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Employing YPAR to Reflect on the Past, Present, and Future Promotes Black Girls to Learn about STEM Fields and Research

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This qualitative study examines six Black girls' knowledge of the growing concern related to the inequitable educational pathways to STEM fields. The 12-week Youth Participatory Action Research Project (YPAR) includes workshops that promoted the girls to examine the underlying causes for the low number of Black girls who participate in STEM courses at their school. Study data revealed concerns these girls had about young people being exposed to danger when using technology. The Researcher discovered their views were perpetuated by learned experiences in their households and by the media they consumed. The participants also recognized how their school environment influenced their perception of and ability to navigate their educational pathways. Findings further reveal that participation in the YPAR project stimulated participant dialogue with other researchers and prompted participants' critical inquiry, and awareness of deeply rooted beliefs. This transformative process broadened the girls' perspectives of STEM fields and aided them in developing a youth-led action plan to improve educational and social outcomes for their peers.

Keywords: youth participatory action research, Black girls, STEM education, youth development, group work, social work

Introduction

When girls' educational pathways are examined, few would deny the need for research and interventions focused specifically on urban Black girls' school experiences and access to specialized educational opportunities. These girls are at greater risk of being victims of inequitable educational experiences because of their race, sex, gender, and class identities (Edwards et al., 2016; Evans-Winters, 2007; Joseph et al., 2017; Morris, 2013; Ricks, 2014). When school data are placed under critical inspection, the disproportionate number of school suspensions for Black girls is blatant. Data show that Black girls are suspended from school at higher rates (12 percent) than girls of any other race or ethnicity and non-Black boys (U.S. Department of Education Office of Civil Rights, 2014, p. 1). The evidence further reveals the overuse of discipline referrals for minor infractions such as violating dress-code policies,

disrupting school settings, and inappropriate school conduct which all serve as pushout methods that alters the educational trajectory for these students (Barton & Nishioka, 2014; George, 2015; Losen, 2011; Losen & Skiba, 2010). Some scholars purport stereotypical beliefs frame Black girls as loud, disruptive, confrontational, aggressive, unlady-like, and ghetto (Evans-Winters & Esposito, 2010), which results in harsh and punitive discipline practices and in disproportionate suspension rates.

Statistics also show that as Black girls progress from compulsory schooling to college, their underrepresentation in science, technology, engineering, and mathematics (STEM) is readily apparent. National data indicates that of all undergraduate degrees earned in science and engineering in 2012, only 5 percent were earned by Black females (National Science Foundation, 2012). The lack of experience and exposure to the scientific-educational pathway directly impacts Black girls' career trajectory, resulting in statistical reports that indicate minority women comprise fewer than 1 in 10 people employed as scientists and engineers (National Girls Collaborative Project, 2013).

Some of these studies found that students' academic trajectory is influenced by individual distinctions such as genetic and cognitive differences, motivation, and interest (Buchmann et al., 2007). In contrast, scholars suggest that stereotypical beliefs influence students', teachers', and society's perceptions of the scientific pathway (Borum & Walker 2015; Condon, 2007; Hughes et al., 2005). These perceptions have negative repercussions for Black girls' academic trajectory. The sobering statistics and empirical evidence expose a problem that impacts Black girls, their families, school, and society.

Researchers demonstrate a commitment to examining Black girls' experiences and how they navigate institutional racism, which ultimately shapes their school experiences (Chavous & Cogburn, 2007; Evans-Winters, 2005; Joseph et al., 2017; Ricks, 2014). A wealth of STEM education research exposes racial and gender disparities along the scientific path in education (Britner, 2009; Christidous, 2000; McPherson, 2013; Pajares, 2005; Oakes, 1990). Some scholars identified mechanisms that marginalize Black girls and adversely impact their engagement and persistence along the education to career pathway (Joseph et al., 2017). Others reveal how socially toxic environments impact Black girls' racial identity development and perceptions of the pathway to STEM fields (Davis, 2019). A growing body of literature provides solutions such as curriculum development and educational enrichment programs that successfully engaged Black girls in STEM learning (Buck et al., 2014; Bystydzienski, 2015; King & Pringle, 2019). What is consistent across the body of literature on Black girls and STEM is the call for frameworks that conceptualize and theorize about structural forces and context-specific social conditions that positively or negatively influence Black girls schooling experiences. Moreover, empirical research is strengthened by evidence that is grounded in participants' perceptions and voices.

This article critically examines Black girls' experiences and perspectives of issues encountered in their community and school. Specifically, the articles elucidate how youth participatory action research can promote critical inquiry, uncover deeply rooted beliefs, broaden participants' perspectives of youth-focused issues, and aid in developing action plans that seek to promote social justice. In addition, this work aims to understand the role YPAR activities play in prompting Black girls to learn about STEM fields and research.

Inequitable Access to STEM Education

Educators play an essential role as granters or gatekeepers to specialized courses, and literature shows Black students, particularly Black girls, are often denied access to educational opportunities (Buchmann et al., 2008; Campbell, 2012; Francis, 2012; Oakes, 2005; Riehl and Pallas; 1999). For example, in a study of high-poverty schools, Riehl and Pallas (1999) found that time constraints and limited personnel caused counselors to enroll Black students in courses without speaking with them. Similar research shows teachers' perceptions and expectations of students influenced their recommendations into advanced courses (Buchmann et al., 2008; Campbell, 2012). For example, Buchmann et al. 2008 found that teachers show preferential treatment towards girls based on higher levels of attentiveness, social skills, self-discipline, and interest in school. Correspondingly, Francis (2012) found that teachers had more negative views of Black girls and perceived them as disruptive and less attentive than their counterparts. Campbell's (2012) analysis of the Educational Longitudinal Study of 2002 (ELS) assessed the degree to which cognitive and non-cognitive factors of Black girls influence teachers' advanced course recommendations. This study of 15,362 sophomores in public and private high schools across the United States revealed that subjective beliefs held by students and teachers critically influence Black girls' persistence along the math pipeline (Campbell, 2012). Moreover, data show Black girls' confidence to master skills taught in math courses reduced the odds of the teacher's recommendation to advanced classes.

Black girls in STEM

The body of literature on Black girls in STEM provides empirical and conceptual understandings of their experiences in STEM education. For instance, Gholson (2016) describes historical and contemporary constructions that erased Black girls' narratives from mathematics education, making them invisible in STEM inquiry. The author's analysis revealed a call for the creation, occupation, and sharing of positive socio-epistemic spaces that allow for the visibility of Black girls and women in mathematics (Gholson, 2016). Empirical studies by Black mathematic educators provide evidence on how scholars disrupt the deficit narrative. This literature demonstrates how problematizing test score data, race and racism, and learning opportunities in mathematics can disrupt deficit perspectives. Another synthesis of 62 research studies asserts that Black girls navigate and integrate identities in education spaces which aids them in persisting along the pathway (Joseph et al., 2017). These scholars further demonstrate how structural disruptions are fundamental in interrupting institutional practices that marginalize Black students. The synthesis also reveals contributing factors for Black girls' persistence and engagements in STEM learning, including having access to psychosocial support, social support for coping, and emotional support to deal with challenges and overcome stressors (Joseph et al., 2017).

