The Urban Education Sourcebook on Instruction and Supervision

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Edited by

Tiffany A. Flowers

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In her role at the CCFP, Dr. McCoy focuses on promoting culturally responsive strategies within two trauma-informed education interventions: Resilience and Learning, a partnership with the Public School Forum to develop and implement a trauma-informed K-12 educational model in North Carolina; and ITTI Care, a professional development framework to promote workforce

wellness and trauma-informed care in early childhood education. She also devotes part of her time to supporting racial equity initiatives with the CCFP more broadly, as well as providing consultation to CCFP staff members on strategies for targeting racial equity within their research.

Prior to joining the Duke University, Dr. McCoy was a Postdoctoral Research Associate in STEM Education for the School of Education and Human Development at the University of Virginia. She oversaw a randomized control trial of a computer science professional development intervention to improve elementary teachers and students' computer science knowledge and coached elementary teachers to support engineering integration in their classrooms. Dr. McCoy received her Bachelor of Science in Biology from Winston-Salem State University, and she earned a Master of Arts in Teaching from the University of North Carolina at Charlotte. As a doctoral student at North Carolina State University, she earned her Ph.D. in Teacher Education and Learning Science with a concentration in Educational Psychology, was a recipient of the prestigious National Science Foundation Graduate Research Fellowship, a Southern Regional Education Board Doctoral Scholar, and her dissertation was awarded Outstanding Dissertation of the Year in College of Education.

Seanna Leath, Ph.D., is an assistant professor in the Psychological and Brain Sciences Department at Washington University in St. Louis. She was the first in her family to attend college, and she graduated from Pomona College in 2013 as a double major in Psychology and Africana Studies. From there, she pursued her PhD in Education & Psychology at the University of Michigan, studying under several brilliant, Black faculty mentors. In general, her program of research examines the identity development processes of Black girls and women within their families, schools, and communities. Specifically, her work focuses on how individual and contextual factors promote Black women and girls' academic achievement and psychological well-being. During her time as an early career scholar, Dr. Leath has focused on building a network of scholarly and community partners who can help her expand and realize her visions of personal wellness and collective freedom for Black women and girls. For example, she is the founder of Black Girls Learn, Experiment, and Play (LEAP) – a pilot fellowship through 500 Women Scientists that provided community-based STEM learning opportunities for Black girls in K-5th grade. She also conducted mixed methods program evaluation (i.e., household surveys and semi-structured interviews with program leaders) for community-based mentoring groups in Charlottesville for Black girls and their families. Dr. Leath has secured funding through numerous grant agencies including 500 Women Scientists, the Society for Research on Child Development, the National Science Foundation, and the Russell Sage Foundation – to collaborate with Black girls and their communities on the best ways to support their wellness. Perhaps most importantly, Dr. Leath is the mother to four beautiful children, who help her find new ways of living authentically and joyfully at each stage of her academic career.

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Lauren C. Mims, Ph.D. is Assistant Professor in the Department of Applied Psychology at New York University. Formerly, she was an Assistant Professor in the Department of Educational Psychology at Ball State University. She earned her doctorate in Educational Psychology: Applied Developmental Science and her B.A. in English and Psychology from the University of Virginia in 2019 and 2012, respectively. She earned her M.A. in Child Development with a concentration in Clinical Developmental Health from Tufts University in 2014. Dr. Mims was formerly Assistant Director of the White House Initiative on Educational Excellence for African Americans during the Obama Administration. Dr. Mims was a member of the White House Council on Women and Girls, the U.S. Department of Education Policy Committee, the U.S. Department of Education Socioeconomic Diversity Working Group, as well as a member of First Lady Michelle Obama's Reach Higher Working Group. Dr. Mims developed and hosted events such as the AfAmWomenLead Student Summit to Support Black Girls, a summit to support African American students with disabilities, and reading parties for youth to share resources, foster creativity and nurture a love of learning. Broadly, the ultimate goal of Dr. Mims' research is to "freedom dream" (Kelley, 2002) with Black children and their families, and then use that brilliance to guide the development of new research, policies, practices, and narratives!

Sheretta T. Butler-Barnes is an associate professor of Social Work at Washington University in St. Louis (Wash U). Her line of research includes examining how Black youth draw on individual and cultural assets and resources to thrive despite challenges to their identities from structural, individual, and cultural racism. Her expertise and scholarly work is on Black children and youth, risk and resilience, academic achievement, and wellbeing. Butler-Barnes also has extensive experience in youth programming as it pertains to Black adolescent girls.

Dr. Butler-Barnes is a developmental psychologist and has expertise and scholarly work on the impact of racism and the use of culturally strength-based assets on the educational and health outcomes of Black American families. Dr. Butler-Barnes received her PhD and MA from Wayne State University in psychology and a BS in psychology from Michigan State University. The two lines of her research agenda include 1) Black Families and Racial Justice Project which explores how Black families draw on personal and cultural assets and resources to thrive despite challenges to their wellbeing from institutional and personal experiences of racism and racial violence; and 2) Equity for Black Women & Girls Project focuses on advancing culturally responsive curriculum and promoting an equitable learning environment.

Dr. Dorian Harrison is an assistant professor in the College of Education and Human Ecology's Department of Teaching and Learning at The Ohio State University at Newark. She teaches foundational and licensure course in literacy at the undergraduate and graduate level. Dr. Harrison has over 15 years of experience in education. She worked as an elementary teacher, Pre-K teacher, literacy specialist, educational consultant, after school program director, and college coach/tutor.

Dr. Harrison's research explores how equity in literacy education is enacted, paying particular attention to the ways communities of learners are challenging deficit views and practices. This approach broadly looks at the intersections of race, class, and language that are at play during teaching and learning and involves conceptual and theoretical approaches, such as critical literacy, culturally relevant pedagogy, and multilingualism. Dr. Harrison's research is aimed at not only improving classroom practice but also restructuring how institutions prepare future educators to engage with diverse populations of students and communities.

