial stages of implementation (e.g., professional development and online trial lesson-planning modules). The third criterion focused on selecting teachers across the STEM disciplines, and to the extent possible, those who teach in the same grade across schools. Obtaining this level of consistency increased the likelihood that the teachers had experiences with the more similarly-aligned pedagogical work based on the material they teach. The researcher selected three teachers at each school site.

School district personnel. The researcher gathered data from one district-level leader. The science curriculum was chosen based on her involvement in district-level initiatives

in STEM education. She provided insight into the direction of the STEM education across the district, documentation of the district's STEM initiatives, and reflections on how both influenced student learning. She also explained the significance of STEM programming across the three school divisions (i. e., elementary, middle, high school). The perspective offered from this resource helped establish trustworthiness regarding data collected at the school-site level.

Consistency across cases. Securing as much consistency across multiple cases as possible was essential to the research process. To support the validity of the cross-case analysis (Schwandt, 2001), the researcher aimed to select at least one teacher interviewee from as many of the STEM disciplines as possible. This helped secure data analysis of similar information across the different school contexts. Establishing consistent representation added to the comparability and breadth of the data collected for the study.

Researcher as Instrument Statement

The researcher conducting this study has relevant experiences in the STEM field that inform the researcher's understanding of the topic under review (Greenbank, 2003). The researcher is a Black woman who taught in two K-12 schools over the course of 11 years (two years in an all-girls school and nine years in co-educational school). The researcher also served on an administrative team at the second school and worked as a high school dean of students and instruction. The researcher earned an engineering undergraduate degree and has worked in the STEM field. The researcher served as a STEM professional partner with teachers in the STEM education program.

The researcher is committed to the success of the STEM program under study because of the researcher's previous experience with and belief in purposeful

collaboration between educators, STEM professionals, and school administrators. The researcher does not believe, however, that her examination of the principals' thinking and practices in this program were biased to the extent of compromising the validity of the collected and analyzed data on the basis of prior experiences. The researcher maintained a methodological journal that chronicled all of the decisions and actions that were included in her work during this project.

Data Collection

The data collection included methods to strengthen the validity and reliability of this research. To triangulate the data from a range of sources, the data collection included the researcher conducting interviews with teachers and principals, using textual analysis, and observing principals and teachers. The data were collected at each of the school sites where principals and teachers were selected. Conducting research in the natural context of the school where the educational professionals conducted their work offered a sense of familiarity for the interviewees.

Access procedures. The access procedures that were part of this study included applying for and gaining Institutional Review Board (IRB) approval from the university where the researcher was conducting doctoral studies. Likewise, the county public school system has a Department of Research & Evaluation that analyzes proposals to conduct research. The authorization from both entities was necessary to conduct research and was secured before the formal research for this study began.

Interviews. The researcher conducted semi-structured interviews in the context of the school site with selected teachers and principals. The semi-structured interview method, which included question-prompted conversations (Creswell, 2013) was

conducted on an individual basis. Interview questions for teachers focused on the instructional climate of their school, their involvement with the STEM education program, their engagement in the program components (e.g., planned lessons, collaborations with STEM professionals), their reflections on student participation, and support from their school leaders (see Appendix B). Teacher observations and interpretations were used to triangulate with those of principals. This decision was based on the role of teachers in the STEM education program, their close working relationships with principals, and their engagement with students. Interview questions for principals focused on their efforts to shape the instructional climate of their school, their thoughts and reasoning regarding the implementation of the STEM education programs (see Appendix A), and the education of Black girls in their schools.

The flexibility in the structure of the interview enabled participants to include responses that were not initially a part of the prompts, but indeed were information that the interviewee deemed critical or pertinent to the conversation (Marshall & Rossman, 2016). The researcher asked follow up questions based on the interviewees' responses to gain clarification during the interview. During the 40-60 minute interviews, the researcher secured the teachers' and principals' perspectives regarding the STEM education program, how they participated in the implementation, the decisions they made as a part of the implementation, and how they supported the success of the program and students' access to it.

The researcher solicited the participation of interviewees through in-person contact. The researcher introduced herself, and the purpose of the study, and provided follow up information in the scheduled interviews including a description to which the

invited interviewee could refer back. The interviewees were asked to sign a consent form. All interviews recorded using an audio recorder, and they were transcribed so that they could be used in the data analysis. The researcher used member checking by asking the interviewees to review the transcript to ensure that it accurately depicted the conversation (Vogt, Gardner, Haeffele, & Vogt 2014). See Appendices A & B for interview protocols.

Document analysis. Document analysis, also referred to as textual analysis, **(**Bowen, 2009; Travers, 2001) provided a different perspective on the context of study; it was a process that involved evaluating and interpreting print and electronic documents. Documents ranged in length, content, and purpose, and they provided insight into the intentions and plans of the people and organizations that created the documents under review. Documents included data regarding the goals of the organization, as well as the steps they planned to take to accomplish the goals. The documents that were analyzed included curricular unit and lesson plans for STEM classes, and district descriptions of the STEM programming that the school district provided for students. The documents were analyzed to identify resources that substantiated: (a) the district's plans for STEM education; (b) the STEM programming that students were provided at each school division level; (c) curricular scope and sequence; and (d) responsibilities at the district, school-site, and classroom levels to deliver STEM content.

School district STEM documents. The researcher obtained and analyzed the county school district's documents focused on STEM education. These documents included STEM education goals at the county level, as well as those related to school site

programs and features. Documents that outlined the most recent status of STEM education in the county were included, as well as plans for future initiatives.

The document analysis, which was conducted early in the research process, was used as a benchmark to examine how principals enact the county school district's STEM education intentions. The researcher briefly summarized the information presented in the documents to ensure that the interviewees were aware of district's portrayed stance included in written documents. The researcher used the STEM documents to guide and leverage interpretation of the site's instructional practices and climate-related to STEM education.

Observations. The researcher informally observed the school sites to understand and note the contextual culture of each school. This method of data collection was important because it offered perspectives that participants experienced in the moment, and established verisimilitude, giving a true sense of the lived experience (Creswell & Miller, 2000). Observations included classes where teachers under study were teaching lessons that were a part of the STEM education program, interactions with STEM education program personnel, principal-led meetings, and professional development sessions that were a part of the STEM education program.

Observation protocol. The observation protocol included prompts and space to write the dates, times, and personnel involved in events, examples, and interactions that the researcher saw and heard during the time at the school site. All names were redacted or changed to pseudonyms to exclude the identity of all participants (see Appendix C).

Data Management

The data management plan consisted of several steps to safeguard all of the data that the researcher collected (Miles & Huberman, 1994). The templates for both interview and observation protocols were shared with participants to strengthen the credibility of the study, and they were made aware of the changing and redaction of all identifying information. All data were stored online using a password-protected computer in the data analysis software, Dedoose. Dedoose is a computer software program that enables researchers to upload, analyze, and store data. The data analysis functionality of Dedoose is further described in the data analysis section of this dissertation. The documents were stored electronically.

Management for interview data. Interview data, including the recorded audio files and the resulting transcriptions, were stored on a password-protected computer and a secure online data storage program. Each interview was named using a naming scheme that identified the location, participant (using initials), and date, and was stored separately in a folder designated for interview data. Within 24 hours of conducting each interview, the researcher wrote reflections of each interview interaction, which was also stored in a folder online.

Management for observational data. Field note observations were also stored on a password-protected computer. All observations were named using a naming scheme that identified the location, participants (using initials), and date, and was stored separately in a folder designated for observational data. Again, within 24 hours of completing observations, the researcher wrote reflective notes about the experiences and stored them in a folder designated for analytic memos.

Data Analysis Procedures

The data analysis for this cross-case analysis (Schwandt, 2001) consisted of the steps outlined by Marshall and Rossman (2014) and Saldana (2013) for qualitative researchers. Those steps directed the procedures the researcher completed to organize, synthesize, and report the data that was collected. It is important to note that the data analysis was completed for each school site, and then collectively to establish the comparisons for the cross-case analysis (Schwandt, 2001). Completing this process three times, that is, two times for each of the two schools and again for the full comparative analysis, established a thorough examination of the data to answer the research questions (Miles & Huberman, 1994).

The researcher wrote analytic memos within 24 hours of conducting interviews and observations (Saldana, 2013). The analytic memos served as the researcher's method of recording her thoughts about the experiences and noting any ideas she had about amending any data collection procedures as she moved forward. The researcher referred to the analytic memos for each type of data collection in preparation for any future procedures. The researcher also relied on these data procedures, as well as the conceptual framework, to develop the coding structure and categories for the analysis of the raw data.

Transcription. The researcher transcribed all of the raw interview data within 48 hours of conducting each interview. The researcher developed transcripts that recorded the words spoken verbatim and included pauses, laughter, sighs, and other sociolinguistic expressions to strengthen the reliability and validity of the interview data (Kvale, 1996).

Coding structure. The researcher based the coding structure on the conceptual framework and the themes that emerged from the analytic memos. The researcher used the practices outlined in the OLF (Leithwood, 2012), as well as those that were perceived as leadership for social justice or from an intersectional lens as a priori codes for use in the study (Saldana, 2013). See Table 4. The literature on all three subjects informed the data analysis as the coding structure was developed and as the data analysis was iteratively implemented. To that end, the researcher established posteriori codes that derived from the emergent themes in the data collection process. Posteriori codes were themes that emerged as the data was iteratively analyzed after it was collected.

Coding methods. The researcher used First Cycle and Second Cycle coding guidance outlined by Saldana (2013) to analyze data during and after collection. The First Cycle and Second Cycle coding methods included the following, respectively:

First Cycle coding methods

1. Attribute Coding
2. Structural Coding or Holistic Coding
3. Values Coding

Second Cycle coding methods

1. Pattern Coding and/or Focused Coding (p. 64)

Attribute Coding functioned as an initial data management technique and it was applied to all of the data as a first step in the process (Bazeley, 2003). It consisted of assigning descriptive notation to all of the identifying factors of the data. The technique was used with interview and observation data. Given the nature of this cross-case analysis (Schwandt, 2001), the Structural Coding technique was employed as a second step in the analysis. Structural Coding allowed the researcher to apply a conceptual code,

grounded in the OLF to data based on content (Namey, Guest, Thairu, & Johnson, 2008). It was particularly useful for interview transcripts (See Table 4 for codes referred to during the Structural Coding process). The coding schemes were based on the OLF domains and practices that aligned with leadership theories (i.e., social justice leadership, distributed leadership, instructional leadership). The third step in the First Cycle coding involved Values Coding. The technique is appropriate for case study methods, and more specifically for this study because it considered the values, attitudes, and beliefs of participants. Saldana reminds us that values are the importance we attribute to oneself, another person, thing, or idea; attitudes are the way we think and feel about oneself, another person thing, or idea; and beliefs are parts of a system that include values and attitudes, plus personal knowledge, experiences, opinions, prejudices, morals, and other interpretive perceptions of the social world. Considering the nature of the research questions regarding principals' thinking and practices, this method of coding helped pinpoint the motivations and foundations of school leadership practices. Furthermore, Values Coding was helpful for analysis of field observations that recorded participants' actions and interactions in their natural environment (LeCompte & Preissle, 1993).

In the Second Cycle coding, the researcher used Pattern Coding, which identified the "meta-code" (Saldana, 2013) of the reduced amount of sets, themes, and constructs (Miles & Huberman, 1994) that emerged from the data. All of the transcripts and resulting coding were stored using a computer program.

Software. The researcher used a computer-assisted qualitative data analysis software (CAQDAS) program to assist with analyzing the data. Utilizing a CAQDAS increased the rigor of qualitative researcher (Onwuegbuzie & Leech, 2007) and aided in

the organization of analyzed data in a way that informed the resulting synthesis of information. The program the researcher used, Dedoose, aided in the identification of underlying relationships in the data collected across a range of techniques. Acknowledging that the researcher was the primary tool for conducting data analysis (Denzin & Lincoln, 2005), the researcher checked the results of the CAQDAS data analysis using several methods to build the trustworthiness of the study.

Trustworthiness

There are several steps that a researcher can take to strengthen the rigor, breadth, and depth of study when data are obtained from multiple sources (Creswell, 2013; Denzin & Lincoln, 2000) to control for potential biases in the research plan, execution, or analysis. This study included a number of those procedures, with the aim of developing and disseminating research that is trusted as a foundational framework to guide principals in their leadership of schools where Black girls learn how to flourish academically and socially.

Triangulation

The researcher collected and analyzed data from sources using several methods to strengthen assertions that were made (Vogt, Gardner, & Haeffele, & Vogt, 2014). The interviews, observations, and document analyses conducted were all used to obtain corroborating evidence of the researcher's understanding of the data collected. The document analyses were done to understand the public school district's and principals' goals for STEM education. The rationale for the engagement with principals and teachers in interviews was to create a record of their perspectives on their work, the school, and their students' education, particularly that of Black girls.

Peer Debriefing

The researcher engaged in peer debriefing as a method of working to establish credibility in the data analysis process and resulting findings (Lincoln, & Guba, 1985). The researcher solicited the assistance of a disinterested peer, a post-doctoral research associate, to conduct a review of the data collection and data analysis that were completed. This enabled the researcher to process their thoughts behind the methodological decisions and adjustments based on work in the field (Lincoln & Guba, 1985).

Member Checking

The researcher completed member checking procedures by presenting the interview transcriptions to all of the interviewees and asking them to check for accuracy. By providing access to the transcriptions, the researcher sought to enhance the validity and credibility of the raw data reporting, which informed the data analysis.

Piloting Interviews

The researcher piloted interview protocols by asking a current school administrator the questions. The administrator had STEM teaching and administrative experience in the county that the STEM educational program was being implemented as well as in a neighboring county with a similar student demographic composition. The pilot participant provided feedback regarding the clarity of the questions as well as the extent to which the questions solicited relevant data. As a result of the feedback, the protocol was modified to include direct questions about teachers' and principals' work with Black girls. It was also amended to include background data on the state of Black female students in the STEM pipeline.

Preliminary Observations

The researcher conducted preliminary observations of the schools to understand the context. Observing the school sites also provided an understanding of the natural instructional culture. The preliminary observations took place at the four schools in which the STEM education program was being implemented. They included observations of the professional development in which teachers and STEM professionals participated, STEM after-school enrichment programs, faculty meetings led by principals, and planning meetings of the STEM educators. The researcher also recruited STEM professionals to participate in the program so that teachers and students would have access to professionals in the field with whom the students could racially and culturally identify.

Conclusion

This work was conducted in an effort to embolden Black girls in the STEM educational pipeline in ways that lead to their success in the field in the future. The study may help principals and other school leaders recognize meaningful ways they can develop thinking and practices that intentionally engage Black girls in educational spaces where they historically have been excluded. By researching educators' work in their environment, it may be possible to also positively influence the lives of other students who need support in their educational endeavors.

Chapter 4: Analysis of Data

The findings presented in this chapter are the results of data collection from two school sites that participated in a National Science Foundation STEM education grant. The data were analyzed to develop conceptually grounded responses to two research questions about the thinking and practices of the school leaders and how they influence Black girls in the STEM educational pipeline.

This chapter consists of five sections. The first section reviews the purpose of the study. The second section summarizes the descriptions of the school sites that were studied in this cross-case analysis (Schwandt, 2001) as well as the STEM education program that was the background context of this study. The third section details the methodological considerations and decisions that informed the development of the findings. The fourth section provides the data analysis that answers the study's two research questions. The fifth section presents the informational summary of the findings.