STEM Teaching and Instruction

Black girls are more successful in STEM education if they are enrolled in a rigorous curriculum that promotes higher-order thinking, scientific literacy, and opportunities to engage in projects (Buck et al., 2014; Bystydzienski's, 2015; King & Pringle, 2019; Pinder & Blackwell, 2013). For example, Bystydzienski's (2015) 7- year longitudinal study of the *Female Recruits Explore Engineering (FREE)* and *Pathways Project* afterschool intervention describes the engagement and outcomes of 131 predominantly low-income, Hispanic, and African American high school girls. This 3-year intervention provided STEM learning and activities to spark and

sustain their interest in engineering careers. The girls participated in exploration intervention for engineering during the 10th grade, self-initiated engineering projects in the 11th grade, and college mentoring in the 12th grade. The researchers studied the young women through their transition from high school to college and found that the intervention encouraged participants to consider careers in engineering fields. After exploring engineering in monthly meetings, attending career fairs, meeting with practicing engineers, and visiting engineering schools and workplaces, the participants became more aware of the field and career options. Planning and executing the projects expanded their knowledge of engineering, gave them some familiarity with technical language, and heightened their interest in social and entrepreneurial application. A high proportion of the participants went on to study other STEM fields such as biology, zoology, chemistry, and environmental science. However, most of the low-income and minority young women lacked financial resources which kept them from going to a college with an engineering program, or in some case, to any college. Some harbored a sense of self-doubt and lack of confidence in their ability to progress in the field. Several young women dropped out of the field, reporting a lack of support from professors, peers, advisors, and others.

A qualitative study of the program, *I AM STEM,* provides evidence of how community-based informal STEM programs, serving predominately Black and lower-income students, provides access to science education (King & Pringle, 2019). Students attended a 25-day summer program organized by grade levels, "kindergarten and first grade; second and third grade; fourth and fifth grade; middle school; and high school (King & Pingle, 2019, p. 551)." Students examine scientific phenomena as part of a STEM curriculum during the program, which includes learning about the impacts of pollution, water quality and availability, recycling and composting, green energy, climate change, and organic gardening (p. 550). The counterstories of six participants, Black girls in the 4th through 8th grade, reveals the participants developed a greater appreciation for STEM learning and an interest in STEM. These girls also developed civic responsibility and scientific literacy. Moreover, the researchers found that providing a safe space with positive support systems allowed the girls to share rich stories about their strengths and struggles related to STEM learning.

A participatory action research (PAR) project seeking to improve African American girls' attitudes toward science was conducted in collaboration with Indiana University and an elementary school (Buck et al., 2014). The team collaborated to design intervention efforts, including professional development, science labs, and a science fair for the youth participants. In addition, the team administered 89 pre- and post-surveys to youth participants to study the initiative to examine the students' orientations towards science and students' science education experiences. In addition, youth participated in focus group discussions divided into groups based on their attitude orientation established from the surveys. The foci of the focus group interview included questions about attitudes toward science, attitudes towards science education, the relative importance of science (as an area of study and school subject), and favorite science lessons (p. 440). Cumulative findings indicated that the initiative positively impacted girls who initially demonstrated low self-efficacy in science education or had low attraction to science. Moreover, data shows girls had positive attitudes toward the other girls; the initiative promoted the establishment of collaborative activities and inquiry-based experiences.

Despite volumes of research on equity and educational issues, relatively few qualitative studies explore and seek to understand what Black girls' early experiences in science were (Pinder & Blackwell, 2013). Also, there are few studies designed for Black girls to examine their

experience and identify what they believe is the underlying cause for racial and gender disparities along the STEM educational pathway. Although many researchers draw on YPAR to engage participants in critical inquiry, a review of the body of literature found no studies that employed youth participatory action research (YPAR) in STEM-related examinations. The following section synthesizes YPAR projects conducted in urban settings, the project's focus, and outcomes.

YPAR Projects

YPAR projects conducted in urban education spaces have proven successful in providing academic and psychosocial support (Cahill, 2008; Davis, 2019; Fernandez, 2013; Kerr, 2013; Kirshner et al., 2011; Scott et al., 2015; Smith et al., 2010). In addition, academic skills like writing, meeting deadlines, and interviewing are developed during YPAR projects (Scott et al., 2015). The authors assert that the YPAR project was effective in promoting youth to engage in critical research. Youth participants gained skills that align with the types of capacities students will need to juggle academic and personal development.

YPAR projects have also been used to promote critical inquiry and multimodal expressions where youth examine, negotiate, and reflect on themselves (Kerr, 2013). These youth participants used creative writing to examine their lives and share their experiences with others. In a similar study, Fernandez (2013) examined how projects using critical dialogue can be an effective approach for youth to examine themselves, past choices, and possibilities for the future. Fernandez also studied how YPAR can be a mechanism for creating steady support systems. The pilot program *Theater Initiative* was conducted with youth participants ages 17-22 during 2008-2009. This study reveals how the YPAR project fostered critical dialogue to build relationships between youth and adults. Other researchers demonstrate evidence of psychosocial skills that are developed during the YPAR project. For instance, meaningful relationships are developed with their peers, and youth can think in broader context about issues that impact other youth and society (Fernandez, 2013; Kirshner, 2011). Kishner et al.'s (2011) study shows the prevalence of biases students brought to the research. However, engagement in the project allowed youth participants to manage their biases during cognitive tasks. For instance, these youth examined other students' experiences, which raised their awareness and disabled biases. Similarly, Smith et al.'s (2014) study reveal that youth entered the project process with personal biases about youth experiences. However, working with other youth and developing research-based relationships changed their perceptions of youth experiences and the results of the project process.

Some researchers have used YPAR to examine the experiences of young women of color (Cahill, 2008; Davis, 2019). Cahill (2008) designed a YPAR study with a team of seven young women ages 16-22 in a lower East Side New York neighborhood. The YPAR team conducted preliminary research examining their neighborhood to see how social, economic and political issues shape social disparities in their life and community. Cahill found that PAR offers a promising process for engaging young people in examining interrelated and complex ways their lives are impacted by stereotypes and assumptions that influence society. Youth participants learned about their community history, which aided them in identifying a set of possibilities to create social change. Cahill asserts that the research process promoted personal and social transformation for the participants. Davis' (2019) study reveals how YPAR was used to aid a team of urban Black girls in critically examining the high school educational pathway to

specialized fields, such as STEM careers. Findings from phase one of the project reveal how school and culture intersect and affect urban Black girls' school experiences, perception of educational and specialized career pathways, and their racial identity development.

Methodological Framework

This study of a YPAR project includes an examination of Black girls' knowledge of inequitable educational pathways. YPAR is a methodological framework that can be used to engage youth in a systematic collaborative research process to critically examine issues that impact their lives and find solutions for change. The origin of the framework is Participatory Action Research, which is "designed to recognize the power and knowledge of insiders; the strength of inside-outside collaboration; the generative power of difference and the urgency of critical work for democratic public institutions (Fine, 2008, p. 23)." This knowledge sharing is instrumental for youth participants as they progress through co-researching about an issue that directly affects their lives. It is also necessary to promote youth co-researchers' decision-making during the co-development of a social change agenda. YPAR is also a tool for exposing flawed theoretical explanations and taken-for-granted interpretations. Engagement in this systematic process allows YPAR participants to "review the problem" with an eye toward complexity, politics, social psychology, and structures and away from simple victim-blaming explanations (p. 20).