Dr. Yolanda Kirkpatrick is a Clinical Associate Professor with the Department of Theory and Practice in Teacher Education at the University of Tennessee, Knoxville. Dr. Kirkpatrick earned a doctoral degree in science education, a master's degree in microbiology, and a bachelor's degree in biology. She supports the field experiences of undergraduate, post-baccalaureate, and job-embedded math and science aspiring and preservice teachers while teaching courses for teacher education and the VolsTeach program. Dr. Kirkpatrick has worked in urban and rural communities with AmeriCorps, Children's Defense Fund, Project Grad, and Trio programs. Prior she was a research assistant (Vanderbilt University) and taught for thirteen years at a community college (Pellissippi State Community College. Dr. Kirkpatrick's teaching, presentations, and creative activities focus on science education, math and science history, scientific literacy, and teacher learning.

Cheeno Marlo M. Sayuno, Ph.D., is an Assistant Professor of Communication, Research, and Children's Literature from the University of the Philippines (UP) Los Baños. He received his BA Mass Communication degree from Cavite State University in 2010, MA Communication Arts degree from UP Los Baños in 2015, and PhD Communication degree from UP Diliman in 2022. For his accomplishments in research and creative work, he has been conferred the award of University Artist 1 under the UP-Arts Productivity System Award. He has received recognition from the prestigious Carlos Palanca Memorial Awards for Literature in 2013 and 2017, the Philippine Board on Books for Young People's Salanga Prize (honorable mention) in 2015, and the Normal Awards

for Gender-Inclusive Literature by Philippine Normal University in 2021 for his stories for children. He has published storybooks with Adarna House, Lampara Books, Anvil Publishing, and Chikiting Books in the Philippines, as well as various textbooks in communication, media, and related fields.

He has participated in numerous conferences as paper presenter and has also published articles with the Plaridel: A Philippine Journal of Communication, Media, and Society; the ASEAN Journal of Community Engagement; the Philippine Communication Society Review; the Diliman Review; and the UPLB Journal. He has also contributed a chapter on Philippine children's literature for the edited collection "International LGBTQ+ Literature for Children and Young Adults," published by Anthem Press UK. He has been a writing fellow at many workshops, including Asian Festival of Children's Content Writers and Illustrators Retreat in Singapore, the UP National Writers' Workshop, Barlaya Writing Workshop for Intermediate and Young Adult Literature by Adarna House, Cordillera Creative Writing Workshop: Palihan sa Panitikang Pambata (Workshop on Children's Literature), and many others.

Currently, Dr. Sayuno also serves as the Assistant Secretary of the Philippine Association for Communication and Media Researchers, Inc.; the President of Supling Sining, Inc.; and an active member of the International Research Society for Children's Literature. In UPLB, he also heads the Graduate Program Management Committee for the MA Communication Arts Program. He is also a mentor of the YouthWorks PH Flexible Training for Work program by the Philippine Business for Education and has engaged as resource speaker and trainer in many national and local trainings in children's literature, pedagogy, journalism, and research. His research interests include children's literature, child studies, (trans)media studies, discourse analysis, and qualitative communication research.

Dr. Kalpana M. Iyengar earned her Ph.D. in literacy at the University of Texas - San Antonio. She was later awarded a postdoctoral fellowship in the Bicultural Bilingual Studies Department. She holds a master's in Linguistics and Commonwealth Literature from Bangalore University and a second masters from Kutztown University, Pennsylvania. Dr. Iyengar received a B.Sc. from Arakalagudu Varadarajulu Kanthamma College for Women, Hassan.

Dr. Iyengar's research foci include cultural preservation, literacy, teacher preparation, Indic cultures, and multicultural education. She co-edited a volume with Cognella Publishers, book chapters in IGI Publications, and articles in peer-reviewed journals including Educational Studies, South Asian Review, Devsanskrithi Interdisciplinary (DSVV) Journal, and English in Texas.

Dr. Iyengar was selected as a San Antonio Writing Project Summer (SAWP) Institute Fellow, 2007. She subsequently became a teacher-consultant and co-director for the SAWP. Continuing her research interest, she co-founded/co-directed the DSVV Haridwar Writing Project in India. In recognition of her literacy work, she was awarded the National Council of Teachers of English Distinguished Early College Educator of Color Award.

Dr. Iyengar's co-edited volume (with Dr. Smith), Diversity in Society and Schools, was published by Cognella Press, 2021. Her current project, a co-edited volume on biliteracy development, will be published by Kendall Hunt, 2022. A co-edited book on Teaching English Writing in the Diaspora: Scaffolding Educators and Students has a publication date of 2023.
Dr. Iyengar offers teacher preparation and literacy courses at UTSA. She was lead faculty for the Family Literacy Project sponsored by the Center for Inquiry of Transformative Literacies. Dr. Iyengar was a Scholar-in-Residence at DSVV and she is a visiting professor in the English department. Drs. Iyengar and Smith, as guest faculty, offered a three-week graduate course on Qualitative Methods at Presidency College, Bengaluru, India.

Dr. Howard L. Smith is Professor in the Department of Bicultural-Bilingual Studies at the University of Texas - San Antonio. He earned a Ph.D. in Bilingual-Multicultural Education from the University of Arizona. He received a B.A. in Spanish Literature from Temple University, Pennsylvania. Dr. Smith conducts research in biliteracy and teaches courses in bilingual education, biliteracy development, children's literature, multicultural education, and reading.

Dr. Smith's publications include the edited volumes, Diversity in Society and Schools and Multicultural Literature for Latino Bilingual Children: Their Words, Their Worlds. He has published articles in the Bilingual Research Journal, Educational Studies, International Journal of Bilingual Education and Bilingualism, The Journal of Multiculturalism in Education, and Language Arts. He has given presentations to academics and teacher workshops in India, Mexico, Nicaragua, Spain, and the United States.