Purpose of the Study

The purpose of this cross-case analysis (Schwandt, 2001) was to investigate the thinking and practices of school leaders at two schools in the context of a federally-funded STEM education grant. The exploration of leadership also examined the extent to which the educational and social positionalities of Black girls' influenced leaders' decisions. The researcher endeavored to develop a study that reifies the nuances of Black girls' education in a way that current and future leaders understand. The researcher held that by studying school leaders' thinking and actions related to Black girls in situ, and

reporting findings, she could establish an empirical body of literature that is underrepresented in educational leadership scholarship

The data collected and analyzed in this study included responses from semi-structured interviews with school principals as well as facts from documents published by the school district in which the STEM grant was implemented. These data were triangulated with findings gathered from interviews with teachers at the schools and four months of observations at the schools. The observations included teacher professional development meetings, faculty meetings, STEM classes, and afterschool extracurricular STEM activities. Each of these data sources informed the findings presented in this chapter. The data were collected during the fall and winter of the 2017-2018 school year as the STEM education program was being executed at four middle schools in the school district.

This chapter presents the results of the study in a manner that establishes evidence to answer the research questions. Each of the two cases is explored separately and later the information is collectively analyzed to undergird the overarching summation of findings for the cross-case analysis (Schwandt, 2001). To fully understand the impact of each on the findings, it is important to understand the context of each school site, as well as the STEM education grant. The contextual realities and resources that the middle school sites and the STEM grant program provide privilege factors that are often otherwise problematized.

Summary of Study Context

The cross-case analysis (Schwandt, 2001) consisted of two middle schools (Fleming Middle School and Harris Middle School) in an urban county in Mid-Atlantic

region of the United States. The schools are in different areas of the large suburban county. With a population of over 900,000 residents, the county is the wealthiest Black county per capita in the United States. The populace of the county is diverse with regards to race and ethnicity, socioeconomic status, educational attainment, and occupations. In 2015, there were 3.59 times more Black people in the county than any other race or ethnicity (Data USA, 2015). During that same year, there were more than 150,000 Latino and over 125,000 White residents, which were the second and third largest demographics (Data USA, 2015). The county is located near a major metropolitan U. S. city, and many of its residents work in the government sector that is centered in the local area.

School District Context

As the second largest school system in the Mid-Atlantic state in which it is located, the school district that Fleming Middle School and Harris Middle School are a part of is comprised of 209 schools and educational centers (King City Office of Communications, 2016). With an annual budget of $1.8 billion, King City Public Schools (KCPS) is managed by a Board of Education, a Chief Executive Officer, a Chief Operating Officer, a Chief of Strategic & External Affairs, a Deputy Superintendent for Teaching & Learning, and a Deputy Superintendent responsible for Instruction, Human Resources, and interscholastic athletics. Figure 5 shows a depiction of the school system's organizational structure. The school district has established career and technical education programs, STEM curricular initiatives, and partnerships with local institutions of higher education to offer students certifications, specialized training, and pipelines to future employment opportunities.

The academic resources that the district offers are components of intentional efforts the district puts forth to educate the student population that it serves. For example, the vision of the school district's science office states it works to

> ensure the teaching and learning of science for all PreK-12 students by providing equitable access to exemplary teachers, science curriculum programming, instructional practices, and standards-based assessments that are reflective of research and best practices, along with quality resources and support from stakeholders at large" (King City County Schools - Vision and Mission, 2018).

One school site was a designated STEM middle school and one was not. Both schools had several local feeder elementary schools.

School Site Description of Fleming Middle School

Fleming Middle School's mission is "to teach children to become informed, engaged citizens, and curious, life-long learners" (Fleming Middle School, 2018). Located in in the southwestern region of the large county, the school includes sixth, seventh, and eighth grades for over 400 students.

Academic departments and program. Fleming Middle School has the following academic departments: creative arts, community reference instruction (CRI), English language arts, mathematics, science, and social studies. Students have the option to participate in a range of extracurricular academic and athletic activities such as the Science Bowl team, the debate team, and the basketball team. Each department has a teacher leader that serves as a department chair. The leadership structure includes team leaders for each grade level. There are also two assistant principals who serve as programmatic leaders for the grade levels; one assistant principal supports sixth grade

and half of the seventh grade and the other assistant principal supports the second half of seventh grade and the entire eighth grade.

Fleming Middle School offers general education and special education academic programming. In addition to the 44 discipline-specific teachers who work at the school, there are also 7 paraprofessionals on staff who support special needs students in CRI and general education classrooms. Additional personnel who support the school program include the professional school counselor, the quarterly learning module (QLM) coordinator, and the school testing coordinator/data coach.

School culture. Fleming Middle School boasts a very welcoming educational and professional environment. Visitors are treated respectfully and greeted intently when they enter the security camera-controlled building by the school staff. During each visit throughout the course of data collection, the researcher witnessed friendly collegial exchanges between coworkers. There were consistently evident displays of engagement, and the faculty members treated each other and students kindly.

Through observations of and conversations with the school's faculty, it became evident that the obvious collective investment in creating a hospitable school culture was a reflection of the priorities of the institution's leadership. As is quite often the case, the leader of a school guides the school community to articulate and live their mission in their daily work. In its mission statement, Fleming prides itself as a "caring community of learners that integrates collaboration, academic rigor, critical thinking skills and effective customer service to ensure that all students are prepared for the demands of college and careers" (Fleming Middle School, 2018). At Fleming Middle School, the drive to accomplish this mission is led by the school's principal, Dr. Ruth Stith.

Professional profile of principal. Dr. Ruth Stith has worked for the King City Public School District for 17 years. After teaching for 10 years in intermediate elementary school, and working for two years as a science instructional coach for KCPS, Dr. Stith became a district performance specialist for six years. As a performance specialist, the majority of Dr. Stith's responsibilities centered on coaching school administrators (i.e., principals and assistant principals) to help them improve as instructional leaders. She helped them understand how to use core academic student data to influence teachers' instruction and engagement with students. Dr. Stith credits a large majority of her approach to her former work as a performance specialist, and now as a principal, to her understanding of and reliance on educational leadership standards. She explained:

> My work was driven by leadership standards…If a principal is supposed to create a mission and a vision, how do I help them create a mission and a vision knowing what they know about student achievement or knowing what they know about how their teachers actually implement instructional practice? And then how do you have that mission and vision for what your belief system is? Helping them to understand how do you create that in your building and also create that in the community? So how do you change your mindset of an impoverished community to let them know that an instructional program is the way that we get out of poverty? How do you help them to know that the community has to be connected to your instructional program? So my work as a performance specialist dealt with a lot of quantitative numbers, but it also had to deal with me understanding what was the expectation of a principal through leadership skills - I mean their leadership standards - and how do I help them to build that skill set to do the two. (Interview, Winter 2018)

Dr. Stith's leadership positively influences the teachers and students. In her first year as principal of Fleming Middle School, she has already established a culture of high professional morale that greatly inspires teachers to do their best on behalf of their students.

Teacher participants. Three teachers were interviewed at Fleming Middle School to triangulate the data that were gathered from district documents, observations, and interviews with principals: Mrs. Atkins, Ms. Crewe, and Mrs. Little. Mrs. Atkins has been an eighth-grade science teacher for three years. She is also the science department chair and the coordinator for the STEM education grant program under study. Ms. Crewe has been a seventh-grade science teacher at Fleming Middle School for five years. She is the coordinator for the school-wide STEM Fair and the seventh-grade field trips. Mrs. Little has been a seventh-grade math teacher at Fleming Middle School for three years. All three teachers have participated in the STEM education grant program for the two years that it has been at Fleming Middle School (2016-17 and 2017-18 school years).

The three teachers' participation in the STEM education grant program exemplifies their commitment to go beyond the required responsibilities of their jobs to educate children. They acknowledged that Dr. Stith's demonstrated dedication to teachers helps motivate them to work diligently. Mrs. Little detailed:

> It's the morale of the, you know, of the team, you know, of the school goes up because when the teachers are felt, you know they feel appreciated, then, of course, they're going to teach at, you know, highest capability. They're going to come in, they're going to want to teach, they're going to want to learn, they're going to want to be here. Um, and so the students learn. You know, and so that's why I think she's focusing there, and I remember she mentioned it at her, one of our team, our meetings, one of our staff meetings. She mentioned that,…'If I focus on the teachers, and I focus on you all, and you're okay, then I know the kids are okay.'…It is boosting morale, you know, and…you're going to want to come to work. You're going to want to teach. Like you're going to want to teach when especially the hard to reach students. You know, we have a lot of hard to reach students, and they will run you out of here every day miserable [laughs] if you let them, you know what I mean? But you know, for the most part, you know, she's building that morale. (Winter, 2018)

In their individual interviews, all three teachers offered additional examples of the strategies Dr. Stith uses to establish high-morale norms at Fleming Middle School. This cornerstone of her leadership has established a strong foundation on which the faculty flourishes and students are nurtured.

School Site Description of Harris Middle School

By way of their mission statement, Harris Middle School's endeavors to "reward excellence and develop college and career ready students through P.E.A.C.E., rigorous education, service, and nurturing relationships" (Harris Middle School, 2013). The school, located in the far southwest region of the county, just recently added sixth grade to its seventh and eighth grades to serve over 500 students. Harris Middle School is one of two STEM schools in the public school district.

Academic departments and program. Harris Middle School includes eight academic departments: Advancement Via Individual Determination (AVID), creative arts and sports, mathematics, reading and language arts, science, social studies, special education, and STEM. As a designated STEM school, students have the option to take Gateway to Technology electives that include engineering innovation instruction, computer programming, and environmental science curriculum.

The leadership infrastructure at Harris Middle School consists of its principal, Mr. Leonard June, an assistant principal, and two academic deans. The school also has a designated STEM coordinator, Mrs. Alicia Windsor, who is responsible for supporting classroom teachers with curriculum development and STEM integration. Alongside the 50 classroom teachers who teach at Harris Middle School, students are supported by two

professional school counselors, one media specialist, six paraprofessionals, one success coach, and a test coordinator.

School culture. Harris Middle School is the home of a wonderfully contagious culture of respect. Upon entering the security camera-controlled school, everyone is greeted in the like manner that all students and adults are addressed: "Peace, Queen" or "Peace, King." The faculty and staff consistently work to live out the school's mission by treating each other and their students in an uplifting way. The researcher consistently observed staff members interacting with everyone with whom they came in contact using language and an ethic of care that demonstrated their commitment to creating a peaceful school environment for everyone who entered. Similar to that of other schools, the learning and social community reflect the vision of the institution's leader, Mr. Leonard June.

Professional profile of principal. With over 10 years of school administration experience in KCPS, Mr. Leonard June is resolutely dedicated to creating a positive school culture at Harris Middle School. He ensures that the school's values are deeply interwoven in its institutional fabric as evidenced by the intentional physical, personnel, and pedagogical character of the school community. As the principal of Harris Middle School for the past seven years, Mr. June has established an ethos that simultaneously celebrates students' successes as well as their potential. It is embedded in components that range from the signs about the restrooms that read, "Queens" and "Kings", to the school motto: "Where eagles soar sky high and P.E.A.C.E. lives." Regarding the school's chosen language and motto, he described:

> Kings and Queens – so that's a self-fulfilling prophecy that we heavily believe in. Our school is based in P.E.A.C.E. – Positive Energy Activates Constant Elevation is our school theme. We do a lot around culture and climate and a lot around relationships. (Interview, Winter 2018)

The intentionality of creating and maintaining a reverential school environment is not only evident in the social dynamic of the school, but it is also a part of the instructional nature of Harris Middle School.

Teacher participants. Three teachers were also interviewed at Harris Middle School to triangulate the data collected at and about that school. The three teachers, Mr. Conway, Ms. Singleton, and Mrs. Windsor, have all participated in the STEM education grant program for both years that it has been at Harris Middle School (2016-17 and 2017-18 school years). Mr. Conway has been a math and technology teacher for 12 years at Harris Middle School. He currently teaches the STEM integration classes for all three grades. Ms. Singleton has been a seventh-grade math teacher at Harris Middle School for four years. Mrs. Windsor, the STEM coordinator, has been a teacher for 16 years. Her experience includes three years as a technology teacher, one year as an eighth-grade science, and eleven years as a fifth-grade science teacher.

The data the researcher gathered were an amalgamation of the leadership and instructional practices that the participants exhibited while implementing a STEM education grant. This specialized program enabled the researcher to contextualize the collective efforts of all of the educators, as well as the results of their work.

Description of STEM Grant Program in Context of School Site

The STEM grant that Fleming Middle School and Harris Middle School took part in was in its second year of implementation during the time of this study. There were

1,332 students in the program across the four schools that were involved. The grant provided structured professional development delivered in monthly virtual meetings and two in-person meetings. The initial in-person meeting consisted of a three-day long training with all of the teachers, the research team (i.e., two co-principal investigators, one post-doctoral assistant, four graduate research assistants, and two engineering educators) and the STEM professionals. The second in-person training included the teachers and the research team. Both of the trainings were supported by the KCPS district, which provided funding for substitutes for teachers who attended.

The monthly virtual professional development allowed the time and space for consistent lesson planning and logistical follow-up. The research team facilitated sharing of ideas within the professional community of teachers. In accordance with the priority of the grant, the team also modeled unit and lesson development that aligned district curricular goals and national science and math standards, with social justice focused instruction. The research team also provided on-demand assistance with the fidelity of implementation of the program components (e.g., coordinating with STEM professional, lesson plan development) to support teacher efficacy.

Methodological Approach to Findings and Reporting

The findings of this study were established using multiple methods of analysis. The methods the researcher used were iteratively enacted during and after the data collection. Each decision was intended to develop a comprehensive study of enacted leadership in a way that prioritized the education of Black girls. By analyzing the data using several methods, the researcher increased the trustworthiness of study.

Computer Program Analysis

Using the CAQDAS program, Dedoose, the researcher analyzed the collected data to exact findings for this study. A qualitative tool in Dedoose, the co-occurrence table, enabled the researcher to effectively pinpoint the leadership practices and thinking within the OLF, that demonstrated social justice and intersectional axes used to effectively support Black girls' education in STEM. In particular, within the Structural Coding phase, the co-occurrence function simultaneously tallied the frequency and indicated the intersections of the practices and leadership stances. For example, principals' thinking and actions that demonstrated OLF practices (e. g., setting directions, developing the organization to support desired practices) and concurrently showed how they led in socially just ways, were coded for both identifiers. Later, in the Second Cycle coding, the researcher used the program to identify the patterns that emerged from the analyzed data. For instance, the frequency of leadership practices and consistency of supporting data were considered and further evaluated to develop the final findings.

Organization of Findings Reported by Research Question

In order to clearly and systematically answer the inquiries posed in this study, the findings are presented in response to each of the two research questions. The nature of leadership practices investigated in response to research question one are detailed using the framework outlined in the OLF. The influence of Black girls' positionality in the STEM pipeline in reaction to research question two is articulated through examples and explanations that evidence intentional programming.

Research Question One Findings: Nature of Leadership Practices

The data-evidenced findings that divulged the nature of leadership practices that support Black girls in the context of implementing a federally-funded STEM education grant included the manners in which principals at Fleming Middle School and Harris Middle School: (a) set directions of the schools; (b) built relationships with and developed the school personnel; (c) developed their organizations to support desired practices; (d) improved instructional program; and (e) secured accountability from the district and multiple stakeholders (Leithwood, 2013). Although all of the practices encompassed in each of the five OLF domains were supported by some form of data collected, the only leadership practices that are outlined in the current section are those that were saliently evidenced upon thorough data analysis. Figure 6 details the evidence that was used to support each assertion regarding the OLF.