Characteristics of YPAR Projects

The key characteristics of YPAR projects include democratic participation, critical theorizing, and research in action. These characteristics are instrumental for youth participants as they progress through co-researching about an issue that directly affects their lives. It is also necessary to promote youth researchers' decision-making during the co-development of a social change agenda.

Democratic Participation. YPAR is an epistemological and methodological framework that employs pedagogical strategies to create a democratic process. Fine (2008) asserts, "PAR projects are designed to recognize the power and knowledge of insiders; the strength of inside-outside collaboration; the generative power of difference and the urgency of critical work for democratic public institutions" (p. 23).

Critical Theorizing. YPAR is a tool for exposing flawed theoretical explanations and taken-for-granted interpretations. Fine and Torre (2004) assert that during the PAR process, the researchers should "review the 'problem' with an eye toward complexity, politics, social psychology and structures and away from simple victim-blaming explanations" (p. 20).

Research-in-Action. One of the core principles of YPAR is to use research to take action by using research. The knowledge produced from their inquiry process leads to youth interventions. Researchers facilitating YPAR projects cannot predict the type of action initiative the team will develop because the design evolves during the process. However, researchers begin the project with an idea about the action alternatives considering a continuum of action possibilities ranging from educational outreach to political lobbying (Powers & Allaman, 2012).

Context of the Study

The study also explores how the YPAR activities were used to promote girls to examine underlying issues that prevented them from succeeding in school. The research was approved by the Institutional Review Board (IRB) at an Urban Public Research University and a Local School District in the southeast region of the United States. Initially, participants committed 2 hours once a week for eight (8) weeks to participate in the project. As the project evolved, the Researcher submitted modifications to the IRB application and obtained approval to increase the number of participants and length of the project. For instance, once the youth researchers identified their focus, they recruited additional participants for their project. This 12-week YPAR project was conducted during the 2015-2016 academic year.

In this article, the school is referred to as Shine High, a pseudonym the participants selected to describe their ideal schooling experience. The significance of the name *Shine High* was conveyed during Workshop 1 when the team discussed their perception of an ideal school for Black girls to be successful. One of the girls referenced the Disney movie *Let It Shine*. The participants explained that the film shows Black youth living "happy" and "normal" lives in a community like theirs. At our final meeting, the girls voted to use a piece of the title "Let It Shine" to name their school "Shine High." They also used words from their brainstorming activity to call the school district "Happy Public School" (HPS) District.

Participants

The YPAR team participants were recruited using criterion sampling and snowball sampling (Merriam, 2009). This recruitment technique allows researchers to establish criteria, identify participants, and provide existing participants an opportunity to recruit participants from their social group who meet the previously established criteria. The selection criteria for this study are: identified as a Black girl, enrolled in a local high school, and interested in learning about STEM education, and how to conduct social science research.

A school social worker passed out flyers stating, "Do You Want to Be Heard? Youth Participatory Action Research"? the 1st letter of each word is pink, signifying the acronym YPAR and the other letters are written in white. The purpose of the flyer was to invite potential participants to an informational session conducted during lunch periods. Approximately 30 girls received flyers, eight girls expressed interest, and they received additional information for the afterschool meeting. However, only two girls, Blake and Hope (pseudonyms), attended the first meeting to learn about this new afterschool activity. After that meeting, Blake and Hope recruited additional girls who met the study's criteria for participation. Four girls participated in the first YPAR project workshop: Blake, Malachi, Hope, and Joi. At the second workshop, Micha joined the group. Infrequent participants were not included in the project. Each participant provided an informed consent form and application to participate in a 12-week afterschool activity to conduct a YPAR project.

The study participants are described below in Table 1. Although the girls were advised that the workshops focused on teaching them about STEM education and research, they expressed personal interest in joining the project. The table consists of the participants' grade level, college and career aspirations, and rationale for joining the YPAR project.

Study Participants				
	Grade	**Career Goal**	**Post-Graduation**	**The Rationale for Joining the Project**
Blake	12th grade	Social Worker	College	To be a part of a project that could help other girls
Malachi	12th grade – *was in early college*	Makeup Artist	Workforce	To have something to do after school
Joi	11th grade	Doctor	College	To have something to do after school
Micha	11th grade	Military Officer	Military	To join my friend and to have something to do after school
Hope	11th grade	Undecided	Undecided	To have something to do after school
Free	11th grader	Unknown	College	To join my friends and to have something to do after school

Table 1. *Study Participants*

Blake. Blake is a senior. She enrolled in the 9th grade after attending the feeder middle school. Blake is an outgoing and friendly young lady who enjoys building relationships with her peers. When asked how she would describe herself, Blake stated, "I get along with everybody." Blake thrives on working with adults and peers to create positive opportunities for people living in her community. At the inception of this project, Blake was involved in three community-based projects. One project involved creating a mural at a historically Black university. Blake always expressed a strong desire to be a part of the YPAR project, and she frequently sent messages via the group Kik account to obtain information about the project. Blake graduated in May; however, she joined the team during the summer to participate in project planning.

Malachi. Malachi is a senior. Before attending this high school, she attended eight schools located in the school district. She was formerly enrolled in a dual education program but transferred into the general school track. According to Malachi, her counselor changed her school track without consulting with her. Malachi expressed her distrust and resentment toward adults. She disclosed that she does not have many adults to talk to in her family or community. Her distrust of adults, including me, was evident during the first two workshops when she frequently rolled her eyes and stared with discontent. As Malachi's rapport with me grew, she became more engaged and often spoke candidly about herself. She provoked in-depth conversations about the life of girls who have overcome several challenges. Malachi's ability to problem solve and engage in strategic planning was instrumental in the project.

Joi. Joi is a junior and an assistant for the cheerleader coach. Joi is influential amongst her peers and teachers. She invited Micha to join the project and later asked Free to join as well. She played a key role in weekly workshops. She was the note taker and facilitated several of the discussions. After the project, Joi assigned each member a position and title that she created based on each person's contribution to the weekly workshops. She assigned herself the Who Knows It (WKI) workshop secretary role, which required her to take notes and send information

to the team. Joi often led group discussions, including several brainstorming activities used to select the official group name—Who Knows It.

Micha. Micha is a junior. She learned about the project from her friend Joi and joined the group after the first workshop. Micha, Joi, and Free are close friends. Micha explained that she does not have many friends at school because it is difficult to get along with girls. Micha was quiet during workshops, but she would engage in the group discussion when prompted. Her participation in the group focused on logistics, ensuring everything was operating, and setting up technology for the group. Micha created the Kik account and managed most of the social media conversations. Outside of the group, Micha shared with me family issues that are the reason why she wants to join the military. She also expressed that frequent domestic issues motivate her to become self-sufficient as swiftly as possible.