Dr. Smith was awarded a Faculty Development Fellowship at the University of Arizona. He received a Title VII Bilingual Education Fellowship from the United States Department of Education and the Marshall Foundation Doctoral Research Fellowship. He is a member of the International Reading Association, American Educational Research Association, and the National Association for Bilingual Education. He has served as co-chairman of the program committee for the Annual Conference of the Texas Association for Bilingual Education, and the program chair for

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Most notably, he led the design and launch of the nation's first state-run teacher residency program with a $4.5M Kellogg Foundation Grant to address the state's teacher shortage and increase the diversity of the educator workforce in Mississippi. While serving at the Mississippi Department of Education, he completed the year-long national School Systems Leaders Fellowship along with twenty senior education leaders from across the country and received training to become a school systems leader.

Phelton began his career in education as a high school English teacher in Greenwood, Mississippi, where he was Teacher of the Year for two consecutive years, and corps member of Teach for America. He holds a Ph.D. in Educational Leadership from the University of Mississippi and a BA in Public Policy Leadership and English from the University of Mississippi. He holds a certificate in Education Finance from Georgetown University. Phelton is a member of The Reading League National Board of Directors.

FOREWORD

DR TIFFANY A. FLOWERS

The Instruction volume includes contemporary topics often left out of traditional urban education texts related to classroom teaching and curriculum. The crucial concerns related to instruction within urban schools are major topics which separate urban schools from their suburban and rural counterparts. For example, curriculum and content area teaching are key controversies debated from both an equity and access space within urban education. This volume includes contributions from subfields in education related to S.T.E.M., Science, ESL, ELA, transmedia, and afterschool programs. Often, urban schools take center stage on issues related to the achievement gap in reading and mathematics and/or the adoption of ethnic studies curricula. However, little research focuses on other studies related to instruction of students in urban communities of color, access to STEM programs, curriculum matters related to language arts instruction, and quality afterschool care.

In this volume, the authors hail from a variety of backgrounds and research areas focusing on vital matters facing children in urban schools and districts. *Dr. Yolanda Kirkpatrick's* chapter centers on a science model for all for children in urban schools. This chapter contributes to the body of knowledge about the history of science instruction in schools. *Dr. Whitney McCoy, Dr. Seanna Leath, Dr. Miray D. Seward, Dr. Lauren C. Mims, Dr. Sheretta, and T. Butler-Barnes* focus on the importance of S.T.E.M. related career opportunities for students. There is no area more important for students within the 21st century which provides access to future careers in science, mathematics, and technology. *Dr. Dorian Harrison* makes English Second Language (ESL) instruction the focal point of her chapter. ESL is one of the most underrepresented areas within urban education research. Research regarding ESL instruction in the classroom is often missing from professional conversations pertaining to instruction in World Languages, dual language schools, and bilingual education. *Dr. Kalpana M. Iyengar* and *Dr. Howard Smith* address concerns related to English Language Arts instruction and literature for classrooms. Often, race is a major issue within these debates. However, the authors of this chapter pivot the discussion to

gender equity within literature. Dr. *Cheeno Marlo M. Sayuno* crafted a chapter related to transmedia and instruction. This chapter highlights the need to bring digital media to the forefront of discussions for urban schools. *Dr. Phelton Moss* focuses on the factors which contribute to high-quality afterschool programs for children in urban communities. As politicians within the U.S. continue to debate over universal PreK and afterschool care, universal models for high-quality care will become more increasingly important.

Through this volume on instruction, it is our hope that this work is salient and useful. We anticipate professors using this volume in foundational diversity courses, urban education courses, and social foundations courses at both the undergraduate and graduate levels. The teachers who read this work will get an overview of instructional issues in urban schools. The Instruction volume will be particularly useful for students in both undergraduate and graduate programs within urban education.

Respectfully,
Dr. Tiffany A. Flowers
Series Editor

INFORMAL STEM COUNTERSPACES FOR BLACK GIRLS AND CRITICAL RACE FEMINISM: A META-ETHNOGRAPHIC REVIEW

DR WHITNEY N. MCCOY, DR SEANNA LEATH, DR MIRAY D. SEWARD, DR LAUREN C. MIMS AND DR SHERETTA T. BUTLER-BARNES

Objectives

The Objective of this chapter is to (1) explain how informal STEM counterspaces for Black girls in K-12 can lead to STEM career opportunities, (2) to share lessons from the field from existing programs in urban and non-urban spaces where Black girls' voices are centered, (3) to consider areas for expansion, (4) to provide resource and tools and to assist with further understanding and exploration of how to engage in assisting Black girls in STEM counterspaces through research and practice.

Abstract

Using critical race feminism, this meta-ethnographic review examines Black girls' experiences in informal STEM counterspaces. Critical components of counterspaces included uplifting intersectional identities; early access to programming; fostering critical consciousness; and mentors that honored the girls' experiences. Implications discuss how stakeholders can address Black girls' challenges in STEM educational settings.

Keywords: Black girls, Critical Race Feminism, identity development, informal STEM contexts, counterspaces

While much has changed by way of educational legislation and Black girls' access to education (e.g., Brown v. Board of Education), the underlying racialized, gendered, and classed hierarchies of social exclusion remain largely the same in many mainstream school settings (Neal-Jackson, 2018). Black women and girls are still positioned as "outsiders" in STEM

learning contexts and knowledge production. To date, there is less research on Black girls' STEM-related experiences (e.g., Hanson 2009; King & Pringle, 2018), particularly those that occur in informal learning spaces. Overlooking Black girls' unique and diverse educational experiences limits our understanding of how educational opportunities (both inside and outside of school) play a powerful role in shaping their future career aspirations.