Furthermore, the researcher analyzed the data using lenses that theoretically considered the significance of social justice leadership and intersectionality. For this reason, the practices that were explicated in this chapter demonstrated leaders' propensities to either operate from a distributed leadership stance or an instructional leadership stance, both in ways that enacted social justice leadership for Black girls.

Setting Directions

Assertion one: Principals prioritized setting the direction of their schools in ways that supported Black girls in the STEM pipeline by: (a) encouraging the development of organizational norms that support openness to change in the direction of that purpose or vision; and (b) devoting additional effort to creating

high expectations among staff on behalf of and for the achievement of historically underserved students.

The practices delineated in this domain directly reflect the social justice leadership that the two principals used. The manner in which both principals shaped their institutions' organizational norms and crafted high expectations on behalf of historically underserved students exhibited their resolute dedication to emboldening Black girls.

Organizational norms. Both schools that were under study in this cross-case analysis (Schwandt, 2001) were guided by leaders who set and supported the direction of the institution. While only in her first year of leading Fleming Middle School, Dr. Stith had established a clear direction for the school's staff and students to lead them in a direction towards a collective school goal. In relation to the way that the STEM grant program helped her lead Fleming Middle School on the path towards organizational norms she wanted to develop, Dr. Stith beamed:

> It's been great for them [teachers] to work on STEM-Communities because they now also are starting to see the level of connection, why we focus on literacy and the writing piece. So, I think that because I've given them opportunity to open that up and participate, it's allowed them to think bigger, dream bigger as a school. (Interview, Winter 2018)

Dr. Stith mentioned her enthusiasm for integrating STEM with each part of the curriculum several times. It was evident that she made it an organizational norm for the school. Ms. Little, a 7th-grade math teacher at Fleming Middle School mentioned Dr. Stith's excitement for the school's first STEM research night and the school's STEM fair.

The researcher observed the STEM fair, which included over 100 displays and demonstrations of students' experiments in and explorations of STEM concepts. The

displays were set up in the school's gymnasium throughout the course of an entire school day to allow teachers to bring all of their students to view the range of STEM-related experiments their classmates had completed. By supporting this school-wide event, Dr. Stith demonstrated her commitment to creating and maintaining a school culture that was moving towards their collective goal of full STEM integration across the curriculum. A similar direction was evident at Harris Middle School.

Mr. June set the direction of the school by the way he established a nurturing culture for students. As it specifically related to Black girls in STEM education, Mr. June noted the way he intentionally built a team that reflected the school's student population. He explained:

> The support that they have through counselors, through advocates, through teachers, administrators.… I think those are all ways in which we're very intentional with our relationships…I mean we try to hire a diverse group of staff persons. So we look for … female teachers as well as uh, male teachers…Our, um, STEM Coordinator is female. Um, one of our STEM teachers is female, 1 out of the 3, is female. And so I definitely think that also plays a role in - just that image - around seeing a Black female in an instructional capacity dealing with STEM.

Mr. June believed that representation was an important component of building a culture in which students see themselves positively reflected in their educational environment. His goal of building a team was also evident in the teaching population demographics at the school. The researcher observed that all of Harris Middle School's administrators and the majority of the school's staff, were people of color. This statement and observation aligned with the district's intention around diversity. The district recently launched a Workforce Diversity Task Force. In accordance, they released a document detailing how the Task Force would be "spearheaded by the district's Office of Human Resources and

[would] analyze current staffing, student enrollment data, and initiatives that address workforce diversity." (Document, 2016). In the document the district's leadership explained:

> It is important for our students to see teachers and staff members who look like them in the classroom, the school building, and throughout our organization. Diversity makes a difference, as it can greatly impact the academic achievement of our students. (Document, 2016).

Both schools' attention to setting directions that supported Black girls was also apparent in the expectations that principals had for their student populations.

High expectations for historically underserved. Dr. Stith's experience as a school administration performance specialist greatly influences her approach to her work as a principal. Undergirded by an appreciation for the manner in which educational leadership standards help her prioritize the needs of the community her school serves, Dr. Stith challenged herself to always work on behalf of those who have been historically underserved. In an interview, she explained this dilemma by prompting herself with a series of critical questions she considered as a district performance specialist:

> How do I help them [principals] create a mission and a vision knowing what they know about student achievement or knowing what they know about how their teachers actually implement instructional practice? And then how do you have that mission and vision for what your belief system is? Helping them to understand how do you create that in your building and also create that in the community? So how do you change your mindset of an impoverished community to let them know that an instructional program is the way that we get out of poverty? How do you help them to know that the community has to be connected to your instructional program? (Interview, Winter 2018)

Dr. Stith further explained that she continued to keep these probing questions at the forefront of her practice as the leader of Fleming Middle School. Particularly, in relation

to STEM education, it was one of the driving factors behind her reasoning for creating opportunities for her students. Dr. Stith detailed:

> I've seen a level of success when people have that [STEM education] interest. The other thing is, as I see what universities - colleges and universities - there are very few African-American males or females that are really driving or in the forefront of science and math and technology. So STEM, there are a few of us, but it's not enough, and I think that all of that starts here, like elementary or middle school. So that it's the interest kids have. So the STEM Fair, STEM Night, STEM interest - is for parents. It's very big because in STEM you can do absolutely anything and if kids have an opportunity just to touch it, it may spark someone to have that interest. So that's where my vision for it is driven. And then kids who do science and math - I mean they're very intelligent children because you got to be able to think through any kind of problem or anything - type of process. So that's really what drives me to do STEM. (Interview, Winter 2018)

Dr. Stith's level of commitment to providing opportunities for historically underserved populations was mirrored in the access that the STEM grant program provided. Her demonstration of social justice leadership through prioritizing awareness for the students at Fleming Middle School was also noted by the school's eighth-grade science teacher, Ms. Atkins:

> So STEM-Communities really focuses on and emphasizes the idea of social justice, just having students be aware of the global picture, the bigger picture of things that are happening outside of their doors, not just you know, within their realm. So being able to expose students to other things that are going on issues other kids are having possibly in other parts of the world, or issues that people are having just in general, as it pertains to science, as it pertains to technology, as it pertains to just individual human rights, and how science and technology, and possibly engineering, could help accomplish those or address those issues. (Interview, Winter 2018)

Both examples show the aim of the school to provide educational access to students. These beneficial thoughts and practices were also evident at Harris Middle School.

Mr. June champions efforts that provide meaningful access to his students, as well as those who help students understand how they impact the world. In his annual letter

(see Appendix D) to the parents and families, he reminded the school community that the school was committed to

> preparing [their] Kings and Queens for lifelong success [through a] focus on how to create and maintain a 'growth mindset'[which] empowers [them] to work toward improvement in school and the community and is essential to becoming a positive change agent who transforms the world. (Document, 2017)

This approach to empowering students to positively impact and improve their world has been actualized throughout Harris Middle School. Mrs. Windsor, the school's STEM Coordinator, recalled how a Black female student was moved to start a drive for supplies after another country was struck with devastation from a natural disaster. In the same manner, Mr. Conway, the technology teacher, explained how students were more motivated to participate in open-ended design challenges that were a part of their curriculum when there was a connection to an issue or problem that someone was facing in society. This type of empowerment in their school was not only showed through the direction principals wanted to take their schools, but it also exemplified how they partnered with others in their organization to make these changes happen.

Building Relationships and Developing People

Assertion two: Principals establish and maintain relationships and develop people by: (a) encouraging staff to pursue their own goals for professional learning and try new practices consistent with their own interests; and (b) encouraging staff, students, and parents to listen to one another's ideas and genuinely consider their value.

The practices set forth in the *building relationship and developing* people domain as well as the *developing organizations to support desired practices* domain revealed the

manners in which social justice leadership could fructify through distributed leadership practices. By supporting the establishment of new practices, developing cultures in which all constituent groups are respectfully heard, and collaborating with community members, principals accomplish the goals of social justice leadership.

Encouraged new practices. Both principals demonstrated a commitment to investing in their staff's professional development. By supporting teachers' work in the STEM education grant program, the principals helped provide access to new and innovative STEM instructional practices.

Dr. Stith empowered one of Fleming Middle School's teacher, Ms. Atkins, to take on a leadership role as a part of her work with the program. Dr. Stith highlighted:

> STEM-Communities also opened them [teachers] up to leadership. So I have… a STEM-Communities coordinator…So on that [in-person professional development] day, she did all the expectations…She has the expectations for that particular event and she did all the leadership things, made sure, and she just checked with me. So it also created leadership skills in some of my teachers that are in STEM-Communities. (Interview, Winter 2018)

By distributing leadership to teachers in the STEM education grant program, Dr. Stith enabled a staff member to enact her expertise as a Black woman and former STEM professional on behalf of students in a way that professionally developed her.

Another science teacher, Ms. Crewe, explained the positive impact the STEM education grant program had on her pedagogical practices. She explained that before having the grant-related opportunities, she had not considered including this type of instruction in her courses. Ms. Crewe admitted, "Before this, we never did an engineering design challenge. I didn't even know what it as so it's impacted us a lot. Now

we do it regularly…They love design challenges. They get very excited." (Interview, Winter 2018)

In another instance, Dr. Stith offered support for a new school-wide initiative that offered access specifically for the females in her school. Ms. Little explained that the school traditionally offered a program, "Men Make a Difference Day" for the male students to have access to male volunteers, such as parents and local business owners, to share their success stories. After several years of offering the program for male students, the teachers asked if they could begin offering it for female students. Dr. Stith agreed with the idea and this year the school is planning to offer its first "Women Make a Difference Day" for the female population, which is largely Black. This notion of support exemplified Dr. Stith's commitment to increasing the number and types of programs Fleming Middle School offers for Black girls in ways that meaningfully distributed leadership to faculty members.

Mr. June similarly encouraged new practices that empowered Black girls at Harris Middle School. Specifically, in STEM education, Mr. June supported the establishment of a girls' coding club. The program, which met after school, was initiated and led by Mrs. Windsor. The program was created to give girls an opportunity to explore computer coding that could be used to solve problems. This initiative aligned with the district's vision statement for STEM education which stated, "KCPS STEM teaching and learning prepares students to create solutions for problems yet unknown." (Document, 2017). The girls who participated in the club were engaged and encouraged in the pursuit of using coding as a method of investigating and solving hypothetical problems that were simulated in computer-based programming environments. Mrs. Windsor created the

opportunity because she believed that the school needed an initiative that engaged girls' creativity in a positive, STEM-based manner. Mr. June's support of the new initiatives strengthened the positive professional rapport he had established with Mrs. Windsor and simultaneously supported the STEM education of Black girls. It was also evidence of his ability to listen to and value several constituent groups of the school community.

Listening to school community. As the time under study was during Dr. Stith's first year at Fleming Middle School, she had to learn many facets of the school's culture. The researcher observed the multiple opportunities offered by Dr. Stith to engage with the parent and family community in including designated time for open dialogue during the school day (e.g., Coffee with the Principal) and evening for curriculum-focused events. By creating these open forums, Dr. Stith has established a presence that shows her willingness to partner with families. She recalled a request from the Parent Teacher Association (PTA) to engage in conversation about STEM education:

> We had PTA ask for my science teachers to come and do an explanation around what was the expectation for the STEM project. So I had a one of my science, Mrs. Atkins, came back and did a brief description of the STEM [project], and how that was going to look, and what does STEM look like, and what the STEM Fair meant, and all of that. So she did that for PTA.

Dr. Stith's responsiveness to the parents' request exemplified her willingness to listen to the school community in a genuine and helpful way. This supported students' needs in the STEM education and modeled a level of respect and engagement in the school community in a way that could garner more interest.

Mr. June also worked to create a sense of community that showed a valuing of others' interests and needs. He explained that the school believed in branding clubs and activities in a way that would pique students' interests. Mr. June elaborated:

> So if you're a member of SGA [Student Government Association], we want you to have an SGA t-shirt along with all the things that you're doing. So you speak that to the rest of the students that this is going on. So you have girls in STEM group, like a girl's group. We want them to have t-shirts so that they wear them at school, and so other girls might see and say, 'Oh My God, what is that about?' It just helps to create interests. (Interview, Winter 2018)

This approach to creating space for community members to express themselves and share their interests was evident in the types of programs in which students participated.

Furthermore, students were afforded the agency to create their own groups. For example, Mrs. Windsor called to mind a previous year when a group of Black girls requested to start an organization that focused on positive images and service. The school administration supported the girls' effort by helping them secure a faculty sponsor and brand themselves (as The Doves) so that others could join if they wanted to share in the experience of constructive comradeship. This type of leadership was also articulated as principals developed their schools to support efforts that they wanted to promote.

Developing Organizations to Support Desired Practices

Assertion three: Principals develop schools to support desired collective practices by: (a) engaging students' families; (b) engaging the school's external community; and (c) developing and maintaining connections with members of the educational research community.

Engaging students' families. Dr. Stith engaged not only engaged families in the way that she formally supported them, but she also engrained her prioritization of partnership with families in the way that she required the school's staff to interact with them. Ms. Little detailed the school-wide expectations that were in place related to parent communication and grades as such:

> She encourages emails, parent contact, phone calls…They [administration] have things in place where the teacher has to contact the parent at least two or three times before they fail them every quarter. So there has to be some kind of parental contact, some kind of email, phone call, conference. Something has to happen at least two or three times before you decide at the end of the quarter to give them a D or an E. (Interview, Winter 2018)

Mrs. Little furthered her point by explaining the impact this approach had on Black girls. She believed that as a result of the consistent parent contact, students were more involved in their STEM education. Mrs. Little noted the difference family engagement made by stating:

> I did have a group of females who weren't as like docile, you know what I mean? And I think those are the girls in my classroom who are just the leaders anyway…They have a leadership quality…they're more empowered. So I'm noticing that the Black girls who are confident in the material or just themselves, they're not afraid to make mistakes. They don't see themselves as inferior to the opposite sex or just anybody else. And I think the confidence… is a big difference in … the Black girls that I've seen in my class that just really tackled… the design challenges. It may be their home life. I know there are some of the home lives of the students who are more dominant in that area…it's not a perfect traditional family or anything like that, but their parents are more involved. I think that attention is there at home for them…The parents are more involved in the … students' education, the Black girls' education, and I think that they're just ultimately paid attention to. And I think that may be the reason. Yeah, because I can tell you… a lot of the parents that I correspond with through email and text - because I do class Dojo as well - a lot of those parents that stay on top - they ask me questions. Those are the Black girls that are very confident, and they dominate just like the others in the class. But the ones that don't, they just, they have a very docile approach to engineering, STEM. (Interview, Winter 2018)

This benefit of increased engagement and confidence was also noted at Harris Middle School.

Mr. June also hosted events to encourage family engagement. Harris Middle School's hosted "Chat and Chew" events and Parent Nights during which they welcomed the parent community to meet with administrators and discuss the STEM program. They also offered Feeder Nights for local elementary schools to explain the process of building

incoming middle schoolers' class schedule (See Appendix E). STEM program representatives typically attended the events to explain the course options students would have at Harris Middle School (e.g., STEM Integrations, Technology Education, and Project Lead the Way) (See Appendix F). Additional modes the school used to communicate included the STEM brochure and the school website.

Teachers at Harris Middle School similarly saw the effects of parent communication and engagement. Ms. Singleton, a seventh-grade math teacher, explained what she thought impacted the Black girls who worked diligently by saying:

> I think its home life has a big piece to do with it. A lot of the kids that do care about their studies have a good family background - parents that are involved, parents that are going to implement some sort of reprimand if they didn't do well in their report card. You know, they value their education, they want to go places. The students that don't really care, their parents are not involved, you know. I have a couple of students that will get off task, but the minute you speak to Mom, you know, two days later [because of alternating A/B day class scheduling], they're fixing their attitude. (Interview, Winter 2018)

The impact that fostering partnerships had in both schools was beneficial as they developed relationships in their great local communities.