Hope. Hope is a junior. She was one of the first participants to join the study, but she left after week 7. She often discussed the lack of opportunities Black girls have to participate in positive things in their school and community. The absence of youth opportunities prompted her to join the YPAR project because she wanted to be a part of something positive after school. Hope explained that she was frequently absent from school because she "dreads going." During weekly workshops, Hope discussed being involved in physical altercations with her peers and some verbal altercations with teachers and administrators. Hope played an instrumental role in providing anecdotes about the adverse effects of negative peer influences and some of the consequences of poor decision-making. Unfortunately, Hope decided not to participate in the project after week seven of a 12-week intervention. After Hope left the project, I saw her wandering in the neighborhood during school hours. I made frequent attempts to reconnect Hope to the research team. However, Hope refused to return because she felt the other participants were accomplishing goals they set at the beginning of the project (i.e., finding a job, applying for college, improving their grades). Hope, on the other hand, felt like things were not improving for her.

Free. Free, a junior at the school and periodic YPAR participant. She submitted her informed consent at the beginning of the project, but her extracurricular activities prevented her from consistently attending workshops. Thus, Free dropped in for three of the workshops. When Free attended workshops, the girls spent a significant amount of time updating her on the project and their information. Her lack of familiarity resulted in the team excluding her from making decisions about the YPAR project. Free's role in the YPAR project was minimal. Free is only included in the study findings when the girls' interactions and dialogue focused on educating her on the project process or when her participation influenced the group's decision-making and project process.

Shadonna. Shadonna is a Black female with nearly ten years of school social work experience at the local school districts. Before the study, she had not encountered the study participants. However, she had previously worked with some students, staff members, and stakeholders at Shine High. Her role as the Researcher and social worker helped her engage the participants in an authentic examination of lived experiences important to them. She assessed her biases by asking the girls critical questions about their experiences and beliefs. She also engaged in active listening during discussions with the participants. Each week, she journaled about her initial thoughts and reactions to workshop discussions. At the conclusion of the project, she explored how engagement in the project shifted her thoughts about the school, students, and staff. Each week, she focused on key topics the girls discussed and helped them identify themes

across the workshops. Shadonna was also a facilitator and participant in the project. Thus, referred to as the Facilitator or Ms. Shadonna, the name the participants used throughout the project.

Research Design

The YPAR project included 12 two-hour workshops facilitated after school in a school classroom at the high school and a neighboring library. Happy School District and the principal at Shine High provided approval for the afterschool workshops at Shine High School. However, school maintenance, extracurricular events, and other unforeseen circumstances would abruptly prevent school access. The meeting room at the neighboring library became an alternate site that was approved through an IRB amendment.

Each workshop was designed to teach the participants how social science research can be used to examine issues and find solutions for improving girls' high school experiences (see Figure 1). The first workshop focused on examining the girls' thoughts about STEM fields and their social science research experiences. The girls played a game called "Say What You Think – Black Girls Education" to examine and promote the girls' awareness of systemic racial and gender injustices along the STEM educational pathway. The girls answered a series of multiple-choice and true/false questions about facts and statistics for Black girls' education to career pathways for this activity. Workshop 2 aided the girls in exploring racial and gender inequities in America's workforce, focusing on how schools contribute to disparities. The girls expressed their thoughts and assumptions during the activity, "Say What You Think – America's Workforce." The next series of workshops focused on the girls' knowledge of and exposure to research. These workshops examined what the participants already knew about research and how they felt about conducting research. For example, the activity "Research for Youth & By Youth" allowed the girls to learn about youth-led research. They watched YPAR project videos and a presentation to encourage the girls' brainstorming on their research project possibilities.

	Workshop Title	**Activity & Purpose**
1	*Getting to Know You, Us, and Our Project*	*Say What You Think – Black Girls Education* • Identify participants' knowledge (and knowledge gaps) about racial and gender disparities and inequities in STEM education • Promote idea generations on an issue that impacts Black girls' educational progress in STEM fields • Examine participants' take-away from this session
2	*Going Back in Time & Looking at the Future*	*Say What You Think – America's Workforce* • Examine what participants know about racial and gender inequities in America's Workforce • Explore how schools contribute to disparities in the workforce • Identify education issues that are important to the youth researchers • Examine participants' take-away from this session
3	*Research for Youth by Youth*	*Say What You Think – Our Knowledge of Research* • Examine what participants already know about research • Examine how they feel about conducting research *Examining Youth-led Research* • Use models of youth-led research projects to encourage the girls to brainstorm possibility for their research project
4	*Designing Our Research Project Part I*	*Knowing our Perspective & Experiences* • Promote the girls to explore team members experiences • Each youth researcher presents their perspective to the team • Introduce coding techniques to facilitate a discussion on the commonalities and differences in the youth researchers' perspective *How Can We Get Other Girls Perspectives & Experiences* • Engage in a critical discussion about who needs to participate in the study and why • Help the team develop a plan for recruiting participants • Identify the data collection sources and process.
5	*Designing our Research Project Part II*	*Planning for Data Collection* • Finalize Participants Questions for the Research Festival • Finalize Flyer & Participants List • Create a Plan for Research Stations
6	*Researcher Training and Certification Course*	*Becoming an Ethical Researcher* • Examine what participants already know about research ethics • Train the youth researchers on ethic and research • Examine participants' take-away from this session *Finalize the Research Project Plan (Research Event)* • Discuss the logistics for the workshop room • Identify member's roles

7	*Research Festival*	*Data Collection Stations* • *Assist the YPAR team with data collection from peers* • *Provide new participants an opportunity to use artistic expressions (e.g., rap/song, poem, picture) to gather information on participants school experiences*
8	*YPAR Team Debriefing Meeting*	*Keep it Real: Lessons Learned About the Research Plan* • Facilitate a discussion to identify lessons learned, challenges explicitly with recruiting participants • Evaluate the participants' commitment to the project • Review group norms and team members' expectations *Write the Vision* • Outline a new plan for the project
9	*Conducting Research Online Part I*	*Conducting Research Online: How to Create a Survey* • Teach youth researchers how to create a survey • Review and select an online survey app
10	*Conducting Research Online Part II*	*Youth-led Research Approval: Working through the Logistics* • Continue the discussion about research questions and sub-questions using the research questions the team identified • Review survey questions using the mobile app • Conduct a pilot test with students • Revise survey questions
11	*Data Collection Presentation and Approval*	*Collecting Data for the Project* • Seek approval from school administrators and administer surveys • Discuss ethical dilemmas and challenges • Identify solutions for the low response rate
12	*Making Meanings of Our Data*	*Coding Our Data and Planning for the Future* • Teach descriptive coding and analysis techniques • Examine youth-researcher and survey participants responses • Identify the theme across responses • Establish a plan for how we will use the data

Table 2. *Workshop Purpose and Activities*

Other workshops focused on preparing the girls to conduct a social science research project. The purpose of the activity, "Designing Our Research Part I & II," was to help the team develop more coherent thoughts about their school experience. For instance, participants reviewed previous workshops' responses and identified commonalities and differences among the youth researchers' responses. As they read strips of paper, they created groups of similar statements. Next, the girls responded to questions like "why does this response belong in this group" and "how would you describe this group?" These preliminary findings revealed a theme focused on "Black People," specifically Black Girls, Counselors, Parents, and School Environment. The YPAR team planned their research project during Workshops 5. The activity "Planning for Data Collection" guided the girls through a focused discussion on recruiting and engaging girls in research. The girls also completed hours of research training to learn the foundations of qualitative research. They participated in an ethical researcher activity,

"Becoming an Ethical Researcher," created by the facilitator and approved by the Institutional Review Board (IRB) at an Urban Public Research University. The interactive activity included slides with case studies and multiple-choice answers for solving an ethical dilemma. After the team reviewed their response, they briefly discussed the best approach for addressing the dilemma. Scaffolding techniques including a series of questions were presented, including "who is at risk," "why should we be concerned about this," and "what should we do." These questions aimed to provoke a deeper understanding of how ethical issues might arise beyond the youth researchers' control. When the team reviewed the correct responses for the questions, they learned that the most appropriate way to address an ethical dilemma is to "Notify the facilitator immediately."