Despite the increased focus on understanding the experiences of women and minorities in STEM fields, educational research on Black women and girls is still limited (Ireland et al., 2018; Joseph et al., 2017). When trying to expand the narratives of Black girls in STEM, gendered racial identity (Ong, Wright, Espinosa, & Orfield, 2011) of being Black-identified and girls in a White male-dominated field compounds the likelihood that they will not persist and makes it even more imperative that we expand our research on this subgroup. Furthermore, while the deleterious influence of racism and sexism on Black girls' STEM persistence is evident in prior literature (Collins et al., 2020; Ireland et al., 2018; Young et al., 2019), not all Black girls who experience such marginalization opt out of STEM career pathways. What is less clear is how certain educational settings and resources support Black girls' STEM persistence and retention.

For example, more scholars have begun to investigate how informal learning experiences inform Black girls' academic identity development and sense of belonging in STEM (e.g., King, 2017). This work suggests that informal learning opportunities can improve the accessibility of STEM pathways for Black girls and increase their sense of belonging in STEM contexts. The current chapter will draw upon critical race feminism within a meta-ethnographic review to consider extant literature on the informal STEM learning experiences of Black girls in K-12. To fully transform pedagogical practices in STEM and spotlight Black girls as knowledge producers, educators must draw on theoretical frameworks that address the intersection of race, gender, class, place, and space in Black girls' educational, social, and political realities.

Critical Race Feminism and Black Girls' Educational Experiences

The current chapter draws upon ***critical race feminism*** (CRF) as a theoretical lens to review the distinctive "roles, experiences, and narratives" of Black girls in urban, informal learning contexts and to analyze how they co-construct knowledge about their STEM experiences (Pratt-Clarke et al., 2020, p. 24). Critical race feminism is a branch of critical race theory (CRT), which scholars have used to highlight how race and racism are central in

explaining how U.S. institutional structures function (Wing, 1997; Wing & Willis, 1999; Ladson-Billings & Tate, 1995). Critical race feminism "places women of color at the center of analysis and reveals the discriminatory and oppressive nature of reality (Wing & Willis, 1997, p. 4). For example, CRT scholars challenge the ideas that all students, regardless of racial background, are treated fairly in school contexts. Instead, scholars who use this framework highlight how racial bias from teachers, as well as racial inequities in school policies and practices (e.g., academic tracking and disciplinary sanctions) contribute to worse academic and social outcomes among Black and other racially minoritized students (Anderson, 2020). In all, this work demonstrates the myriad ways that racism continues to be a determining factor in structural inequity in the U.S., more broadly, and in school contexts, more specifically. Educators have also drawn attention to the need to focus on the interactive effects of racism, sexism, and classism, which may capture the nuances of Black girls' schooling experiences in ways that some critical race theorists may overlook (Belgrave, 2009; Collins et al., 2020; Gholson, 2016).

Evans-Winters & Esposito (2010) proposed ***critical race feminism*** (CRF) as "an interdisciplinary lens of investigation and theory building around educational issues impacting Black girls" (p. 20). CRF has five main tenets, which assert that: (1) women of color's experiences and perspectives are different from those of men of color and those of White women; (2) scholarship must focus on the lives of women of color in intersectional ways (e.g., thinking about how race, gender, and class operate within a White supremacist capitalist society; hooks, 1982, p. 121); (3) women of color navigate the world based on their multiple identities and consciousness (i.e., anti-essentialist); (4) scholars should use multidisciplinary approaches to contextualize their experiences; and (5) theories and practices must simultaneously interrogate and challenge structural oppression from an intersectional standpoint.

Black Girl Cartography

In addition to using critical race feminism as a theoretical framework, we also use Black Girl cartography as a framework for considering how "Black Girlhood is informed, reformed, or stifled by the geopolitical space of school" (Butler, 2018, p. 30). In particular, this framework allows us to consider how time, space, and place impact Black girls' identities in addition to other broader individual and societal factors (Mauldin & Presberry, 2020). We as Black girl cartographers have ''a deep concern for Black girls' health, lives, well-being and ways of being, [and our]

commitments to Black girls extend beyond the page and the walls of the academy'' and as such we are constantly interrogating our own identities as Black girls and how we make space (Butler, 2018, p. 33). Formal learning spaces have often served as sites of exploitation and harm, for Black girls. Thus, by focusing on the affirming and liberatory nature of informal STEM learning spaces, we highlight a number of programs that encourage Black girls to take up a more collectivist rather than individualistic approach in their learning and that encourage Black girls to reclaim their space in STEM education contexts.

The main tenets of CRF and Black Girl Cartography provide useful frameworks for speaking to Black girls' educational experiences, especially regarding how Black girls negotiate their identity-based experiences and conform to or resist mainstream educational norms (Carter Andrews et al., 2019). Within the current chapter, we draw upon CRF to challenge deficit-based perspectives of Black girls' academic capabilities and prioritize the use of counter storytelling in the experiential knowledge of Black girls. We will use CRF and Black Girl Cartography to explore the various learning contexts where Black girls are able to engage in STEM learning: after school, at home, and within their urban communities. We will review literature that details how each of these environments support Black girls' academic identity development and interest in STEM. In addition, we will examine how a number of informal STEM programs (e.g., Black Girls Create Project; Lindsey, 2021; I AM STEM; King & Pringley, 2018) have supported Black girls' STEM engagement.

Informal STEM Education as Counterspaces for Black Girls in K-12

While scholars have examined Black girls' STEM experiences in formal educational settings (e.g., Buck et al., 2014) and how children of color respond to informal STEM learning experiences (Falk et al., 2016), fewer studies have specifically focused on how Black girls navigate informal learning opportunities in STEM (Braswell et al., 2021; Erete et al., 2017; King & Pringley, 2018). Informal STEM contexts prioritize outside-of-school opportunities, provide alternative modes of STEM exposure and engagement for Black girls (Eshach, 2007). These experiences can be instrumental in changing Black girls' perceptions of STEM through activities that directly connect science with girls' interests and lived experiences. Compared to formal educational settings, informal learning contexts can serve as counter spaces that more fully meet the needs of Black girls. We invite educators and scholars to consider the successes and

challenges of Black girls' experiences in informal learning spaces (Collins et al., 2020; Joseph et al., 2017).