Engaging external community members. The STEM education grant program provided invaluable access for students to connect with community members that volunteered their time. The STEM professionals offered insight into their educational paths and their career choices.

Dr. Stith expressed the value of the sustained connection that the STEM education grant offered because the engagement extended beyond the parameters of most programs that only consisted of one isolated meeting (e.g., Career Fair, Career Day). She remarked

about partnership with the external community members by likening the professionals to valuable "fixtures in a building." She painted a verbal picture of STEM professionals as

> A fixture - to where if I [a student] have the interest in this, if I'm doing my STEM project, I should be able to touch virtually…to ask you questions about what I'm investigating in STEM…I just need to call you because I need to know why is there a decline in honeybees, or how does the decline in honeybees impact, um, the world as a whole? Those are things that as in education we should be doing. (Interview, Winter 2018)

The principal supported the ongoing virtual interaction that STEM education grant secured. The teachers in her school also saw the usefulness in the STEM courses they taught and content they delivered by arranging to have participating STEM professionals visit their classes virtually.

The researcher observed several virtual visits between the STEM professionals and STEM classes. The students were extremely excited to participate in the exchanges to have the opportunity to show off the open-ended designs they created and to ask STEM professionals questions. During a virtual visit between Mrs. Little's class and a Black female STEM professional, Terry, the students eagerly posed questions about a range of career-related topics. Mrs. Little arranged for each of the 24 students to have a laptop computer to access the virtual meeting with Terry, who was joining from a state in the western region of the United States.

The students asked questions about Terry's educational path and the responsibilities of her job as a clinical program manager in the field of full genome sequencing technology. Terry offered insight regarding her career's impact on the lives of children in the United States, and the global health community. She also explained the importance of giving back to her community, as a former resident of the state in which

the class members currently live. Terry shared her future career goals and connected it to her belief that the children should strive to do their best in school at the time of the study and in the future as they continue becoming lifelong learners. The students were impressed by how Terry's educational journey, which included her bachelor's degree in biology, and two master's degrees in business administration and project management, and her professional story were interwoven into a personal narrative that both reflected their reality and motivated them to achieve in their education.

This level of access was an invaluable experience for the students. It showed the importance of engaging with the greater community in a way that made use of the different resources available. This type of commitment was also evident at Harris Middle School.

Mr. June highlighted the importance of working with community partners for teachers, families, and students. He described the many relationships he had built over his seven years as principal of Harris Middle School and the usefulness of the different perspectives that the partnerships added.

The teachers at Harris Middle School also saw the advantage of sharing the STEM professionals' narratives with their students. Mr. Conway used the storyboards that each STEM professional created to introduce his classes to William, the medical technology physicist with whom he collaborated before they met him online. Mr. Conway explained how equally important it was for students connect to with STEM professionals of color who may share similar social backgrounds as theirs. He detailed:

> I think the major benefit is just the fact that there was someone who looks like you who is in it. So it can be done. They may have a similar background. Many of the students that I teach are in family situations where they're either living with

> one parent or an extended family member and to see that there's a scientist who comes from that same situation but has been able to become that scientist, engineer - that gives them hope. Or even just the fact that hey, it's possible in spite of what your circumstances are. (Interview, Winter 2018).

The personal connections that students were able to make with volunteers who were invested in their future, even when from afar, were meaningful and motivating. The principals also believed it was important to align their efforts with other external partners, specifically from the educational research community, to develop their organizations.

Connections with external experts. Dr. Stith reminisced on her first few weeks as Fleming Middle School's principal, when the STEM education grant research associate approached her about the continuation of the program and asking about the ways Fleming Middle School might be able to support it. Overwhelmed at the time by everything that consumes a new school administrator, Dr. Stith admitted that initially, she added the request to her long list of tasks to return to at a later date. However, the moment she learned it was a project of the participating HBCU, she prioritized it and was willing to do anything in her power to support the collaboration.

Dr. Stith immediately agreed to arrange for the use of Fleming Middle School for the three-day long professional development for all of the grant program's teachers, professionals, and research team to attend. She also volunteered to host the Spring exhibition event in the second implementation year so that teachers could share their students' work with each other and the school communities. Dr. Stith, who is an alumna of the HBCU, knew firsthand the level of commitment that the institution had demonstrated to the greater metropolitan region in which both schools are located. She also knew of the historicized legacy of social justice that the university had since its

founding in the late 1860s. Dr. Stith knew this connection to a local external expert would lead to benefits for Fleming Middle School's teachers and students.

The engagement with the external community had an encouraging influence on the students at Fleming Middle School. Ms. Crewe, the seventh-grade science teacher, reported that the students "love[d] the fact that they were affiliated with [the HBCU] now because a lot of them want to go there…A lot of them have asked me if we could go to [visit] [the HBCU] or an engineering field trip" (Interview, Winter 2018) This meaningful engagement was equally beneficial for the teachers who participated in the STEM education grant program.

The researcher observed the in-person professional development that was hosted at Fleming Middle School. During the event, teachers enjoyed having the time and resources to plan class units, complete design challenges in groups, and collaborate with STEM professionals to develop lessons that aligned with their course content. The groups worked diligently to align the lessons they created with both the district requirements and national standards (e.g., Next Generation Science Standards). They shared every product that they created with each other in person and by uploading them to an online sharing portal so they could access them on demand as they needed them throughout the school year. Teachers from all four of the STEM grant programs attended, and Dr. Stith visited during the three-day event to welcome participants, offer her support, and observe the professional development that occurred. Her beliefs about the value of the program were confirmed as she saw the work that was taking place in the professional development and in the participating teachers' classrooms during the course of the school year.

Mr. June also believed in the value of connecting teachers and students with members of the external research community. He began a summer program for students that was led by faculty and students from another local HBCU. Mr. June cited:

> Last year we had a summer STEM [program] sponsored through Richmond State*…which focused on engineering tasks and so we also will have the program again, but the district has picked it up. So being intentional about who's in those programs would also be, you know, important. (Interview, Winter 2018)

Harris Middle School's engagement with the local university also aligned with the school district's renewed commitment to preparing students for their future.

The district recently established a Career & Technical Taskforce to "provide an internal evaluation of the quality of the programs provided to KCPS students." (Document, 2017). The task force launched surveys to solicit feedback from the business, parent, and student communities regarding the extent to which the district was successfully working towards its vision of a "rigorous, robust, and cutting-edge career and technical education system… [that would] prepare [the district] for the economy of the future. The taskforce's resulting report echoed the critical nature of establishing partnerships with the external community to respond to labor markets and develop globally competitive career and technical education programs. It also outlined the importance of developing curricula that advanced the current instructional goals.

Improving Instructional Program

Assertion four: <u>Principals work to improve instructional programs by (a) observing classroom instruction; and (b) providing constructive feedback to teachers.</u>

The practices accounted for in the *improving instructional program* domain and the *securing accountability* domain indicated how the principals exemplified social justice through instructional leadership strategies. As the principals observed classroom instruction, offered related feedback, and aligned their school's targets with the district's STEM education goals, they established an instructional culture that supported Black girls in an environment devoted to STEM education.

Observing classroom instruction. Instructional fidelity is an essential component of a school's infrastructure. Both principals engaged in this critical aspect of their school by being present and offering constructive feedback of the informal and formal settings of their schools.

Dr. Stith prioritized both informal and formal classroom observations. To take a pulse of the instructional environment, she held herself responsible for being aware of what her school's ethos portrayed about itself (e.g., building facilities, informal areas, etc.) by often asking herself, "Have I tapped into my culture? Let me go out in the hallways. Let me pay attention….How am I engaging the community?" (Interview, Winter 2018) Likewise, she engaged in classroom observations to show her commitment to the teachers and students.

Mrs. Little remarked about the influence of Dr. Stith's presence in the school and the classroom, and how it empowered students by reporting:

> When she comes in, she circulates the hallways. She goes into the classrooms, and she, you know, she peeks in. She lets the students know that she's here. She lets the teachers know that she's here. When she comes in [for] observations sometimes she includes herself in the lesson at times, which is really cool because it makes the teacher feel you know, less pressure. And the students really get to know her too by, you know, being in on the lesson and you know, being involved with it. (Interview, Winter 2018).

Teachers and students benefit from Dr. Stith making herself available on a consistent basis in instructional spaces in Fleming Middle School's formal and informal learning spaces.

At Harris Middle School, Mr. June spoke about the student-focused approach he had when he conducted classroom observations. He explained, "We make it an intentional thing where we do walk-throughs or learning walks to focus on them, the engagement of the girls and the boys, especially in STEM and science classes." (Interview, Winter 2018) This approach also had a motivating effect on the STEM teachers. Mr. June specified attention to the ways that girls were participating in STEM classes demonstrated his intentionality. The teachers at Harris Middle School also knew this was a facet of the classroom that was important.

The researcher observed a class that Mr. June visited for teacher evaluation. The teacher in the class was very excited to have received exemplary ratings for his delivery of a STEM-Communities lesson that he had developed in collaboration with peer STEM-Communities teachers and their partnering STEM professional, William. Mr. June's presence in the classroom showed his investment in the program and in helping Harris Middle School teachers improve.

Providing constructive feedback. Mr. June's feedback focused on how engaging the lessons were for the students. He also offered feedback to help the teacher improve. Dr. Stith also offered feedback in a way that encouraged teachers to improve their instructional practices. At Fleming Middle School, the researcher observed a faculty meeting during which Dr. Stith offered clarity on the logistics of classroom observations.

She guided the faculty members through the evaluation process in an effort to make the process less intimidating. The faculty members remarked that the meeting was beneficial because it offered insight and modeled Dr. Stith's leadership in a way that reflected her genuine commitment to helping them improve as educators. She also demonstrated, using one educator as an example with their permission, suggested strategies that they could use to improve instructional practices. Dr. Stith was invested in scaffolding educational excellence at her school by developing instructional qualities that would benefit all of her students.

Dr. Stith detailed the components of the observations that were required as a part of school district mandates. She expressed her confidence that the educators would perform well on the evaluations because they were being assessed on successful instructional practices that they were already undertaking. The act of providing feedback was a leadership responsibility that aligned with the school district's requirements for essential leadership practices to secure accountability.

Securing Accountability

Assertion five: Principals secured accountability by aligning their schools' targets with those of the school district in ways that provide STEM educational opportunities to Black girls.

Align school targets with district targets. Both principals demonstrated their allegiance to the school district's expectations. They detailed some of the plans the district had and how their schools were working towards or involved in accomplishing those newly-set goals.

Dr. Stith acknowledged that the practices the STEM education grant program offered teachers aligned with the direction that the school district had in mind for the near future. She added that while the district was in the process of reaching this goal, it was advantageous for teachers to have access to professional development that helped them

> hone their skills,...understanding, and how they practice when it comes to science, technology, engineering, and mathematics…[since] as a district, that's something that [they] have touched based on and [they've] worked toward, but it's not something that [they] really have honed in to. (Interview, Winter 2018)

The explanation that Dr. Stith offered mirrored the first tenant of the KCPS STEM mission which proclaimed that the district department worked:

> To provide to our students, staff, and partners high quality, rigorous and authentic learning experiences designed to promote the creation and implementation of effective STEM education that results in outstanding academic achievement for all students. (Document, 2017)

Mr. June similarly relayed the district's plans with which Harris Middle School was continuing to align its instruction. As Harris Middle School was one of two designated middle schools in the district, there were plans in place to fully integrate STEM for all students in all of their classes. Mr. June divulged:

> We don't limit the students who take STEM. So you don't have to have a particular grade point average or anything like that to be signed up for STEM classes. And the district has supported the school by adding additional staffing which has allowed us to add additional courses. And the vision for the school is for us to be a STEM school – a complete STEM school with - utilizing STEM instructional strategies in all content areas. (Interview, Winter 2018)

His claims were in accordance with the second tenant of the KCPS STEM mission statement that stated that the department sought:

> To create ecosystems of question posing and problem-solving where students experience connected learning across disciplines that prepare them for life, college and career in our ever-changing global society. (Document, 2017)

The researcher spoke with the district's science instructional specialist to learn more about its intentions. The district personnel confirmed that they planned to make the STEM designated middle schools, including Harris Middle School, model schools so that other middle school could build similar programs. She also confirmed that they intended to comprehensively integrate STEM across all disciplines and that they were moving towards having each middle school in the district operate using that instructional approach. (Interview, Winter 2018)

Both principals' aims to mirror KCPS's goals for students and educators helped them define school cultures in which Black girls were considered in STEM education initiatives. They also operated with an understanding of Black girls' position in society as students who were doubly marginalized because of their race and their gender.

Research Question Two Findings: Intersectional Positionality of Black Girls Affect on Leadership Thinking

Endeavors to liberate Black girls from the historicity of two-fold oppression that they have faced was reified by the principals at Fleming Middle School and Harris Middle School. Both principals paid specific attention to the intersectional needs of Black girls by providing opportunities for them.

Assertion six: Principals consider the intersectional positionality of Black girls as they support their development through the STEM education pipeline.

Intersectional Lens

Dr. Stith referred to the unique needs of Black girls as she took heed of the inherent risks of focusing solely on Black boys. She observed:

> At one point we talked about the danger of African-American boys, and we talked about how Black boys were an endangered species in education. But now, over the last probably two or three years, that is starting to shift because we did this big campaign around Black boys, and we need to keep them in school, we need to keep them out of jail lesson, you know, get them to read….We're now facing - some of our African-American girls are falling by the wayside, and they're just getting lost in the process. So it is important that - not only with just STEM-Communities - just as a whole, we need to be very more aware of how we're impacting Black girls. (Interview, Winter 2018)

District documents encouraged and outlined opportunities, such as the Women in Engineering Program, that were being offered for middle school girls in conjunction with the school of engineering at a large local public state university. The program was offered as a way to "recruit, retain, and advance women in engineering." (Document, 2018)

Mr. June's attentiveness to the intersectional needs of Black girls was exhibited by way of his support of similar programming. He shared how the girls at Harris Middle School were supported in field trips that were designated especially for them. He detailed how, "the [local military university] does something there to increase their [Black girls'] awareness of exposure to STEM. (Interview, Winter 2018). Accompanied by the school's STEM coordinator, Mrs. Windsor, girls from Harris Middle School attended the program year after year.

Mrs. Windsor explained that she prioritized the importance of girls having access to opportunities in the local higher education community that could pique their interests STEM fields. She explained that she stood in as a family liaison for the group of girls each year and attended the parent session to learn about ways to engage the girls in STEM education in preparation for college. The intentional methods that Harris Middle School utilized to expose Black girls to STEM education were put in place to support their success in the pipeline.

Assertion seven: Principals embolden Black girls through STEM programming and partnerships with educational research communities that secure access to professional mentorship for teachers and students.

STEM Programming that Emboldens Black Girls

Both principals offered STEM education opportunities at their schools. Fleming Middle School implemented inquiry-based learning in their STEM classes as a strategy for scaffolding a well-rounded approach to learning the course content. Students also had the option of participating in the Science Bowl team; at the time of study the majority of the team members were girls and they had recently placed in the local competition.