Workshop 7 was "the Research Festival," which had a low attendance rate. The request to conduct the research festival was approved approximately 48 hours before the workshop. The team discussed canceling the festival, but most girls were confident they could recruit participants. However, only 2 participants registered for the festival. Workshop 8 provided an opportunity to identify the project challenges during "Keep it Real: Lessons Learned About the Research Plan." The purpose of the activity was to explore what went wrong and devise a new research plan. The girls outlined concerns such as time constraints and difficulties discussing the project with their peers. This brainstorming activity resulted in a revised research plan to administer surveys via Survey Monkey by disseminating a link via text messages and the classroom whiteboard.

The final project phase focused more on providing guidance and technical support to the girls as they created, administered, and analyzed surveys. In Workshop 9, the girls learned how to create surveys, wrote two open-ended and five closed-ended questions. The following workshop allowed them to administer the survey to students in the hallway for a pilot test. They used the pilot test to revise survey questions. The girls presented their survey to the school administrator and received approval to post the survey link on chalkboards in the classroom two days before Workshop 11. The low survey response rate of 12 participants was the focus of Workshop 11, which included identifying ways to increase survey responses. At the end of the workshop, the girls established a goal for each participant to administer at least two surveys before the next workshop. Workshop 12 provided an opportunity to analyze 32 surveys. The coding activity provided a process for identifying themes in the data. The girls also engaged in a focused discussion to determine how they would use their research findings. This discussion led to the group co-writing a Black Girls Empowerment Initiative proposal, a one-year project conducted in 2017.

Methods

Data Collection

Contrary to research projects conducted solely by the Researcher, projects grounded in YPAR methodology usually include a study of a study. For instance, the researcher gathers data on the youth participants' experience in the YPAR project while the youth researchers are engaged in their data collection process. For this study, data were gathered before, during, and after the 12-week project. The purpose of the data is to examine the YPAR project, including the youth researchers' research. Figure 1 below delineates these data sources. Workshop transcripts, focus groups, and observations were conducted to examine the participants' knowledge and

perspectives about their educational experiences, disparities in STEM fields, and engagement in the YPAR project. To examine the workshops' outcomes, documents from weekly workshops included written sheets collected from educational games, workshop wrap-it-up responses, and individual and group activities (poems and collages). Also, documents the participants created to design their research project were another source of data included in this study. These documents included a poem, collage, agendas, an action plan proposal, activity planning notes, iterations of survey questions, and the final survey that was used for the YPAR project.

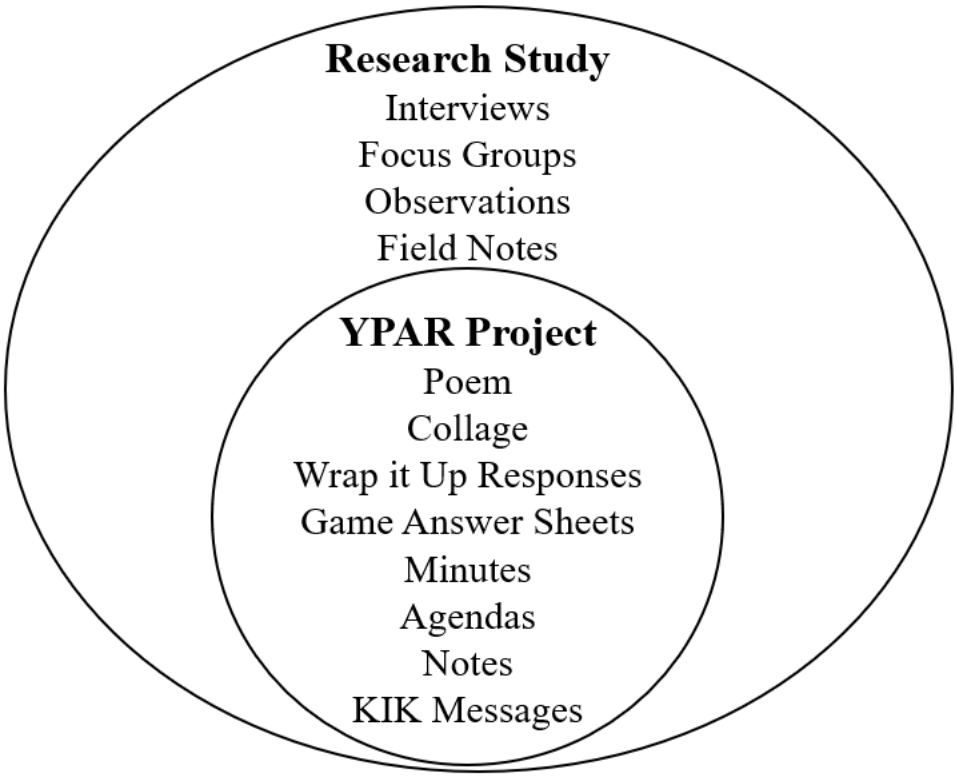

Figure 1. *Research Study and YPAR Project Data Sources*

Participant-generated data includes the survey findings and action plan proposal drafted using their research findings. The researcher/facilitator's reflective pedagogical journal is a data source, including field notes written to examine the project's workshops and reflections. Another source of data was text messages the girls sent via Kik, a group text messaging application. Throughout the project, the participants used Kik to share information, schedule meetings, and address logistical concerns. For instance, the girls notified the facilitator of the number of attendees and school closure or extracurricular activities that might impact the workshop. These text messages from the Kik account pertained to their project process, thus included in the study data. Text messages that were not relevant to the study (i.e., greetings, photos, and conversations about personal situations) are not included in this study. Field notes, observations, interviews, focus group discussions, and documents were used to create composites of the data collected.

Data Analysis Process

A critical analytical approach was employed during two data analysis stages, beginning with a preliminary analysis, then moving to a thematic analysis. This approach is the most appropriate analytical process for analyzing the forms of data gathered during a participatory research study. The preliminary analysis is a way to step away from the field and examine the impact the project and process had on the research. The youth co-researchers were involved in the preliminary analysis considering they coded raw data collected from weekly workshops' audio transcriptions. The researcher/facilitator regularly examined data to determine the workshops' design and additional information during subsequent data collection opportunities.

The codification process is a way to assign a designation to various aspects of the data so that researchers can group and easily retrieve specific content using the code. The Researcher designated codes using single words and phrases, symbolically assigned to provide a summative and salient interpretation for portions of data (Saldona, 2013, p. 3). The descriptive coding technique was employed to examine the interviews, journals, and observations (Charmaz, 2000). The data were then analyzed using thematic coding to develop themes (Saldana, 2013) and presented to the YPAR team for member checking. This method is used to eliminate misinterpretations, increase trustworthiness, and ensure the findings' credibility (Merriam, 2009).