What is a "counterspace?"

Research has consistently found that biased attributions are also held by educators in formal STEM education spaces (e.g. Rampal, 1992; Moseley & Norris, 1999). Teachers can also hold significant race and gender science stereotypes about the students in their classrooms, underestimate the abilities of Black and Hispanic girls, and exhibit biases that favored white youth (Gencturk, 2019). These attributions have real-world implications, from racial and gender disparities in teacher referrals to advanced STEM courses or clubs, to reports of more discrimination and harassment among women of color in STEM careers (U.S. Department of Education Office of Civil Rights; Clancy et. al., 2017).

In the current chapter, we characterize ***informal STEM counterspaces*** as learning contexts that affirm the knowledge, cultural capital, and abilities of minoritized groups. By focusing on the needs of a specific group or identity (i.e., racial/ethnic groups), these spaces allow students to be authentically and unapologetically present without being subjected to the stereotypical notions that they may experience in mainstream spaces. By affirming that they do belong and attending to the psychological needs for strong identity formation, these spaces can help ensure that Black girls' expertise is valued in STEM. Based on various research studies to support Black girls in informal STEM spaces (Ashford et al., 2017; Ireland et al., 2018; Young et al., 2019) components for a learning counterspace include: (1) *accessibility at an early age* -- addressing limitations and barriers to Black girls being in STEM spaces by broadening opportunities through community engagement and partnerships; (2) *culturally responsive pedagogy* -- learning activities that allow Black girls to experience academic success and develop cultural competence by integrating the strengths and unique backgrounds of everyone in the group; (3) *critical consciousness* -- spaces in which Black girls can critique and discuss social issues related to the fields within their own communities; (4); *involvement of socializers*- including teachers, parents, peers, and community members who encourage achievement, interest, and assist with identity development*;* and finally, *(5) ongoing mentorship* from role models who can assist with relationship building and allow Black girls to see themselves in their potential field of interest.

A growing body of literature demonstrates that Black girls' sense of accomplishment within such programs -- having a space to indulge in activities that they are interested in and develop new skill sets -- can influence their future career outcomes (e.g., Collins et al., 2020; Locke & Grooms, 2022; Ong et al., 2017; Scott & White, 2013; Spencer et al., 1997; Wilkins-Yel et al., 2022; Young et al., 2017). Informal STEM counterspaces in urban settings, in particular, have been on the rise, drawing attention to the importance of considering how and where Black girls are physically and sociopolitically mapped in education (Butler, 2018). While these programs are still fewer in number, the current chapter will highlight the critical work occurring in these spaces, as well as the policies and practices necessary to make these programs sustainable. Black girls cannot begin to build academic identities and envision future career paths as scientists, technologists, mathematicians, and engineers if they are not provided with spaces that resonate with their identities and experiences (Ireland et al., 2018). Thus, the current review was guided by the primary question: *How do informal STEM counterspaces support Black girls' identity development, what are their experiences in these spaces, and what strategies and programmatic components are recommended for future equitable engagement?*

Method

For the current meta-ethnographic review, we conducted a series of searches in Google Scholar, ERIC, and other STEM education research databases (e.g., n = 16 studies total; n = 11 Black and Latina girls, and n = 5 were found on Black girls only). We reviewed and organized available articles that emerged from combination searches with the following keywords: (Black OR African American), (minority OR underrepresented), (girls of color, girls, OR female adolescents), (intersectionality, critical race theory, OR critical race feminism), (science, technology, engineering, mathematics, STEM identity), AND (education, counterspaces, informal learning OR informal STEM learning). Additional articles were found using article references, backwards retrieval, and previous resources/course content regarding STEM education (Xiao & Watson, 2019). Through a screening process, abstracts and full text articles were used if they met the following criteria:

(1) Does the research focus on the experiences of Black girls or Black adolescents' girls in pre-kindergarten, elementary school, middle school, or high school, learning settings?

(2) Does the study focus on STEM education for Black girls in informal learning programs or contexts (e.g., outside-of-school, afterschool, community programs)?
(3) Does the study contain original empirical data?

Given the focus of the current chapter, we only included empirical articles that focused on African American girls or Black girls, and excluded broader investigations of girls of color (i.e., girls from Latina, Asian American, and Indigenous communities). Due to the limited amount of literature on K-12 STEM education for Black girls, we analyzed 16 articles that focused on science education, computer science/technological education, engineering education, and mathematics education literature within informal learning spaces.

Centering Black Girls' Voices in Informal STEM Counterspaces: Lessons from the Field

To inspire academic growth and confidence in STEM amongst Black girls, many informal counterspaces have begun to attend to the needs of Black girls' intersectional identities. The components of counterspaces included: (a) accessible programs at early ages, (b) culturally relevant teaching to build STEM identity--interest, performance, (c) critical consciousness related to community issues, (d) mentorship to build reflective identity, (e) parent, peer, and community engagement for maintained interest, and (f) program evaluation to address intersectionality and career interest. Informal learning for Black girls provides them with free choice and spaces without stereotype limitations (Eshach, 2007). Using their own intrinsic motivation, the learners themselves can lead their own exploration compared to the formal school environment (Eshach, 2007). In many of the settings that cater to the needs of Black girls, the staff members are invested in the personal outcomes of Black girls specifically (Rockman et al., 2017; Scott & White, 2013). These programs are reflective of what counterspaces should be doing to address structural and social barriers in the STEM learning field. Below, we review seven programs/projects that are helping Black girls "see themselves" in STEM while providing space for their intersectional identities.