Even with these tactics, Dr. Stith believed there was more that could and should be done on behalf of Black girls in STEM programming at Fleming Middle School. She admitted:

> So we definitely have some work that we could be - where we can open up the opportunity. We're also not being very deliberate and focusing on that body of people - so like, we're teaching the whole body, but then there's a group that we all talk quietly about that we want to expose more of this to, but we haven't done the work to be able to do that…We should have something like Black Girls Rock with STEM, or Girl Power instead. We should have some type of club that these girls do need where they're actually having an opportunity to be one-on-one with an engineer. We need that type of interaction with girls. So the girls right now, they're exposed in the inquiry-based environment, but it's just still at a more general level. It hasn't gone deep enough. (Interview, Winter 2018)

Dr. Stith's thinking around providing more opportunities for Black girls was a deliberate component of STEM-Communities. She recognized that Black girls needed more programming that would engage them in STEM in innovative ways. The connection to

hands-on innovation that Dr. Stith was driven to include was accessible in STEM-Communities.

Ms. Crewe shared her excitement about the exposure that STEM-Communities secured for the Black girls in her class. She said that it positively impacted their drive to do well in classes. In relation to their previous work ethic, Ms. Crewe compared:

> I think they're being exposed to engineering and before I think if you [they] just heard the word engineering, they wouldn't have been even interested. I think now being able to do things hands-on and work through problems they are getting the sense that they can solve engineering problems, that you [they] don't have to be the best at math to do an engineering problem, and you also don't have to love science to do an engineering problem. Engineering is its own thing that relates to both, but it is its own entity. I think having the connection to engineers shows them other - like, engineering is not just one job. There are probably thousands! (Interview, Winter 2018)

Ms. Crewe's contagious excitement about what her students gained access to through her participation in the STEM-Communities was exemplary of the common sentiment regarding the program at her school. The principal and teachers were glad to be able to add it to the list of opportunities they secured for their Black girls.

At Harris Middle School, Mr. June reflected on the ways that Black girls are encouraged in the school's STEM programming. He highlighted the importance of exposure for them to possible STEM careers and how the school's opportunities provided access.

> We have special emphasis on girls, our Queens. There's a girls' coding class or coding group that meets after school. We've had several STEM after-school groups, um over the years. We've had underwater robots. We've had um, [statewide STEM achievement competition], and not only have they been after-school, but they've also gone out and competed um, with other schools in these different areas. (Interview, Winter 2018)

Documents reported how the many opportunities that Harris Middle School included in its curriculum intentionally focused on students with intersectional identities. For example, the statewide STEM achievement competition in which the students participated was established to: (a) support students statewide to prepare them to enroll in and graduate from a two- or four-year college or university with a degree in a STEM field; and (b) target students who are traditionally underrepresented in these fields – specifically minority and female students. (Document, 2018) The program, which was sponsored by the applied physics laboratory of a large local private university, provided access to inquiry-based exploration of STEM challenges. Similar experiences were made available to Black girls through their participation in STEM-Communities.

STEM-Communities Programming that Supports Black Girls in STEM Pipeline

There were several deliberate choices made in the development of STEM-Communities that considered the needs of historically underserved student populations. The principals at Fleming Middle School and Harris Middle School considered this intentionality as they supported the implementation of the program.

While she was only in her first year as principal of Fleming Middle School, Dr. Stith's depth of professional experience in the school district informed her understanding of what the student population at her school needed. Dr. Stith believed:

> I have a body of students, who are African-American females, who are Black girls, who really enjoy science…I think the middle school is just a place that should be a like a platter of opportunities to touch and do a variety of things. So bringing STEM-Communities in will give them an opportunity to be exposed to an inquiry process project, [and] other professionals in STEM, you know. I think that with Black girls as long as they can see women of color doing something positive and in a particular direction, it helps them to have an ability to just do something or dream about something different than what they're in right now. And so, STEM-Communities can open up the opportunity for more Black girls to

> be in STEM and I think that that is important for them to know. (Interview, Winter 2018)

Ms. Crewe described ways in which Black girls connected with the inquiry-based design challenges embedded in STEM-Communities in a meaningful way. She detailed how it helped the girls engage in new ways. Ms. Crewe reported:

> I found they enjoy the engineering challenges and girls that maybe just sit in class and do nothing are very engaged and motivated in the engineering, and a lot of them take on leadership roles…They really focus on that challenges themselves. Um, especially when it's a competition, like who's going to win. They, they like that. (Interview, Winter 2018)

The STEM programming made a difference in Black girls' levels of participation. They benefited from course content and the type of instruction which challenged them to work collaboratively to answer questions and solve problems.

At Harris Middle School, Mr. June had a clear vision about the value of career readiness for Black girls. He believed that the intentionality around careers and witnessing what a "STEM education could possibly lead to" was a paramount component of the STEM education grant program. (Interview, Winter 2018)

Mr. Conway saw the same value in including engaging STEM-Communities in his technology courses. Reflecting on its worth, he echoed:

> I think the professionals that are in STEM-Communities provide an opportunity for the kids to see that, 'Hey, my previous view of what a scientist or an engineer looked like is totally different than the person who's in front of me or I'm Skyping with, and that that could be me!' (Interview, Winter 2018)

The teachers and leaders' attitudes towards career exploration also focused on the importance of representation. They felt that it was equally important for Black girls to

benefit from having a sense of identity-oriented connection to the mentors with whom they connected in the program.

Assertion eight: <u>Principals consider the social and academic needs of Black girls as they develop school programming that prepares students for success in the STEM pipeline.</u>

Evidence of Thinking about Black Girls' Social and Academic Needs

Both principals recognized how important navigating the academic and social nuances of the STEM pipeline was for Black girls. Dr. Stith confirmed this reality by unpacking the multiple layers of access that Black girls had to face along their possible journey to STEM careers. As she reflected on the notion of access to STEM professional of color for Black girls, Dr. Stith highlighted the importance of the

> … socializing of intelligences, and making sure, to be able to sit down with a professional in a certain realm, and have a conversation about something is definitely going to impact anybody.…I don't think that people realize how much they influence others due to the socialization that you have between two people. The other thing is that being able to have STEM-Communities in a predominantly Black school is always going to impact those majority of the people that they service. So clearly here at Fleming Middle School, when you have STEM-Communities that's backed by an HBCU, and then also you have people of color who are presenting alongside with people not of color, it helps not only the teachers to see what's possible, but it also helps to influence the mindset of those teachers who then impact and influence those Black girls that they see on a day to day basis....So I think that that side of it would also continue to bring in some influence and would probably move girls of color more in the direction of STEM. (Interview, Winter 2018)

Dr. Stith's emphasis on the social and academic dynamics that Black girls have to navigate, highlighted the uniqueness of their position. She expressed value in the work

that teachers, STEM professionals, and research team did with and on behalf of the students.

Mr. June also discussed how the unique position of Black girls necessitated the school's programming that supported the whole child. Specifically, he believed the school's approach, which included counseling groups for girls, academically-focused extracurricular activities, and intentionality around career-readiness, helped the girls' successfully engage in the academic and social intricacies of the STEM pipeline. This reality was reflected in teachers' work with the Black girls.

Mrs. Windsor reported that the work that she did with girls at the military academy, as well as in her previous STEM classes, affirmed the needs of girls in STEM education. She said that in both cases, it was clear that girls were more engaged with assignments that involved an emotional connection. Mrs. Windsor noted that, when working with Black girls, lessons worked best when they pulled at their heartstrings. For that reason, she developed lessons related to societal challenges and health issues because "they were more committed to working at coming up with solutions" (Interview, Winter 2018)

Similarly, Mr. Conway admitted how his awareness of Black girls' social and academic needs was heightened through his work with students in the context of the program.

> I believe it [STEM-Communities' impact] has opened my eyes to how empathetic they can be. And then it's also allowed them to see themselves as scientists and engineers. With having an introduction to engineering class at the school I'm at, many of them have never met or seen people who are engineers or scientists. (Interview, Winter 2018)

Developing a program that purposely considered the needs of Black girls resulted in an all-inclusive pedagogical to STEM education. The intentionality regarding educational access was also a critical part of the program that principals considered.

Long-term Thinking about Black Girls' Educational Access

Both principals expressed long-term goals they had in mind for each of their schools to support Black girls. They discussed the critical nature of sustainable work in the STEM field. Dr. Stitch elaborated:

> that [the] relationship we build between the community and school, with women of color in those professions, is what will actually ultimately impact. So what has to happen is we have to start having more conversations. I don't know if it needs to be where you have a forum where you have - and this might be an idea for [HBCU] - where we have forum where we have professionals of STEM women, women of color of STEM, and women of color in leadership and education, where we two come together and then begin to build the relationship of what that would look like. Because we, we're not getting any more money, okay, so nobody has any more money. However, we have a lot of human capital resources that we're not maximizing and so it has to be at a point where we say these two [groups of] women must come together in order to influence the women, Black girls, period. And I think that that has to happen….I would love for STEM-Communities, that to be the next step, where you begin to bring those two bodies together, and we say, 'Okay, so what does our work really need to look like?' Because we have the venue, you all have the content or you have the resource. So we have a place where the work can happen, you will have the resources that're needed for the work to happen. And until the two meet, we will always be having this conversation. (Interview, Winter 2018)

Mrs. Atkins reiterated the importance of developing a sustainable culture of collaboration among committed STEM-Communities members. The expressed the importance of building on the established foundation in a way that provided tangible models for Black girls. She suggested:

> I think it's always good to have concrete examples, and I think the connection of engineers, especially Black engineers to students at this great level helps them to see that you know science exists outside of the textbook, science or technology exists outside the laptop, there are real people who look like them who are you

> know, working making decent money, you know making good money um, you know, being smart, and they're still doing well. (Interview, Winter 2018)

The essentiality of continuous support of Black girls was ingrained in the sentiments expressed by and work of teachers and leaders at Fleming Middle School.

Mr. June forecasted the resources that would help Black girls in terms of tangible resources. He expressed how meaningful it would be to create a sustainable method of tracking Black girls' progress through high school and college. He believed that understanding who remained in STEM higher education degree programs, and what kept them interested, could produce data that in turn informed the type of exposure he and his staff should and could offer at Harris Middle School.

Efforts related to this type of follow through were detailed in the documents produced by the district's career and technical education programs. These programs, which were established to enable students to obtain professional experience and earn college credit while in high school, offered students early access to a diverse range of industries. The school district's commitment to nurturing students' interests helped them move towards informed and fulfilling careers in the STEM pipeline.

Summary of Findings

The findings expounded upon in this chapter provided insight into the thinking and related practices of school leaders. The eight assertions presented reflect a comprehensive analysis of data gathered from participant interviews, site observations, and documents. The researcher synthesized the data and opined the constellation of assertions as a representation of the work that is done to secure STEM educational opportunities for Black girls.

Research Question One: What is the nature of leadership practices that support Black girls in the context of implementing a federal-funded STEM education grant?

Assertion one: Principals prioritized setting the direction of their schools in ways that supported Black girls in the STEM pipeline by: (a) encouraging the development of organizational norms that support openness to change in the direction of that purpose or vision; and (b) devoting additional effort to creating high expectations among staff on behalf of and for the achievement of historically underserved students.

Assertion two: Principals establish and maintain relationships and develop people by: (a) encouraging staff to pursue their own goals for professional learning and try new practices consistent with their own interests; and (b) encouraging staff, students, and parents to listen to one another's ideas and genuinely consider their value.

Assertion three: Principals develop schools to support desired collective practices by: (a) engaging students' families; (b) engaging the school's external community; and (c) developing and maintaining connections with members of the educational research community.

Assertion four: Principals work to improve instructional programs by (a) observing classroom instruction; and (b) providing constructive feedback to teachers.

Assertion five: Principals secured accountability by aligning their schools' targets with those of the school district in ways that provide STEM educational opportunities to Black girls.

Research Question Two: How does the intersectional positionality of Black girls in the STEM pipeline influence school leaders' thinking about practices to support the implementation of a federally-funded STEM education grant?

Assertion six: Principals consider the intersectional positionality of Black girls as they support their development through the STEM education pipeline.

Assertion seven: Principals embolden Black girls through STEM programming and partnerships with educational research communities that secure access to professional mentorship for teachers and students.

Assertion eight: Principals consider the social and academic needs of Black girls as they develop school programming that prepares students for success in the STEM pipeline.

Chapter 5: Discussion, Conclusion, and Recommendations

The purpose of this study was to examine the influence of two principals' leadership on Black girls' educational experiences. Specifically, the research investigated the nature of the principals' thinking and actions in the context of a STEM education grant. The unique conditions of the educational program provided a setting in which the researcher could comprehensively explore the extent to which principals consider the societal position of Black girls in their work. In particular, Black girls' arrant underrepresentation in the STEM educational and professional pipelines served as a distinctive contextual background to conduct this work.

Research highlighting principals' practices has long explored the effects on children learning in the schools they lead. Well-established explorations have explained the ways that school leaders scaffold institutional environments by engaging educators in work that holistically nurtures students (Hallinger & Heck, 1998). The leadership that principals enact on behalf of all of those who they serve makes a difference for the young individuals whose lives are entrusted to leaders' care (Hallinger, Bickman,& Davis, 1996). Further, in the STEM education genre, empirical research illuminates how instructional strategies influence students sustained success in the field.

While scholarship has slowly expanded to elucidate administrators' impact on different demographic groups, there is a gaping lacuna existing in relation to exploring the ways that they influence the education of one group of students who are doubly marginalized: Black girls. The unequivocal fact that the historicity of oppression and

privilege has collectively affected students in different ways, signals to many the necessity to thoughtfully address different student groups' positionality in society. Literature that prioritizes Black girls has slowly been established as the field of Black girlhood studies (Evans-Winter & Esposito, 2010; Grant, 1984; Morris, 2007). However, there is a paucity of scholarship that synchronously explores the reciprocal nature of principals' practices and Black girlhood.

The research conducted in this study examined two questions related to principals' work. Grounded in one leadership framework, one leadership theory, and one identity theory, the study addressed the concomitant influences of educational administration, social justice leadership applications, and the intersectional realities of Black girls' lives. This chapter summarizes the ways that the study's findings respond to former scholarship in a manner that advances the educational and social needs of Black girls. The chapter begins with an exploration of demonstrated practices that embolden Black girls in STEM education. It then positions the needs of Black girls in an explication of principals' thinking and actions. Then, the chapter presents the implications in a way that privileges them in educational administration scholarship. Finally, it concludes with recommendations for future research in an endeavor to call scholars and practitioners to action.

Summary of Findings

To ascertain the extent to which school leaders consider Black girls historical disposition in the STEM pipeline, three types of data were collected and analyzed. The data provided a rich source of perspectives to establish a synthesized explanation of two

principals' work. The relationships between the data obtained from the interviews, observations, and documents studied were used to answer two research questions.

Research Question One: What is the nature of leadership practices that support Black girls in the context of implementing a federally-funded STEM education grant?

The paramount findings of this study demonstrate principals' leadership of middle schools in ways that secure access to STEM educational opportunities for Black girls. Principals support Black girls' education by constructing and maintaining the schools' directions. The directions that leaders set operationalize social justice leadership when they establish organizational norms that foster high expectations among staff for historically underserved students.

School administrators distribute the responsibilities of social justice leadership when they prioritize the professional development of staff. By supporting teachers in the pursuit of professional goals that offer enhanced STEM education for Black girls, leaders delegate agency to others. Principals also value the curriculum that is informed by parents and students aims to create supportive and culturally relevant pedagogy. School administrators distribute leadership throughout their school by fully engaging families, including relevant STEM professional communities, and partnering with the broader educational research community to actualize a school culture that values Black girls' success in STEM education.