Findings

This qualitative research study was designed to facilitate a youth participatory action research project (YPAR). The study examined the participants' experiences as they engaged in a systematic process of examining, interpreting, and theorizing about the educational pathway to STEM career fields. YPAR methodology and critical pedagogical approaches were used to facilitate the 12-week research project conducted with a team of 11th and 12th-grade Black girls who attend a low-income urban high school. The data collection and analytical process provide a story of how engagement in YPAR workshops helped these participants examine and identify causes for the low number of Black girls in STEM fields. The findings below are organized around the research question, "What role does YPAR play in promoting Black girls to learn about STEM fields and research?" Findings reveal that after participating in the YPAR project, the girls learned statistics that promoted critical inquiry, uncovered deeply rooted beliefs, dialogue with other researchers broadened their perspective, and qualitative data analysis led to a youth-led action plan. Themes related to findings written in a narrative format include excerpts from workshop discussions. In addition, the Researchers' reflective comments (in bold italics) reveal issues and interpretive thoughts during data collection activities.

Learning Statistics Promote Critical Inquiry

Initially, the participants knew little about racial and gender disparities along the STEM educational pathway (Davis, 2019). At times, they reified racial stereotypes to explain social and educational injustices. However, after weeks of workshops, they developed a greater understanding of school-level issues that adversely impacted their school experience. The first activity, "What Would You Say," a guessing game reveals the low number of Black girls in STEM fields. As the girls played the guessing game, they overestimated the number of Black girls who took AP Computer Science, enrolled in advanced placement mathematics and science

courses, and majored in STEM degrees. The excerpt from Workshop 1, below, is a composite of the observation and participants' answers to a series of questions.

> Shadonna: Black girls' makeup ___ of the student population. However, they represent only ___ of the students enrolled in AP Math and Science courses."
>
> *At first, the girls appeared confused and stared at each other, which prompted Shadonna to draw a picture of a pie with slices inside the circle to visually represent the question.*
>
> Shadonna: Let's think of it this way if the student population was a pie, how much of the pie would be Black girls.
>
> Malachi (*looking confused*): 95 percent.
>
> *Shadonna attempted to provide the girls with clarity by asking several probing questions. First, she asked Malachi if Black girls make up 95 percent of the student population, then what percentage would other racial groups be. Shadonna also asked, "In the United States, there are ____ Black girls in schools"? Next, she asked, "In the whole United States, how many Black girls are in schools?"*
>
> Malachi: A bunch.
>
> Shadonna: You think 95 percent of the student population is Black girls?
>
> Malachi: Yep, boys don't go to school.
>
> Shadonna: Ok, but now this question is for all students, all racial groups.
>
> Malachi: Hmmm.
>
> Shadonna: For all racial groups in the United States, in the United States there are several different racial groups. How many Black girls would be in the schools?
>
> Malachi: Just Black girls, OK maybe 40.
>
> *Shadonna noticed the girls looking around at each other's sheet and reminded them that there is no right or wrong answer while stating, "the purpose of the game is to see what you know." Nevertheless, the girls proceeded to write Malachi's response on their answer sheets.*
>
> Malachi: Everybody got 40 percent.
>
> Shadonna: OK. So now answer this part: Black girls represent __ % of the students enrolled in AP science and math courses?

The second part of the question caused the girls to reconsider their previous answers, which was evident when Blake heard the second half of the problem and immediately started erasing her first answer and stated, "Oh, that's not it." The other participants also scratched out their responses on the answer sheet.

Shadonna: Across the whole country how many Black girls are in AP math & science courses?

Hope: Is there a right or wrong answer?

Hope: Because I know I got it wrong. . . .

(The girls laugh.)

The girls received the answers to the question: "Black girls make up 17% of the student population. However, they represent only 5% of the students enrolled in AP Math and Science courses" (US Department of Education, 2014). The girls' responses indicated that they had not previously considered STEM education or Black girls' underrepresentation. Their initial responses also illustrated how challenging it was to answer questions focused on racial and gender disparities in STEM education. As a result, these participants were unaware of the state of Black girls' education. Towards the end of the workshop, the participants shared what they learned or a shocking fact. Table 3 below is their responses from the Wrap It Up Activity, which revealed their growing concern about the state of Black girls' education (Workshop 1).

	What I learned/What was shocking	**What do I want to know**
Blake	• As in the black society, families have a little opportunity to other races. • We was not given a choice to take the AP exam • 17% of black girls make up the population.	Why is the Black girl race low and inefficient in society?
Hope	• The percentage of black females with a STEM education. • Black girls make up 17% of the population.	Why do they compare the Black society to the White society?
Malachi	• Basically, we talked about black women (people of our kind) in society and how they are/aren't making a difference. • What shocked me was in the U.S., only 17% of black girls make up the student population.	What I want to learn is why don't people put effort into being something in life?

Joi	• That black girls are not as active in school as we thought. • I learned that we never look outside the box about anything that happening around us.	Why do we act the way we do?

Table 3. *Wrap It Up Activity Responses*

History Discussions Uncover Deeply Rooted Beliefs

Another theme reveals that when the girls examined workforce trends and the need for preparing people to enter the STEM workforce, they focused more on the dangers of technology. During Workshop 2, the girls engaged in activities to review the careers Black women performed in the workforce and the current concern regarding preparing Black girls for STEM careers. This workshop started with an icebreaker discussion about what they learned from the previous workshop. Blake shared percentages and numbers she learned about Black girls in STEM courses. Joi shared the percentage of Black girls in the STEM fields. Next, Shadonna explained the importance of examining how changes in the workforce impact Black women, stating, "we need to learn more about what women used to do and what is going on today (Workshop 2)." The team received instruction for the game and a reminder that there are no wrong answers. The girls were asked to look at the photos on a PowerPoint presentation (see Figure 1), write their first thought on the paper, and share them with the group after everyone finished writing.

Figure 1. *Say What You Think – America's Workforce PowerPoint Photos*

Each slide included photos taken from Google that focused on different periods of America's workforce and the type of labor that dominated the era. For instance, black and white pictures showed depicted the agricultural and industrial economy. The girls recognized the workforce's evolution, including slavery, manufacturing, and the service industry. They also

discussed Black women's role in the workforce as the maid, secretary, teacher, or hairstylist. However, when the girls saw a series of slides focused on technology and global society, they did not discuss the workforce. Instead, they focused more on the dangers of technology. These slides included pictures of cell phones and computer manufacturing companies. Another slide featured a cartoon family with a dog, child, mother, and father using different computers. Below is an excerpt of the girls' discussion, which explicate their perceptions of the workforce and concerns about the dangers of technology (Workshop 2):

> Shadonna: What are some of the thoughts that come to your head when you see this picture?
>
> All girls: Technology taking over society.
>
> Joi: Bad influence.
>
> Blake: Kids are more engaged in technology.
>
> Joi: Bad influence.
>
> Shadonna: What's a bad influence?
>
> Joi: The technology.
>
> Shadonna: The technology is having a bad influence on them?
>
> All girls: Yep.
>
> Micha: Because they would rather stay inside and play on the technology instead of going outside to play.
>
> Shadonna: What else can we see in this picture, what is on each person's device?
>
> *Shadonna is referring to the globe in the cartoon photo.*
>
> The girls: They are connected to everything.
>
> Joi: That's the other dangerous part about it.
>
> Micha: Yes, technology connects you to everything. That gives pedophiles more leeway.
>
> Blake: Not even just the pedophiles think about the murders.