Black Girls Code

The most prominent program that spans across the United States in major urban and metropolitan cities is BlackGirlsCode (BGC). The aim of

BGC "introduces programming and technology to a new generation of coders, coders who will become builders of technological innovation and of their future" (Rockman et al., 2017). Annual reports from these programs discuss program goals, but only BGC includes a case study research evaluation listing themes of "mattering and belonging," "leadership and confidence," "culturally relevant programming", and "increased academic success and interest in STEM career pathways" (Rockman et al., 2017, p. 14). The goals of the evaluation were to assess long term interest, and how external factors influenced long-term impact. The study examined parents and alums that participated in the program as high schoolers where they participated in project-based curriculum focused on technological tools and web applications during after school programming, summer camps, and weekend workshops. Survey results indicated that that 83% of students felt as if they belonged and parents indicated that it was an "identity safe" atmosphere because of the focus on components such as Black female role models. Girls had a heightened sense of confidence and leadership and 76% of students indicated that it was important that the program was designed for Black girls and 85% indicated that the program made them more successful in school related STEM courses (Rockman et al., 2014). Thus, the program was successful in promoting identity development and creating a program to support Black girls in STEM.

Black Girls Create Project

Black Girls Create Project uses a culturally responsive model to engage girls in STEM by examining Black women's historical contributions in STEM, culturally responsive teaching related to the girls' lives, mentorship, and transferable skills through design (Lindsey, 2021). Furthermore, the program is specifically looking to engage low-income girls who have limited access to STEM. Using hands-on STEM learning projects, Black Girls Create Project will evaluate girls' self-efficacy in STEM, how engagement influences racial gendered identity, and how interest develops based on program dynamics.

Black Girls STEAMing Through Dance

Black Girls STEMing Through Dance is an interdisciplinary program that uses urban education, dance, product design, and computing to inspire Black girls to build positive STEAM identities and self-concept through self-efficacy, cultural competence, and culturally relevant pedagogy. Mentors that lead the program are Black women professors, graduate

students, and undergraduate students. For example, a unit related to energy allowed girls to engage in dancing to visually represent energy through rippling, girls designed a circuit that allowed a bracelet to light up, and programming assisted in girls seeing how characters could move through code. By using words and phrases to embody movement, girls used repetitive coding sequences to display the concepts. While no formal evaluation or study has been conducted, this program builds on girls' cultural wealth and knowledge while bridging racial and gender disparities in STEM.

COMPUGIRLS

COMPUGIRLS, a computer-based informal program is targeted for girls from under resourced areas. Participants were minority girls from various backgrounds (e.g., school dropouts, group homes, pregnant teens, and delinquents. A designed culturally responsive computing experience for adolescent girls related to social justice (e.g., LGBTQ issues, sexism in the workplace, and gentrification) allowed girls to work on their academic possible selves (e.g., what they expect to become and what they want to avoid becoming) and see how their own identities were reflective of the technological experiences they engaged in for academic goals outside of school (Lee, Husman, Scott, & Eggum-Wilkens, 2015). Components of the program focused on connectedness to social issues through technology, reflection of self, and asset building based on the knowledge the girls had based on their race, gender, and class. Mentor teachers that received training prior to the program assisted students in developing these self-regulatory behaviors while they participated in the program. Results from pre- and post- tests indicated that there was significant growth in academic possible selves through self-regulation after participating (Lee, Husman, Scott, & Eggum-Wilkens, 2015).

Digital Youth Divas

Digital Youth Divas, an informal program for Black and Latina middle school girls, is a middle school girls design-based engineering and computer science program in an urban community looking to recruit and retain girls from underrepresented backgrounds (Erete, Martin, & Pinkard, 2017). The girls engaged in design projects, narrative stories, online social networks, and a community of mentors and peers to guide girls to address social issues within their communities through digital storytelling. Programming activities are scaffolded to meet the needs of the girls at varying levels and

have been shown to increase interest amongst girls that are not typically connected to STEM learning. Results indicated that girls found authentic purpose related to their own community thus influencing their personal STEM identities while increasing their awareness of their race, gender, and intersectional presence in the program (Erete, Martin, & Pinkard, 2017). Relationship with mentors and program staff also led to further reflection and connectedness amongst the girls to prompt discussion about identity and STEM.

I AM STEM

Using a community-based informal STEM program (*I AM STEM)*, King & Pringle (2018) looked to address intergenerational poverty through STEM related to social justice for K-12 students. The program was housed at a local community center and allowed the girls to develop relationships with their teachers, community members, and other role models/mentors within STEM discipline. While program participants identified as Black or Biracial boys and girls and qualified for free/reduced lunch, study participants were Black girls. With goals of creating scientific literate citizens, and preventing learning loss, the curriculum was related to water quality, impacts of pollutants, and organic gardening. By interacting with student groups such as the National Society of Black Engineers and participants engaged in informal science field trips (e.g., zoo, planetarium) and other content related activities curriculum. Extracurricular activities were related to Black history, swimming, and engineering design to name a few. Using various forms of qualitative data collection, the girls discussed the importance of the space was in shaping a STEM identity as related to their race, gender, and class (King & Pringle, 2018). The program allowed Black girls to problematize stereotypical notions about their academic skills and establish and maintain relationships with other aspiring girl scientists who “looked like them”. Participation in this programming led to Black girls understanding how science intersected with their lived experiences and the local community concerns (King & Pringle, 2018). I AM STEM provides an opportunity to further shape identities, buffers against microaggressions due to racism and sexism, and centers on Black girls' voices and experiences. These findings have implications for educators, families, and youth-serving community organization stakeholders.