As instructional leaders, principals improve the pedagogical programming in their schools by monitoring Black girls' engagement in classrooms and offering support for improved educator practices. Finally, school leaders align their schools' goals with those

of their school district to implement STEM educational opportunities for Black girls. Designing the instructional substructure with Black girls in mind likewise achieves social justice leadership goals because it privileges their needs in meaningful ways.

This study expounded upon the leadership practices outlined in the Ontario Leadership Framework (OLF) (Leithwood, 2012) by specifying which actions were enacted with consideration for Black girls' positionality in the STEM pipeline.

Research Question Two: How does the intersectional positionality of Black girls in the STEM pipeline influence school leaders' thinking about practices to support the implementation of a federally-funded STEM education grant?

The essential findings that revealed how principals' thinking is influenced by Black girls' intersectional place in the STEM pipeline were indicative of the social justice leadership that school leaders should do on behalf of students. The results of this study indicate that school administrators do in fact consider what Black girls need based on the effects of long-term oppression as both Black and female. Principals also distribute social justice leadership by collaborating with others who provide industry relevant, culturally relevant, and academically relevant perspectives. Lastly, school administrators lead the instructional programming using strategies that prepare Black girls long term for the STEM pipeline.

While there exists literature that articulates the influence of school leadership (Leithwood, 2012), the essentiality of Black girlhood studies (Owens, Callier, Robinson, & Garner, 2017), and the impact of STEM education in their siloed disciplines, little, if any, scholarship addresses the functions of each in relation to the others. In this contemporaneous study, it is evident that the three fields indeed influence each other in

meaningful ways. These findings corroborate examinations that detail the type of support Black girls need, including school culture and professional capacity building practices of school leaders (Watson, 2016). Likewise, scholars have identified the intersectional positionality of Black girls in society (Crenshaw, Ocen, & Nanda, 2015) and recommended what educational leaders need to understand about their lives as they scaffold schools and educational opportunities to support their sustained success and livelihood. The current study's findings similarly substantiate the ways that thinking about the use of social justice leadership lens supports Black girls in STEM education.

Empirical research has cataloged what Black girls experience in schools, and subsequently what principals should enact to support these doubly marginalized students. However, there is no evidence in the literature of a study that has zeroed in on a specific educational discipline where these students are grossly underrepresented. By purposefully examining principals' thinking and practices in the context of a federally-funded grant, the results of this study demonstrate how school leaders secure STEM educational opportunities that positively influence Black girls' academic and social experiences. As principals develop relationships with school and community stakeholders, and as they support access to programs that privilege the intersectional position of historically underserved students, they embolden Black girls to succeed.

Nature of Leadership Practices

By further contextualizing direction setting practices with considerations for what is socially just in different school settings, leadership researchers and practitioners can situate their work in ways that more preferably enrich students' lives.

Social Justice Leadership

This study's findings add depth to the research found in the larger context of school leadership research. Hallinger, Bickman, & Davis (1996) demonstrated the positive statistically significant relationship that existed between principals' leadership and the schools' stated norms. The two principals that were studied in the current study also demonstrated an ability to influence organizational norms. Specifically, they shaped school norms that privileged Black girls' needs in ways that were similar to the measures assessed by Hallinger et al., such as school mission and instructional leadership. Both sets of results aligned with Goldring & Pasternak (1994) and Heck (1993) who championed the role and impact of leaders setting and promoting clear goals for schools. The specificity of the current study's results stretches the former literature to more deeply consider the influence of this leadership practice on each demographic in schools.

Distributed Leadership for Social Justice

The distributed nature of social justice leadership was demonstrated in two ways in the current study which both build on previous research. Bredeson and Johansson (2000) analyzed data gathered from policy reports, standards documents, focus groups, and 48 interviews to enumerate four ways that principals can engage in teacher learning. Among their findings, the researchers detailed principals' roles in establishing a professional learning environment and including teachers in that process. The current study of Fleming Middle School and Harris Middle School included examples of principals not only investing in the professional development of the schools' teachers but also encouraging staff to lead in it. Teachers' commitment to and principals' distribution of leadership within a program that intentionally centered empowerment of students and

professionals of color, demonstrated the importance of school leaders' valuing teachers' professional development in the ways that Bredeson and Johansson articulated.

Secondly, the distributed nature of social justice leadership was realized in the current study through the two principals' engagement with and on the behalf of their schools' families and students. Spillane, Halverson, and Diamond (2004) designed a framework for distributed leadership that has been used to conceptually bolster investigations of school leaders' actions that were informed by the context and contextual stakeholders. The results of this examination of principals' actions related to a specific student population, corroborated Spillane et al.'s articulation of a focus that uniquely places constituents' unique, in this case intersectional, position at the forefront of leadership work. The distributed leadership conceptual framework, which included the leaders, followers, and situations over time, acknowledges the influence of each component. Similarly, this study reflects the theory by highlighting two principals who use their awareness of their situation (e.g., school and local context) and followers (e.g., student groups, parent groups, Black girls, etc.) to make a sustained difference in their lives over time.

Equally, related findings from this study that demonstrate the benefit of partnering with the larger community, operationalize what Spillane, Halverson, and Diamond (2004) describe as the social distribution of task-enactment. In their longitudinal study of 13 schools, Spillane et al. observed how leadership was stretched over many people and constituent groups in a school's social network performing several tasks. Studying the thinking and actions of leaders in the context of a federally-funded grant produced results that show how a number of stakeholders (e.g., families, teachers, government

organizations, industry professionals, etc.) work to improve the educational experiences available to schools. This can extend the understanding of all groups involved in ways that improve their practices and the reach of their contributions to the community.

Instructional Leadership for Social Justice

Previous scholarship illumines the role that principals fulfill as instructional leaders in schools. In large-scale study results of 809 teachers' responses to an open-ended questionnaire, Blase and Blase's (2000) presented two effective instructional leadership themes and 11 embedded strategies. Of the findings the researchers presented, the overall propensity of principals to talk with teachers to promote professional reflection was also evident in the current study. Analogously, in the study of Fleming Middle School and Harris Middle School, the school leadership observed classes and offered feedback to teachers to assist in their continued progress. Both sets of results indicate the advantage of principals engaging in instructional improvement. The current study advances the previous research by opining that focus on one student demographic will lead to reflection and understanding that enhances the educational experience of others.

Critical Race Design

The principles of Critical Race Design (CRD) provide a sound theoretical foundation for interpretation of the school leadership that was enacted at Fleming Middle School and Harris Middle School. The principals' thinking and practices operationalize what Khalil & Kier (2018) prioritized in their design-based, equity-centered interpretation of STEM education. Specifically, their work is aligned with the CRD principles that Khalil and Kier have explained are rooted in the tenets of Critical Race

Theory (CRT) (Bell, 1995): (a) critique of liberalism; (b) interest convergence; and (c) counter-storytelling.

Critique of Liberalism

A synthesis of the assertions presented in the current study, reveals how they are in tandem with CRD. Khalil and Kier's (2018) construal of the critique of liberalism counsels:

> When designing community partnership with schools, the goal is to attend to the historicity of minoritized students by taking a race-conscious approach when identifying stakeholders as collaborators. Stakeholders may be 'hidden' or leading figures from communities of color and/or allies from local neighborhood companies that can counter ahistorical rhetoric or merit and neutral education spaces (p. 60)

The third and seventh assertions of the current study demonstrate the power of intentionally critiquing liberalism. By developing a partnership with the broader research community specifically (Assertion three) at a historically Black higher education institution (Assertion seven), the principals counteracted racial and class-based neutrality. The principals' support of engagement with a university that consciously promotes educating Black students operationalized their commitment to the critique of race-neutral approaches to education.

Interest Convergence

The benefits of the student-centered focus of STEM-Communities demonstrates the importance of developing strategies that chiefly prioritize Black girls' learning in an educational setting. Khalil and Kier's (2018) elucidation of interest convergence advises:

> When designing academically rigorous learning environments, the goal is to converge the interests of multiple dominant stakeholders around the interests of students. By centering minoritized students' interest as the foci, stakeholders

> need to iteratively devise ways to disrupt top-down, high-stakes technicist achievement measures, and re-converge interests on designing meaningful learner-focused practices. (p. 60)

Assertions one, two, four, and five articulated the results of this study that align with the second principle of CRD. As principals enact mission-driven work that privileges what Black girls learn and contribute (Assertion one), it positions the students as valued members of their school community and society writ large. Principals are able to accomplish their vision-oriented work by supporting teachers as they take initiative to learn new practices that fully consider the experiences of Black girls, and their families (Assertion two). In their instructional leadership role, principals also consider the interests of districts and students by focusing on what Black girls are learning in classrooms and holding teachers accountable for using engaging instructional practices (Assertion four). Finally, school leaders align their focus on Black girls with the foci of district initiatives in ways that uplift students (Assertion five). The second principle of CRD calls for the usage of diverse funds of knowledge to fully understand Black girls' needs. These resources can also be employed to counter the narratives that have been told about Black girls in schools for years.

Counter Story-telling

The Black female students at Fleming Middle School and Harris Middle School were emboldened by having their voices heard in the development of meaningful curriculum. The academic and social opportunities afforded to Black girls in the STEM education grant program reflected their unique experiences. The STEM-Communities design paralleled the recommendations of literature that endorsed the inclusion of Black girls' stories in a positive light as opposed to former scholarship that has solely

positioned Black girls' education in frames that problematized their learning. Khalil and Kier's (2018) explanation of counter-storytelling recommends:

> When designing classroom curricular tasks, the goal is to empower minoritized students by situating their everyday experiences and narratives as epistemological resources for solving authentic community problems. The narratives of students, as well as other stakeholders, serve to counter erasure of Black excellence by focusing on cultural assets and funds of knowledge of communities of color (p. 60)

The findings articulated in assertions six and eight of the current study illustrate the imperative role that counter stories have in Black girls' education. Principals acknowledge the double marginalization Black girls have historically endured as they advocate for their success in the STEM education pipeline (Assertion six). Likewise, principals consider the needs of Black communities as they establish educational spaces where Black female professionals can share their stories with Black girls in middle school so that girls are encouraged to excel throughout their time in the STEM pipeline (Assertion eight). School leaders' understanding of the dangers of a single-focused approach to eradicating what has historically oppressed Black girls, empowers them to make use of funds of knowledge that benefit Black girls.

The principals' support of STEM-Communities' intention of providing experiences that reflect Black girls' realities, helped them to dismantle the deficit-based rhetoric that is often specifically associated with doubly marginalized students. The findings in this comprehensive examination of what Black girls need to excel in the STEM pipeline can help school leaders and educational administration researchers secure meaningful opportunities for a diverse range of students.

Implications

The interpretation of this study's findings offers useful insight into the influence of school leaders thinking and practices on Black girls' access to STEM education. The current study corroborates educational administration literature that details how the context of schools influence the ways principals lead (Leithwood, 2012). Furthermore, mirroring claims made by Brooks, Jean-Marie, Normore, and Hodgins (2007), this analysis of the two middle school principals' work, showed how they lead for social justice, and distribute that responsibility over their organization and the broader community. Lastly, the strategies that principals used to lead the instructional practices of their schools garnered similar results as previous studies regarding the academic needs of Black girls (Bruning, Bystydzienski, & Eisenhart, 2015). Specifically, both this study and earlier research highlight the need for Black girls to have access to instruction that is relevant to and respectful of their own experiences (Gholson & Martin, 2014). The two principals' community engagement strategies demonstrated the advantage of being aware and making use of resources in order to develop pertinent learning environments for their students. This study echoed the importance of school leaders partnering with external education research collaborators and professionals with whom Black girls share an affinity.

It is important to expound on what the noted gaps in leaders' practices mean. While they may warrant concern if taken at face value, the specific nature of this study helps further support the distinction of leadership and pedagogical practices that particularly serve diverse populations of students. As this study showed the influence of Black girls' positionality on middle school principals' work, which practices were most

prevalent, and how they engaged school communities, there are implications for other student populations, and schools in different types of communities, writ large. The extent to which the practices that were observed less in this study, may appear more prevalent in other contexts, reveals the potential to further articulate a type of leadership that is patterned in nature. This leadership, defined as intersectional leadership later in this dissertation, is a proffered articulation of practices that specifically support students who live lives that are multiply marginalized.

While the research findings did align with Leithwood's (2012) emphasis on district accountability, it simultaneously illumined one difference between the local school district agenda and that of the STEM education grant program. The district's career-readiness taskforce outlined their interest in promoting STEM education as a means of providing advancement opportunities to students in the context of the local workforce demands. Conversely, STEM-Communities' motivations prioritized students' needs and interests in solving social problems in local and global context. The researcher's use of a critical, race-conscience research design enabled the recognition of this misalignment. By implementing CRD, each element of research included investigations of the ways that the historicity of race-based oppression and systems of privilege may have influenced the results. The resulting difference in the motivations of the principals and the school systems highlights a departure from previous research and indicates the need to further investigate the ways the two entities can better serve students collectively. A greater convergence in efforts can result in meaningful articulation of the power of supporting Black girls in STEM education. Further recommendations expound

upon efforts that can contribute to the practice and scholarship of educational administration.

Recommendations

The assertions drawn from this study of principals revealed how the nature of school leaders' practices is influenced by the historicized marginalization of Black females throughout the STEM pipeline. The following recommendations offer challenges in research and practice for: (a) educational administration researchers; (b) Black girlhood scholars; (c) school and district leaders; and (d) educational policymakers.

Recommendations for Educational Administration Researchers

These findings indicate how the experiences of students can and should inform the way that educational administrators lead. Research that examines the existence and extent of this type of influence across larger educational realms (e.g., school districts, state systems, etc.) should be conducted to continue promoting evidence-based solutions to historical school-based and societal inequities. Also, the work that was done on behalf of Black girls is needed for all historically underserved, or otherwise under-researched, populations, if educators and educational researchers aspire to equitably embolden students.

The data analysis that illuminated practices that were not often evident in the principals' work also provides an opportunity for further exploration. In particular, there is a need to determine if this work is evident in practices that principals enact when working on behalf of their entire student population. Likewise, it is essential to understand principals' thinking regarding other student populations. To that end, research should be conducted to identify the extent to which the practices outlined in the OLF that

were not as prevalent in the principals' work in this study, are influenced by students who live different intersectional realities.

This study also revealed some deviation between principals' motivations and approaches, and the impetuses promoted by school districts. As senior educational administrators (e.g., superintendents, curriculum coordinators, etc.) shape district policy, additional examinations are suggested to determine what influences leaders at higher levels. Research that expands to specifically investigate the ways that district-level leaders consider the histories of student populations should be executed, as it can preferably influence the establishment of equitable practices at broader levels.

Recommendations for Black Girlhood Scholars

There is also paramount need for more research that explores the differences in contextual-based educational leadership practices that impact Black girls' lives. In the current study, there were several examples of Black girls and parents articulating what they preferred as it related to their academic and social experiences in school. This research added to the continuously developing studies of Black girlhood that stress the importance of culturally relevant and responsive schooling for this particular population. This study adds credence to the scholarship that impresses upon educators the importance of this type of instruction. It also adds to the growing call for research that agentially privileges the voice of Black girls in educational fields. Past studies have provided Black girls platforms to express what they want and experience, however, there is a need to champion Black girls' reflections in educational leadership scholarly spaces and publications.

Recommendations for School and District Leaders

School leaders and district leaders should include historically marginalized student groups as they plan educational opportunities and policies. The taskforce in the district under study included some students; however, it was at a minimal level. This practice should be expanded at the school and district level to amplify students' voices and agentially register their experiences as valid and worthy of consideration in policy development. This change in practice will further operationalize and bridge the theoretical principles (e.g., CRD principle 3; Khalil & Kier, 2018) with the practical strategies that school leaders employ in situ.