> Shadonna: So, for you guys technology means danger but what does it look like the people in the picture think about technology?
>
> All girls: Danger, danger.
>
> Micha: They bringing themselves closer to danger.
>
> Shadonna: Who is actually using this technology?
>
> Joi & Micha: The younger generation.

This except reveals the girls' deep concerns about youth being at risks of exposure to dangerous content and people. During this activity, the girls saw cartoon pictures of youth using technology for entertainment. Despite seeing the family's image, including the mother and father, the girls focused more on the younger generations' ability to use technology and the dangers of smart devices. As the dialogue continued, Shadonna tried to shift the discussion back to the workforce to guide the girls to think critically about STEM fields and the low number of Black girls who progress along the education to career pathway. She presents pictures of youth using technology while reminding the girls of previous history discussion about the United States workforce, the global economy, and the emergence of jobs that require STEM education and skills (Workshop 2):

> Shadonna: Before when we looked at this picture, technology was negative, but now, when we look at this picture, we are thinking differently about technology. We are thinking differently about what it means to be a part of technology in this global economy. Is it still dangerous?
>
> Micha: It is still dangerous, but kids are going to be able to handle it because they have had more exposure to it.
>
> *The girls think that younger children are more prepared for being a part of the STEM workforce because they are using technology at a younger age. They do not waiver on their position that technology is harmful. Instead, they focus on the functionality of technology while explaining that young people will be able to utilize all the functions.*
>
> Shadonna: Looking at this picture, do you think all of them would be prepared for a job where they worked with technology?
>
> All the girls: The younger people would.
>
> Shadonna: You think everyone who is young is prepared to get a job that requires you to know about STEM? You think this is the case for everyone? Is everybody getting jobs in STEM fields?
>
> Joi: Yep, all of them.

Shadonna: So, from last week, how many Black girls are in STEM classes?

Blake & Joi: Not a lot.

Shadonna: Are the Black girls going to be prepared for these jobs? Then how many Black women are in the STEM field. We saw that last week. Was it a high number?

Joi looks at Shadonna as she tries to answer the question. She then asked Shadonna for the answer sheet from the Say What You Think about Black Girls in STEM to find the correct answer.

The girls: All of the numbers were low.

Shadonna: Do we have Black women in the field who can be mentors and help other Black girls get into the field?

Blake: No, because there is not a lot.

Shadonna: Who is going to make up the STEM workforce?

All of the girls: Probably the White people, the Whites.

Shadonna: So probably white people and maybe any other racial groups that have STEM education and STEM experience. But what do we know about Black girls?

All girls: They are not in there; our numbers are low.

Shadonna: Should we be concerned about Black girls' education.

All girls: Yes, Yes, Yep.

Shadonna: What things should we be concerned about?

Joi: Why they are not doing it?

Micha: What the set back from it?

The excerpt reveals how these girls' beliefs and experiences caused them to focus more on the hazards of technology and less on the workforce. They knew that technology dominated society, but they were deeply concerned about young people being exposed to danger when using technology. The girls also assumed that because young people play with technology more than other generations, they are more prepared to enter the workforce. However, their assumptions were ruptured when they were reminded of the statistics they learned during the previous session, which revealed the low number of Black girls in STEM fields. The workshop

activities and problem-posing techniques generated this interest by sparking the participants' awareness of this education issue and concern about the state of Black girls' education.

Revealing other Youth Researchers' Experiences Broadens Perspectives

Another theme reveals that these girls' limited exposure to research and STEM fields influenced their understanding of research. However, when they learned more about other youth researchers' experiences and challenges, they demonstrated knowledge of STEM disparities and interest in YPAR. Workshop 3 and 4 included a short presentation focused on teaching participants about social science research and youth-led research. The first slide asked, "what is research?" and Joi said, "I have no idea." Blake mentioned that she believes it is when people work in labs. Malachi agreed and said, "Only certain people can do that." Micha laughed at Malachi's statement and said, "I definitely don't know anyone who do that because most of the people in labs are White" (Workshop 3).

Shadonna asked the team a series of questions like, "have you done research?" and "do you know anyone who is a researcher?" The girls were eager to respond to this question with personal experiences they considered to be research. Most of the examples focused on finding information on people, things, or places. For instance, Micha stated that her sister is a researcher because she looks up hairstyles, clothes, and makeup on YouTube, Pinterest, and Instagram. Free joined the discussion and stated she also uses Google to conduct research when she has questions like what to eat, where to go, and what to do during her spare time. As the discussion continued, it appeared the girls believed internet searches focused on answering questions are research. Blake shifted the discussion when she described learning about research from the librarian at Shine High. According to Blake, the library hosted an event during Dr. Seuss' week, and one of the presenters discussed research conducted on the Dr. Seuss book. Although Blake could not recall specific details, she remembered that the presenter interviewed people and wrote an article about it. Blake's example sparked the girls' memories of times they conducted research for school assignments such as research papers and presentations. Micha described the research process, stating, "we look up information to sum it up, and report the information in a presentation or a paper."

Shadonna drew on the girls' examples to explain the difference between internet searches, school research papers, and scientific research. When Shadonna asked the group to explain the difference between hard and social science research, Blake told the group that hard science is when a researcher "mixes things together and see what will happen." Blakes' comment sparked a discussion about hard science research (Workshop 3):

> Blake: I think an example of hard science is when people make medicine
>
> Joi: Yeah, me too, it the people who be in the labs mixing up chemicals too. They make house cleaners.
>
> Malachi: (laughing) I think the people who make makeup are doing that in a lab too, but I don't know because some people I see on YouTube make it at home
>
> *The girls provided several examples of experiments in hard science. However, when asked about social science research, the girls were silent until Shadonna asked a few probing questions.*

Shadonna: Have you ever participated in a survey?

Blake: Yes, we do surveys when we finish a class.

Joi: I did a survey online to get a coupon put I don't know what type of research that is.

Shadonna: Has any one ever been interviewed?

Malachi: I guess so, maybe when the [social] worker came to talk to me. Does that count?

Shadonna: All of these examples are great. They are helping us to think about different ways we can gather information that we need. But social science research is different from the examples we discussed. This type of research is used to learn about people, like why they do certain things, what is going on in their lives. We can use the research to figure out what things are working and what's not working.

Blake: So, this is different from the other research

Shadonna: Yes, because this research is used to learn about a person or a group of people. So, what kind of research do you think we will do in our meetings?

Girls: Unanimously responded social science.

Blake: Yep, cause we are not in a lab.

This excerpt from Workshop 3 reveals that none of the girls provided an example of a social science research project. Thus, Shadonna offered examples of different qualitative research projects, including video clips of other YPAR projects. Shadonna selected YPAR videos of Black, Hispanic, High School boys and girls to provide them with a diverse perspective of what is possible for YPAR research. The presentation included a project Shadonna previously facilitated with a team of Black High School boys and girls in the 11th and 12th grade who attended an Early College Program. This YPAR team focused on identifying underlying causes for out-of-school suspensions to create a gaming app to provide students solutions for real-life challenges. Shadonna informed the girls that the project was not finalized because the team lacked the coding skills needed to develop the gaming app. The excerpt below is the girls' responses after discovering that the youth-led project was halted because the youth researchers experienced challenges with developing a gaming application (Workshop 4).