INTech Camp for Girls

To support Black and Latina girls' interest in computer science, INTech focused on "intersectional computing" to address race and gender within their learning experience for girls designed to master computer science concepts, introduce girls to women in the tech industry, and work together in team to develop tech solutions (Braswell et al., 2021). Researchers looked to investigate the effects of having Black and Latinx staff members in increasing participant confidence. Although typically held in person, this virtual camp for middle and high school girls allowed girls to engage with mentors in technological fields at companies such as Facebook, Microsoft, and Bank of America. The culturally responsive curriculum allows for girls to build websites or mobile applications based on previous experiences (Braswell et al., 2021). Topics of these sites and apps were developed in collaborative teams based on discussing with students regarding personal interest or concerns such as COVID-19, Black Lives Matter, or online safety to name a few. Using pre- and post- surveys regarding computing confidence, social support, intent to pursue, and computing outcome expectations, results indicated that there was a significant change in confidence, computing expectations, but not for social support and intent to persist (Braswell et al., 2021). Girls were especially engaged in discussions with mentors during the virtual speaker series. Additionally, the camp noted support and strategies are needed for virtual facilitation of project design and collaboration, as well as translingual support to better position girls and families in virtual informal spaces.

Where Do We Go From Here?: Supporting Black Girls in STEM

Black girls must be supported and nurtured as STEM learners. Black girls have unique intersectional experiences that stakeholders should consider in STEM retention efforts (Ireland et al., 2018). Also, as guided by CRF and Black girl cartography, these counterspaces allow girls to deconstruct negative notions and ideologies about who belongs in STEM by highlighting their own experiences, identities and using an interdisciplinary approach in urban settings. Additionally, the attention to detail in creating dedicated time, space, and places allowed for Black girls to collectively reflect and engage with one another in safe, welcoming environments. Black girls benefit from spaces that affirm their intersecting identities through formal (e.g., school) and informal learning opportunities (e.g., after-school programming). Both formal and informal spaces should have a curriculum

and programming that centers the experiences of Black girls. For instance, in academic spaces, educators that incorporate a blend of individualized learning where Black girls are allowed to ask questions and are inquisitive and support each other (peer-to-peer learning) nurture STEM identity development (Joseph, Hailu, & Matthews, 2019).

Based on our meta-ethnographic review, informal learning counterspaces are uniquely situated to develop Black girls' STEM identity and sense of academic belongingness. Within these spaces Black girls' ability to access programs despite funding limitations at various ages, mentors and instructors attending to cultural identities to assist with achievement and belonging, an increase in gendered racial pride through STEM understanding related to the oppressive nature of the field, parental and community involvement, as well as year-long programming and mentorship were significant strategies to privilege the girls' experiences in these safe spaces. STEM experiences and opportunities that affirm Black girls' intersecting identities and center on their lived experiences within their homes and communities will strengthen the pipeline. Below, we offer specific recommendations for key stakeholders.

STEM Education Research with an Intersectional Lens

First, *more research is needed on Black girls, racial identity, self-efficacy, science and engineering identity, and STEM education; not one construct, but all of them at once* (Ireland, 2018). Currently there are studies focused on white girls, but there is a dearth of literature regarding Black girls, racial identity, science and engineering identity, efficacy, and STEM education (Davis, 2020; King, 2017; Gholson, 2016). Most studies are focused on students that are middle school aged or higher in science and they do not examine the intersectionality of the Black girl experience (Young & Cunningham, 2020). In moving forward, we must disaggregate the data to understand the intersectional experiences of Black girls. For instance, Black girls are not a monolith. STEM is not just science and all girls do not have the same lived experience. Thus, their experiences across race, gender, class, place, and space will provide an opportunity to understand STEM experiences. It's also imperative that we consider the STEM learning context of Black girls. For instance, considering the environment would provide information on equitable resources – such as access to equitable STEM learning opportunities. Actively and intentionally engaging in developing counterspaces that support Black girls in disrupting stereotypes, building confidence, identifying role models that have the same race and/or gender, opportunities for collaboration, providing enrichment

opportunities, supporting a STEM identity development (e.g., I can be good at math if I continue to try), and connecting to their lived experiences is essential (Hughes et al., 2020). These opportunities assist in disrupting the "leaky STEM pipeline", the lower participation of ethnic racial minority girls in STEM and the dropping off or leaking through of the pipeline throughout various stages of one's educational trajectory (Dasgupta & Stout, 2014). Allowing Black girls to have experiences in STEM beginning at the early childhood level can assist in increasing interest. Also, instead of critiquing Black girl behaviors, we should work to understand their actions. Therefore, using a mixed methods approach, not just narrative or quantitative (most studies focused on one method of interpretation), we can expand our understanding of how Black girls are persisting as they live with multiple identities in our society (DeCuir-Gunby, 2020; Grossman & Porche, 2014; Ireland et al., 2018;).

Policy Reform in Teacher Education

Second, teacher education programs and professional development for current educators must work on *understanding and critical discourse implementation with students in science, technology, engineering, and mathematics education at the K-12 level*. Prospective educators should investigate and learn how to provide equitable opportunities for students, look at systems of injustice, and engage in culturally relevant pedagogy to affirm the STEM identities of Black girls such as STEM application to the real-world (DeCuir & Dixson, 2004; Ladson-Billings, 1998; Young, Ero-Tolliver, Young, & Ford, 2017). Along with this, the psychological factors that influence Black girls should be understood and teachers should pay attention to how they affect efficacy and identity based on their practices. By developing strategies for adapting instruction to meet the learning needs of Black girls' students that are placed at risk for STEM failure teachers can provide equitable experiences for students through teaching in STEM. As a result of the leaky pipeline, preparing Black girls early by providing enrichment opportunities and encouraging educational opportunities (e.g., AP courses, gifted programs, & honors classes) has helped support Black girls and teachers should attend to Black girls also being less likely to be referred to these opportunities (Young et al., 2017). Thus, understanding academic tracking practices within different schooling contexts would assist programmatic efforts to supplement STEM pedagogy and content delivery. Policies should also push curriculum to include or integrate STEM content. With broad content knowledge, teachers will have more opportunity to focus on delivering innovative instruction to students in formats such as

inquiry-based learning, interactive notebooks, and hands-on experiments; rather than focusing on learning the content one must teach. Furthermore, more investigation of educator preparation regarding STEM should take place at the K-6 level instead of examining just upper elementary grades, middle school, or higher. Addressing STEM learning inequities with Black girls in formal classroom spaces is imperative (Joseph et al., 2019). This invisibility in STEM curriculum exacerbates the existing achievement gap and representation of Black girls STEM education (Collins et al., 2019)