Recommendations for Educational Policymakers

The final recommendation of this study is that school district leaders and broader education policymakers should review policies to examine the extent to which they perpetuate underrepresentation in the STEM educational pipeline. This type of investigation should include a longitudinal analysis of the effects of their established STEM education policies on students' success in related fields. Moving the success to the center of the explorations will juxtapose research that problematizes these students. The findings of the current study suggest the usefulness of including multiple stakeholders in research. For example, the principals offered school-level leadership perspectives, while the teachers and STEM coordinators explained how those leadership practices affected students at the classroom level. Furthermore, the district documents and input represented alignment and even points of distinction from what was reported in the schools. Future research on policy effects should include additional educational professionals (e.g., school counselors, academic specialists, etc.) to identify ways that

social justice oriented leadership can and should be distributed across educational contexts.

Recommendations for the Establishment of Intersectional Leadership Studies

Based on these findings, the researcher also recommends naming the field of study in which scholars explore the leadership of doubly marginalized student populations. The reasonableness of this study's recommendations lies in the logical and contextual importance of the research and practices that are being investigated. This articulation of what one might call intersectional leadership, endeavors to privilege the experiences of students, and the school leaders who work on their behalf, to demonstrate how stories such as theirs can be reified in ways that uplift historically underserved populations. As a practice, the researcher proffers the following definition for intersectional leadership: "to operationalize visionary strategies that privilege the experiences of followers who live the realities of more than one historically oppressed identifier." The researcher suggests that scholars employ it as they conduct future studies using other research methods (e.g., quantitative, mixed methods) to continue establishing the validity of this realm of educational administration.

Limitations

The research conducted in this cross-case analysis sought to thoroughly investigate the leadership that was operationalized at two middle schools in the context of one STEM education grant program. There are several limitations that are associated with this type of qualitative study. As is the nature of case study research, the findings are not generalizable to every educational setting that is similar to those that were under investigation because of the small sample size. While the results do offer insight into the

practices of the school leaders that were studied, it is not reasonable to assume the same is true for all principals of middles schools. The assertions that were made do not justify making any causal claims about contexts or practices that are analogous to those enumerated in the results.

There are also limitations related to the bias that can be present in qualitative work. The opinions of the principals and teachers may be influenced by the context of the study. The contextual factors that may have influenced the study's participants include the climate of the school and district. The collegial nature of the STEM education grant program may have also affected what the participants opine about their experiences as well. The use of district documents and conversations with district personnel helped reduce some of the bias. Resources that may have provided even more insight during the study to make it more well-rounded include members of the research team who assisted with implementation of the grant program, and other school-level administrators (e.g., assistant principals).

The study was also limited by the frameworks that were used. Although the OLF did provide an evidence-based scaffold for the study of leadership practices, this structure may have the researcher to overlook relevant data when conducting research using observations, interviews, and document analysis. Likewise, the use of critical, race-conscience theories may have resulted in inadvertent omissions during the analysis of results.

Conclusion

Essentially, this study demonstrated how Black girls' intersectional realities are and should continue to be considered as principals enact intentional leadership practices

for students from historically underserved backgrounds. Regardless of whether students' identifiers represent oppressed histories or not, their lived experiences inform their educational realities. As the study was grounded in a framework that operationalized an intersectional theoretical lens, the resulting assertions can influence work that school leaders, researchers, and policymakers do on behalf of all students. Finally, as opposed to perpetuating the deficit-based beliefs about the ability of historically underserved students, this study demonstrated the possibility and purpose of centering different student groups in ways that privilege their backgrounds, interests, and potential to contribute to their communities and society in meaningful ways.

Table 1

Ontario Leadership Framework

Attached as separate PDF

Table 2

Research Questions and Interview Question Alignment

Research question	Interview question
1) What is the nature of leadership practices in the context of implementing a federally-funded STEM education grant?	L5, L8, L9, L10, L11, L12, L13, L14 T9, T12, T13, T14, T15
2) How does the intersectional positionality of Black girls in the STEM pipeline influence school leaders' thinking about practices to support the implementation of a federally-funded STEM education grant?	L15, L16, L17, L18, L19, L20, L21 T18, T19, T20, T21, T22

Note. L denotes Leader interview and T denotes Teacher interview

Table 3

OLF and Intersectionality Practices

OLF Domains and Subdomains (Strands)	OLF Practices Extracted Using Intersectional Lens
Setting directions	Social Justice Leadership
(a) building a shared vision (b) identifying specific, shared, short-term goals (c) creating high-performance expectations	(a) encourage the development of organizational norms that support openness to change in the direction of that purpose or vision (b) regularly encourage staff to evaluate their progress toward achieving school goals [and] encourage staff to develop and periodically review individual professional growth goals, as well as the relationship between their individual professional goals and the school's goals (c) devote additional effort to creating high expectations among staff for the achievement of students who have traditionally struggled to be successful at school
Building relationships and developing people	Distributed Leadership
(a) stimulating growth in the professional capacities of staff (b) modeling the school's values and practices (c) building trusting relationships with and among staff, students, and parents	(a) encourage staff to pursue their own goals for professional learning [and] encourage staff to try new practices consistent with their own interests (b) exemplify, through their own actions, the school's core values and many of its desired practices (c1) demonstrate respect for staff, students, and parents by listening to their ideas, being open to those ideas and genuinely considering their value (c2) encourage staff, students, and parents to listen to one another's ideas and genuinely consider their value
Developing organizations to support desired practices	Distributed Leadership
(a) building collaborative cultures and distributing leadership (b) building productive relationships with families and communities (c) connecting the school to its wider environment (d) allocating resources in support of the school's vision and goals	(a) nurture mutual respect and trust among those involved in collaborating (b) engaging students' families and their school's external community (c) develop and maintain connections with other expert school and district leaders, policy experts, outreach groups, and organizations and members of the educational research community (d) distribute resources of all types in ways that are closely aligned with the school's improvement priorities
Improving instructional program	Instructional Leadership
(a) providing instructional support (b) monitoring student learning and school improvement progress	(a1) observing in classrooms and providing constructive feedback that is useful to teacher (a2) participating with staff in their instructional improvement work (b1) use multiple sources of evidence when diagnosing student progress (b2) provide conditions for teachers to use data effectively, such as time, professional development support, partnership with field experts, and a culture in which the use of data is valued
Securing accountability	Instructional Leadership
(a) building staff members' sense of internal accountability (b) meeting the demands for external accountability	(a) assess one's own contributions to school achievements and take account of feedback from others (b1) align school targets with board and [district] targets (b2) provide an accurate and transparent account of the school's performance to all school stakeholders (e.g., Department of Education/local district, School board, parents, community)

Table 4
A Priori Codes

Setting direction	Social Justice Leadership	A Priori Codes
	(a) encourage the development of organizational norms that support openness to change in the direction of that purpose or vision (b) regularly encourage staff to evaluate their progress toward achieving school goals [and] encourage staff to develop and periodically review individual professional growth goals, as well as the relationship between their individual professional goals and the school's goals (c) devote additional effort to creating high expectations among staff for the achievement of students who have traditionally struggled to be successful at school	Organizational norms Professional growth review Collective high expectations on behalf of historically underserved
Building relationships and developing people	Distributed Leadership	
	(a) encourage staff to pursue their own goals for professional learning [and] encourage staff to try new practices consistent with their own interests (b) exemplify, through their own actions, the school's core values and many of its desired practices (c1) demonstrate respect for staff, students, and parents by listening to their ideas, being open to those ideas and genuinely considering their value (c2) encourage staff, students, and parents to listen to one another's ideas and genuinely consider their value	Individual staff goals Encouraged new practices Core value actions Listening to school community members
Developing organizations to support desired practices	Distributed Leadership	
	(a) nurture mutual respect and trust among those involved in collaborating (b) engaging students' families and their school's external community (c) develop and maintain connections with other expert school and district leaders, policy experts, outreach groups, and organizations and members of the educational research community (d) distribute resources of all types in ways that are closely aligned with the school's improvement priorities	Mutual respect Engaging families Engaging external community Connections with district experts Connections with external experts Resources distributions
Improving instructional program	Instructional Leadership	
	(a1) observing in classrooms and providing constructive feedback that is useful to teacher (a2) participating with staff in their instructional improvement work (b1) use multiple sources of evidence when diagnosing student progress (b2) provide conditions for teachers to use data effectively, such as time, professional development support, partnership with field experts, and a culture in which the use of data is valued	Classroom observations Constructive feedback to teachers Active participation in instructional improvement Multi-tiered evidence Encouraged to use data
Securing accountability	Instructional Leadership	
	(a) assess one's own contributions to school achievements and take account of feedback from others (b1) align school targets with board and [district] targets (b2) provide an accurate and transparent account of the school's performance to all school stakeholders (e.g., Department of Education/local district, School board, parents, community)	Consider feedback from stakeholders Align targets with districts Transparency provided for stakeholders

Figure 5
Organizational Structure of School District

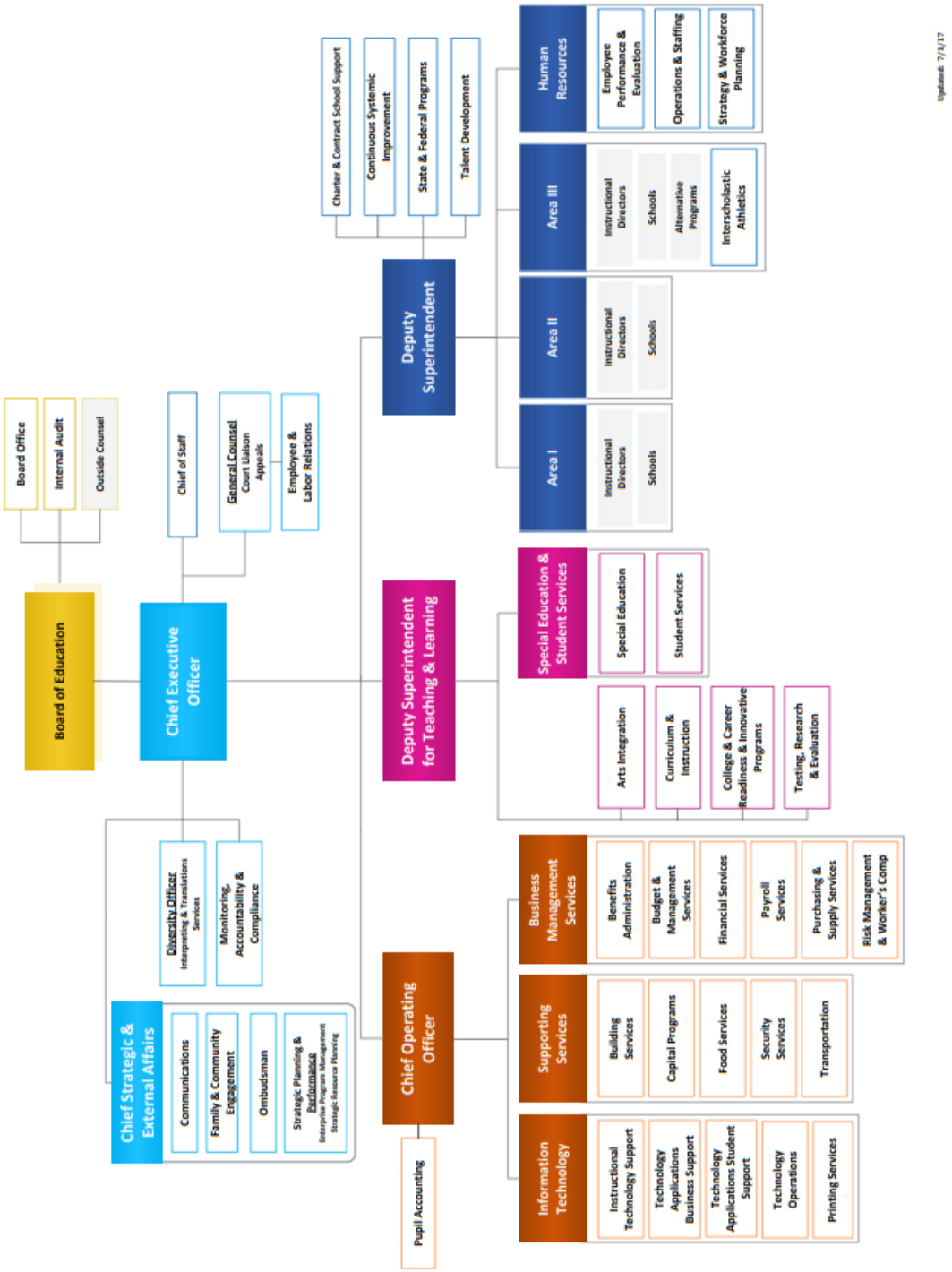

Figure 6
OLF Assertion Evidence Organization Chart

Assertion	Evidence	Evidence	Evidence	Evidence	Evidence	Evidence
SD-ON	FMS	FMS	FMS	HMS	HMS	HMS
SD-HE	FMS	FMS	FMS	HMS	HMS	HMS
BR-EN	FMS	FMS	FMS	HMS	HMS	HMS
BR-LS	FMS	FMS	HMS	HMS		
DO-EF	FMS	FMS	FMS	HMS	HMS	
DO-EE	FMS	FMS	FMS	HMS	HMS	
DO-CE	FMS	FMS	HMS	HMS		
II-CO	FMS	FMS	HMS	HMS		
II-CF	FMS	FMS	HMS	HMS		
SA-AT	FMS	FMS	HMS	HMS		

Interview Quote	FMS	Fleming Middle School
Interview Summary	HMS	Harris Middle School
Document		
Observation		

Key	Domain
SD	Setting directions
BR	Building relationships and developing people
DO	Developing organizations to support desired practices
II	Improving instructional program
SA	Securing accountability
SD-ON	Organizational Norms
SD-HE	Collective high expectations on behalf of historically underserved
BR-EN	Encouraged new practices
BR-LS	Listening to school community members
DO-EF	Engaging families
DO-EE	Engaging external community
DO-CE	Connections with external experts
II-CO	Classroom observations
II-CF	Constructive feedback to teachers
SA-AT	Align targets with districts

Appendix A

Leader Interview Protocol

Interview Questions for School Administrators and Leaders

School Leader Professional Background

1. What is your position and instructional role(s) and/or responsibilities here at _____ School?

2. How long have you been in your position as _____?

3. Can you briefly tell me about your assignments/positions in education and leadership experiences before working here in your current role?

School Leader Experiences with and Observation of STEM-Communities

4. Please share your knowledge and understanding of the STEM-Communities Program and Engineering Design Process Model?

5. What led to your schools' initial interest in STEM-Communities and decision to implement the program?

6. How does the STEM-Communities program benefit your students?
    a. From your perspective, what impact or influence has the STEM-Communities program had on student learning?

7. Detail the greatest benefit of the STEM-Communities program for you and your school?

8. Describe the greatest implementation challenge of the STEM-Communities program for you and your school? How was the challenge resolved?

9. Please explain how you have prioritized the three components of the STEM-Communities program (Teacher PD, Engagement with STEM professionals, and Curriculum informed by students).

10. How have you introduced and engaged parents in the STEM-Communities program?

11. What are your resource allocation efforts for STEM-Communities? What specific resources you have allocated to the STEM-Communities program?

12. Considering your observations of the teachers' engagement and interaction with students, what specific pedagogical stances have you observed the STEM-Communities program teachers demonstrating? (pedagogical stances= motivation, inspiration, responsiveness, knowledge of student backgrounds)

13. The vision for STEM-Communities is "the implementation of a virtual and engaging social network of continual learning between engineers, middle school teachers, and students." Given this vision, to what extent do you believe the related goal of creating an E-Community that benefits teachers and their students have been achieved?

14. What are the school districts' priorities in STEM education?

School Leader Experiences with Black Girls

15. How would you describe the (academic experiences) of students who self-identify as Black females here at _____ School? Provide a general description of the lived academic experiences of students who self-identify as Black females.

16. How would you describe the (social experiences) of students who self-identify as Black females here at _____ School? Provide a general description of the lived social experiences of students who self-identify as Black females.

17. According to the National Science Foundation, over the last 20 years, Black women's attainment of bachelor's degrees in STEM fields such as computer science, mathematics, and engineering has declined. Nationally, in 2014, 0.99% of STEM BS degree recipients self-identified as Black or African American females. Considering these statistical data, what are your thoughts regarding a.) the effects of early engagement with STEM professionals, b.) early access to STEM educational opportunities and c.) early college STEM career pathways and programs for Black girls?

18. How does STEM-Communities influence Black girls' academic and social education? What value is added?

19. In your opinion, what resources are needed to increase participation of Black female students in STEM-related programming at your school?

20. What key components, curricula and instructional frameworks would you include in a P-12 STEM College and Career Preparation Program to address the current racial and gender gaps in the STEM pipeline and workforce?

Wrap up

21. Is there any additional information or insights you would like to share about the impact of STEM-Communities on Black girls' education that we have not discussed?

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Appendix B
Teacher Interview Protocol

Interview Questions for Teachers

Teacher Professional Background

1. What is your role here at _____ School?

2. How long have you been in your role as _____?

3. Can you briefly tell me about your positions in education before working here in your current role?

Teacher Experiences with and Observation of STEM-Communities

4. Can you tell me about your familiarity with the STEM-Communities and the engineering design process model?

5. To what extent have you seen STEM-Communities impact student learning?

6. What are the benefits of STEM-Communities for your students?

7. What are the challenges of STEM-Communities for your students?

8. To what extent have you engaged in the implementation, programming, and success of STEM-Communities here at _____ School?

9. What, if anything, has impacted your level of participation in the work of STEM-Communities here at _____ School?

10. How have you engaged parents in STEM-Communities?

11. Our initial research question was, "How do we create a virtual and engaging social network of continual learning between engineers, middle school teachers, and students?" Given that original mission, to what extent do you think we have accomplished the goal of creating an E-Community that benefits teachers and their students?

12. How does your school's principal support the implementation of STEM-Communities?

13. How does your school's principal lead in a way that reflects social justice?

14. How does your school's principal engage with students' parents and families?

15. How does your school's principal partner with the community?

Teacher Experiences with Black Girls

16. How would you describe the academic experiences of students who self-identify as Black females here at _____ School?

17. How would you describe the social experiences of students who self-identify as Black females here at _____ School?

18. According to the National Science Foundation, over the last 20 years, Black women's attainment of bachelor's degrees in STEM fields such as computer science, mathematics, and engineering has declined. Nationally, in 2014, 0.99% of STEM BS degree recipients self-identified as Black or African American females. What does that bring up for you as you think about the effects of early access to STEM educational opportunities for Black girls here at _____ School?

19. How do you think STEM-Communities impacts Black girls' education, both socially and academically?

20. If you could make a wish list for Black female students at your school regarding access to academic and social resources, what would it include?

21. If you could develop a program that specifically addressed the racial and gender-based gaps that exist in the STEM pipeline and workforce, what would it include?

Wrap up

22. Is there anything else you would like to add about the impact of STEM-Communities on Black girls' education that we have not discussed thus far?

Reference

National Science Foundation (2014). Science and engineering bachelor's degrees earned by black or African American women, by field: 1995–2014. Retrieved from https://www.nsf.gov/statistics/2017/nsf17310/digest/fod-wmreg/black-women-by-field.cfm

Appendix C

Observation Protocol

Date:	Time:	Location:
Participants:		
Descriptive Notes		Reflective Notes
Visual Representation:		

Appendix D

Principal Letter

[redacted] MIDDLE SCHOOL

Where P.E.A.C.E. Lives

[redacted]

Principal [redacted] Academic Deans [redacted] Assistant Principal [redacted]

August 7, 2017

Peace Parents and Guardians,

Welcome to school year 2017-2018: I hope everyone has had a restful break and is ready to embark on an exciting and rewarding school year. In preparing our Kings and Queens for lifelong success we will focus on how to create and maintain a "growth mindset" in our children which leads to their understanding that with consistent effort and persistence they can learn and achieve great things in school and life. A growth mindset empowers our Kings and Queens to work toward improvement in school and the community and is essential to becoming a positive change agent who transforms the world.

We will also continue preparing our Kings and Queens for the PSAT 8/9 which helps students identify strengths and areas of growth in preparing them for college when they graduate from high school. In addition, the results from the PSAT 8/9 are part of the entrance criteria for selection into high school specialty programs: Science and Technology at [redacted] High School and Aerospace and Engineering at [redacted] High School. For additional information on the PSAT 8/9 visit their website at https://collegereadiness.collegeboard.org/psat-8-9.

As always, the cornerstone to our success will be building and maintaining positive relationships with our Kings, Queens and families. I am looking forward to our best year yet.

In Peace,

[redacted]
Principal

Positive Energy Activates Constant Elevation

Board of Education o[redacted]s County

Appendix E

MIDDLE SCHOOL
CORE CURRICULUM COURSE SEQUENCE

CONTENT	GRADE 6	GRADE 7	GRADE 8
MATHEMATICS	• Math 6 • Accelerated Math 1	• Math 7 • Accelerated Math 2	• Math 8 • Foundations for Algebra • Algebra 1
READING/ENGLISH LANGUAGE ARTS	• Reading/English Language Arts 6 • Reading/English Language Arts 6 Honors • ESOL 1, 2, 3	• Reading/English Language Arts 7 • Reading/English Language Arts 7 Honors • ESOL 1, 2, 3	• Reading/English Language Arts 8 • Reading/English Language Arts 8 Honors • ESOL 1, 2, 3
SCIENCE	• Science 6 • Science 6 Honors	• Science 7 • Science 7 Honors	• Science 8 • Science 8 Honors
SOCIAL STUDIES	• World Cultures and Geography Part 1: Western Hemisphere • World Cultures and Geography Part 1: Western Hemisphere Honors	• World Cultures and Geography Part 2: Eastern Hemisphere • World Cultures and Geography Part 2: Eastern Hemisphere Honors	• United States History Revolution to Reconstruction • United States History Revolution to Reconstruction Honors

Appendix F

District Middle School STEM Course Offerings and Descriptions Fall 2017

STEM Integrations

STEM Integrations 1 Course Codes: 751001, 751002 Prerequisites: Entering sixth grade student Credits: .50 STEM is the acronym for Science, Technology, Engineering, and Mathematics. STEM Integrations 1 is a course designed to allow students to use learned content to generate processes, select tools and hone skills to solve a problem of practice. Utilizing a problem based learning approach, students will create and articulate solutions to problems of practice that require a transdisciplinary approach. Textbook(s): N/A

STEM Integrations 2 Course Code: 751003 Prerequisites: STEM Integrations 1 Credits: 0.5 STEM is the acronym for Science, Technology, Engineering, and Mathematics. STEM Integrations 2 is a continuation of the teaching and learning from STEM Integrations 1 that is designed to allow students to use learned content to generate processes, select tools and hone skills to solve a problem of practice with more autonomy than in STEM Integrations 1. Utilizing a problem based learning approach, students will create and articulate solutions to problems of practice that require a transdisciplinary approach. Textbook(s): None

TECHNOLOGY EDUCATION

Technology Education 6 Course Code: 801600, 801601, 801602 Prerequisites: None Credits: .25 or .50 Students in this 9-week course will explore modern technology. They will become inventors by designing and constructing solutions to problems. Tools and materials will be used creatively in applying technology. The application of science and math concepts in technology will be emphasized. Student experiences will include using a computer to control a robot, constructing and testing solutions to technology problems, using a computer for drafting (CAD), assembling and testing a pneumatics system, drawing to communicate technical information, and using computers to practice problem-solving procedures. Textbook(s): TBD

Technology Education 7 Course Code: 801700, 801701, 801702 Prerequisites: None Credits: .25 or .50 Students in this 9-week course will explore modern technology. They will become inventors by designing and constructing solutions to problems. Tools and materials will be used creatively in applying technology. The application of science and math concepts in technology will be emphasized. Student experiences will include using a computer to control a robot, constructing and testing solutions to technology problems, using a computer for drafting (CAD), assembling and testing a pneumatics system, drawing to communicate technical information, and using computers to practice problem-solving procedures. Textbook(s): TBD

Technology Education 8 Course Code: 801800, 801801, 801802 Prerequisites: None Credits: .25 or.50 Students in this 9-week course will explore modern technology. They will become inventors by designing and constructing solutions to problems. Tools and materials will be used creatively in applying technology. The application of science and math concepts in technology will be emphasized. Student experiences will include using computer circuits to solve problems, constructing and testing solutions to technology problems, using a computer for drafting (CAD), assembling, and testing an electrical system, drawing to communicate technical information, and using computers to practice problem-solving procedures. Textbook(s): TBD

Technology Integration 8 Course Code: 760000, 760600, 761600, 761700, 761800 Prerequisites: None Credits: .25 or .50 The Middle School Technology Integration courses are focused on teaching students the [Redacted] Technology Literacy Standards for Students, which are based on the National Educational Technology Standards - Students. The course material focuses on the Technology Literacy Standards for Students. The course content is project-based. Students participate in practical applications that incorporate an array of interdisciplinary skills from math, language arts, fine arts, geography, science and technology with a particular emphasis on social studies themes. This ensures that technology will not be taught in isolation, but infused throughout the students' daily instruction. Materials: Microsoft Office Suite (software); Mavis Beacon (software); Inspiration (software); Imagination Suite (software); Blackboard

Technology, Media and Design 6 Course Code: 761901, 761902 Prerequisites: None Credits: .50 This is a combined digital and product design course that uses the design cycle and combines knowledge, skills, techniques and materials of both digital and product design to develop solutions that solve a problem and meet a need. Combined topics include Media, Technology Integration and Design. This course could be used to replace Technology Integration and Technology Concepts at the middle school level and meets the design requirement of the Middle Years Program for International Baccalaureate. Textbook(s): Online

Technology, Media and Design 7 Course Code: 761911, 761912 Prerequisites: None Credits: .50 This is a combined digital and product design course that uses the design cycle and combines knowledge, skills, techniques and materials of both digital and product design to develop solutions that solve a problem and meet a need. Combined topics include Media, Technology Integration and Design. This course could be used to replace Technology Integration and Technology Concepts at the middle school level and meets the design requirement of the Middle Years Program for International Baccalaureate. Textbook(s): Online

Technology, Media and Design 8 Course Code: 761921, 761922 Prerequisites: None Credits: .50 This is a combined digital and product design course that uses the design

cycle and combines knowledge, skills, techniques and materials of both digital and product design to develop solutions that solve a problem and meet a need. Combined topics include Media, Technology Integration and Design. This course could be used to replace Technology Integration and Technology Concepts at the middle school level and meets the design requirement of the Middle Years Program for International Baccalaureate. Textbook(s): Online

PROJECT LEAD THE WAY (PLTW)

Gateway to Technology Course Code: 762003 Prerequisites: Successful completion of Grade 6 Mathematics Credits: 1.0 The Gateway to Technology (GTT) curriculum provides project-based learning — a hands-on approach — that relates technology to students' daily lives. It also promotes communication and collaboration by emphasizing a teaming approach in the four instructional units: Design and Modeling uses solid modeling to introduce students to the design process. Automation and Robotics traces the history, development, and influence of automation and robotics; Flight and Space introduces students to aeronautics, space and the use of design to help make aerospace engineering an important field; Science of Technology traces how science has affected technology throughout history; and The Magic of Electrons, through hands-on projects, explores the science of electricity, the movement of atoms, circuit design, and sensing devices. Students acquire and apply knowledge and skills in engineering problem solving and explore the many aspects of aerospace engineering. Textbook(s): TBD

Gateway to Technology 7 Course Code: 762013 Prerequisites: Successful completion of 6th grade math Credits: 1.0 The Gateway to Technology (GTT) course is designed to be taught in conjunction with a rigorous academic curriculum. This course engages the students' natural curiosity and imagination in creative problem solving to teach them how to apply math, science, technology, and engineering to their everyday lives. The GTT curriculum provides project-based learning — a hands-on approach — that relates technology to students' daily lives. It also promotes communication and collaboration by emphasizing a teaming approach. The focus of the 7th grade course is teaching students the concepts in the two foundational units: Design and Modeling uses solid modeling to introduce students to the design process; and Automation and Robotics traces the history, development, and influence of automation and robotics. Students may also be introduced to one or more specialty courses that are selected by each school. These include: (1) Flight and Space introduces students to aeronautics, space and the use of design to help make aerospace engineering an important field; (2) Science of Technology traces how science has affected technology throughout history; (3) The Magic of Electrons, through hands-on projects, explores the science of electricity, the movement of atoms, circuit design, and sensing devices; (4) Energy & the Environment challenges students to think big and toward the future as they explore sustainable solutions to our energy needs and investigate the impact of energy on our lives and the world; (5) Green Architecture teaches students how to apply this concept to the fields of architecture and construction

by exploring dimensioning, measuring, and architectural sustainability as they design affordable housing units using Autodesk's® 3D architectural design software; and (6) Medical Detectives provides opportunities for students to play the role of real-life medical detectives as they analyze genetic testing results to diagnose disease and study DNA evidence found at a "crime scene." They solve medical mysteries through hands-on projects and labs, investigate how to measure and interpret vital signs, and learn how the systems of the human body work together to maintain health. Textbook(s): online curriculum

Gateway to Technology 8 Course Code: 762023 Prerequisites: Successful completion of 6th grade math, Gateway to Technology 7 recommended Credits: 1.0 The Gateway to Technology course is designed to be taught in conjunction with a rigorous academic curriculum. This course engages the students' natural curiosity and imagination in creative problem solving to teach them how to apply math, science, technology, and engineering to their everyday lives. In this course, students apply the design process to solve problems and understand the influence of creativity and innovation in their lives. Using Autodesk® design software, students create a virtual image of their designs and produce a portfolio to showcase their innovative solutions. Students also use the VEX Robotics® platform to design, build, and program real-world objects such as traffic lights, toll booths, and robotic arms. Schools offering the GTT program also select from six specialty units to provide a stronger foundation for students interested in furthering their studies in STEM fields: (1) Flight and Space introduces students to aeronautics, space and the use of design; (2) Science of Technology traces how science has affected technology throughout history; (3) The Magic of Electrons explores the science of electricity, the movement of atoms, circuit design, and sensing devices; (4) Energy & the Environment challenges students to think big and toward the future as they explore sustainable solutions to our energy needs and investigate the impact of energy on our lives and the world; (5) Green Architecture teaches students how to apply this concept to the fields of architecture and construction by exploring dimensioning, measuring, and architectural sustainability; and (6) Medical Detectives provides opportunities for students to play the role of real-life medical detectives as they analyze genetic testing results to diagnose disease and study DNA evidence found at a "crime scene." They solve medical mysteries through hands-on projects and labs, investigate how to measure and interpret vital signs, and learn how the systems of the human body work together to maintain health. Textbook(s): online curriculum

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