Pipeline Support for Informal Outreach Programs

Third, *we must challenge the structural systems and resource gaps that are oppressive in nature and neglect to support Black girls in informal STEM education.* Black girls, underserved, or minority students need more opportunities and culturally immersed programs to get them interested in STEM. However, informal STEM does not address the constructs in the U.S. system that prevent these populations from doing so (Simpson & Parsons, 2009). Although these STEM counterspaces are growing in popularity, they are still inadequately integrated into local schools and community organizations. School leaders and community organizations should partner to implement year-round programmatic models that develop Black girls' STEM identities. Culturally relevant teaching, critical conversations that factor in community issues, access opportunities that are within communities and address issues such as program fees, transportation, or knowledge needed to participate, and mentors are necessary factors that should be considered in these spaces. Thus, formal and informal education settings, afterschool, communities, and families should look to employ these aspects to challenge existing barriers that may deter Black girls from participating in these spaces.

Stakeholder Support

Fourth, *parents, educators, and youth-serving community organization stakeholders must be engaged and invested in the success of Black girls*. Opportunities include supporting informal learning spaces that center the lived experiences of Black girls in STEM. Given the inequitable learning environments of Black girls' informal settings (Gholson, 2016; Joseph et al., 2019), encounters of racism and sexism can hinder the development of a STEM identity (Joseph et al., 2017). In preparing parents, educators, and organizations, these stakeholders must understand the context of informal STEM learning opportunities are critical. For these stakeholders, supporting

informal STEM learning opportunities and essential programs counter the negative experiences Black girls encounter in the formal settings (Young et al., 2018). Also imperative is community-school partnerships. Building partnerships to support efforts in STEM learning spaces is beneficial for the learning community. Students have the opportunity to obtain STEM resources, access mentors in their area of interest, and potential job prospects – developing and sustaining STEM pipelines (Watters & Diezmann, 2013). More specifically, identifying targeted programs to increase the representation of Black girls on the STEM pipeline. These informal learning spaces provide an opportunity for Black girls to thrive and, most importantly, for their voices and experiences to be valued (Young et al., 2019).

Conclusion

Informal learning spaces, beyond school contexts, can help address inequitable classroom experiences. In particular, by creating "Black girl spaces," (e.g., King, 2017), Black girls will have the opportunity to engage in STEM experiences that bridge academic and cultural ways of knowing and learning (e.g., peer-to-peer collectivistic opportunities and oral history/storytelling; Carter Andrews et al., 2019). These spaces can integrate racialized and gendered experiences in a safe space. These spaces provide opportunities that support academics, learning, and wellbeing. More specifically, these spaces afford Black girls the chance to be heard and valued. Thus, moving forward, informal learning spaces for Black girls is vital in addressing the STEM inequity and opportunity. Instead of trying to "fix" Black adolescent girls (i.e. test scores, family structures, and academic readiness), educational systems should be challenged and interrogated to face the structural biases that live within them. The cultural capital that Black girls can bring to informal STEM counterspaces are much more than what we allow to be shown in many mainstream educational classrooms. There are racial, social, and economic barriers to Black girls accessing STEM due to racial identity, efficacy, STEM identity, and intersectionality. Structural inequity in STEM education, the lack of informal STEM education, and not addressing psychological factors that influence the outcomes of Black girls in STEM have all played a major role into gaps that lead to persistence and how Black girls perceive themselves as scientists, technologists, engineers, and mathematicians. There is a high need to address these issues in and outside of the classroom to increase STEM pursuit. By using critical analysis of STEM education research and having

advocates challenge inequity through counterspaces, we can provide bridges and address barriers to build the STEM pipeline among Black girls.

Chapter Activities

Vocabulary

1. **Informal STEM Counterspaces** - out-of-school or community-based "sites where deficit notions of people of color can be challenges and where a positive climate can be established and maintained" (p.70) (Solorzano, Ceja, & Yosso, 2000)
2. **Critical Race Feminism** - theoretical lens for studying, analyzing, critiquing and celebrating the educational experiences of Black female students at the intersection of their multiple social identities (e.g., race, gender, and social class; Evans-Winters & Esposito, 2010)
3. **Intersectionality** - a Black feminist theoretical critique of antidiscrimination; posits that individuals have social identities that intersect in ways that impact how they are viewed, understood, and treated (e.g., Black girls are both Black and girls, but because they are *Black girls*, they endure specific forms of discrimination that Black men, or White women, might not; Crenshaw, 1989)
4. **Black girl cartography** - praxis-oriented framework that draws attention to how and where Black girls are physically and sociopolitically mapped in education (Butler, 2018)
5. **Identity Development** - also known as identity formation, is a multifaceted process in which individuals form a specific view of themselves based on experiences throughout their lifetime (Velez & Spencer, 2018)

Topic Questions

1. What is an informal STEM counterspace? Brainstorm what it could look like. Visit a Website. Is it a Counterspace? What makes it a STEM Counterspace?.
2. Why are Black girls underrepresented in STEM fields and why are they needed in these fields?
3. How does Critical Race Feminism guide our understanding of Black girls in informal STEM counterspaces?
4. How do informal STEM counterspaces assist with Black girl identity development?