Shadonna: They wanted to build a gaming app but they ran into some problems creating the game. What do you think was the challenge?

Micha: They didn't know how to do it.

> Shadonna: Right. None of them knew but we found some girls who were learning how to code.
>
> Blake: I'm surprised you found Black girls who know how to code cuz you know we ain't learning stuff like that at Shine High. We ain't learning how to do that.
>
> Shadonna: Good point Blake, we talked about that a few weeks ago. What was the percentage of Black girls did not take AP Math and Science classes?
>
> Blake: Like 17%
>
> Hope: It was lower than that – like 11 states don't even give girls a chance to take STEM test.

Another example of the participants' knowledge of disparities in STEM fields was evident during Workshop 4 when the team focused on developing a research plan and timeline for their project. The girls were planning to invite 10-15 girls from their high school to a research festival. The girls learned about data collection and recognized after Workshop 3 that that they needed to collect data to learn more about other girls' school experiences after Workshop 3. However, all of the girls expressed concerns about the best method for gathering information without making it evident that they participate in a research project (Workshop 4). They also expressed concerns about girls not wanting to participate in the research festival if they conduct a "boring" interview. They voted against conducting interviews. Instead, they discussed inviting girls from their high school to participate in a research festival to create a poem or collage about their school experience. The girls decided the best way to gather information from their peers was to create stations for participants to express themselves creatively. They planned to use the data collected from the research festival for their YPAR project. Hope suggested setting up stations to allow the girls to respond to a list of questions using an artistic expression (e.g., music, writing, or drawing). Joi joined the discussion, stating, "we need to give them a chance to choose a station to make sure that everyone can do something they wanted to do" (Workshop 4). The girls decided that participants would choose to write a song/rap, write a poem or freewriting, or draw a picture. Next, the team reviewed the themes from workshops 1, 2, & 3 to draft questions the girls would use to help the participants focus on the purpose of the artistic expression.

As the team brainstormed and voted on ideas for the research festival, Free repeatedly asked questions. However, the girls replied with short answers like "we worked on this last week" and "we've been talking about this for a week" (Workshop 4). Shadonna joined the discussion and prompted questions to provide Free with more information and examine the girls' knowledge of information learned during previous workshops. The following is a composite of the observation and discussion on how the girls' knowledge of racial and gender disparities in STEM prompted them to focus on Black girls' educational experience (Workshop 4).

> Shadonna: I think she needs to know about some of the things you all learned. So, can you all do something for Free? Can you update Free on where we are?

Malachi: So, next week we come in, we've got to come in with our poem, raps, and pictures to give everybody an example of what we will be doing in the research festival.

Shadonna: You're right, Malachi, we are discussing the plans for the research festival, but I think we need to take her back a little further because she doesn't know the things you guys learned that helped y'all to decide that we should focus on Black girls' experiences. Like the STEM workshop and the one about the workforce.

Hope: No, that's the week I missed, too.

Shadonna: So, we went through a whole game of understanding what has happened to Black people and Black women in particular, in the workforce. And how we were slaves, right? Joi, help me out. You were here, too, Micha, right? You guys said black people were slaves first, and that's the only job we could have. Then we went from being slaves to what?

Blake: Free, basically, [but] we keep being behind. We wasn't ready for the industrial society or the service jobs and now we not going to be ready for STEM jobs.

Shadonna: Ok, Blake, that helped us. I remember someone saying we have always had lower positions and white people have higher positions. Then we went to a service industry, and when it went to the service industry, some of the jobs we even could get then, we still see it, we're not always in those professions. That took us to STEM, Science, Technology, Engineering and Math, and the first week we learned that black girls are not in Science, Technology, Engineering, Math. We saw the percentage of women that are in that field and how many of them are in the classroom? So, what that helped us to understand was there's something that's happening in schools that we should be a part of and if we're not getting that we won't be in STEM.

Free: We need to show the people that not only men can do everything, women can, too.

Shadonna: But. . .so we need to show them, meaning expose them, but there's something that's going on in the school that's causing us not even to get a STEM education.

Joi: *(Joi looking at Free)* – Yeah, you missed a lot. You know it's like, you know, in eleven states, they don't even… Like a Black girl's not even in the STEM class. So even though women can do it, some states aren't given them a chance. That's why we need to figure out what's going on in our school.

The Wrap It Up Activity provided the girls an opportunity to provide written responses and discuss the new knowledge they gained. During the discussion, most of the girls expressed their interest in leading a station to gather information and solutions that could improve their school experiences. They also demonstrated an optimistic outlook on creating research stations and using the data to complete their project. The girls talked about the project timeline and assigned roles to team members. Hope reminded the girls of challenges other researchers

encountered when she explained her Wrap It Up Card, which stated, "I learned there are some Black kids who care about what's going on out here." When Shadonna asked her to explain her response, she told the group that she "had no idea kids can do research" and that learning about their projects changed her view of youth and research (Workshop 4).

Qualitative Coding Techniques Lead to Action Plans

The final educational workshop included a coding activity, which guided the participants through grouping and assigning categories to the survey responses. The coding activity aided the team in identifying themes in their data extracted from the surveys. I then facilitated a focused discussion with the team to determine how they would use their research findings. When we analyzed the survey responses during Workshop 10, the data revealed similarities in the youth researchers' perceptions of their school experiences. The project also provided the research team with a greater understanding of how the school's climate and culture directly impact students. In this case, they found that some girls indicated that school climate and culture prevent them from focusing on their education. The youth researchers' new knowledge of key school-based issues that emerged in the data is the focus of Phase Two of their YPAR project, the execution of their action plan.

The youth researchers co-wrote an action plan using information they gathered throughout the research project. This was evident during a group discussion when the youth researchers were coding some of the survey responses to these questions: How would you describe your school? What would you change about Shine High? What advice would you give to an incoming freshman girl about Shine High?

I asked the team to organize the survey responses into separate piles, placing similar responses together. We then read each survey response out loud and briefly discussed what they thought the survey responses meant. I then asked the girls to select a word or phrase that described each pile. For example, one stack of survey results indicated that the survey participants would change their school administrators if given an opportunity. After the girls counted each survey response, they discussed the lack of trust and respect students have for teachers and administrators. Joi stated: "These kids at this school don't like the administrators." Then Blake explained, "They don't trust them because they always overreaching and doing the most." Some of the survey responses indicated that negative peer relationships prevent Black girls from focusing on their education. The youth researchers talked briefly about students' personal opinions at Shine High sharing anecdotes that supported the survey responses.

The team then decided that they wanted to find a way to help younger girls acclimate to Shine High. Blake suggested the team should host a meeting with younger students to give them information about Shine High before the first day of school. Joi became excited and said, maybe we can go to the middle schools and talk to the girls. This idea resulted in the group voting to create a freshman orientation. The youth researchers discussed designing an interactive orientation that would allow attendees to learn firsthand from their peers. Upper-class students would share information about school facts, student experiences, lessons learned, and methods to resolve educational and social issues.

The youth researchers recognized the significance of accomplishing their research project and wanted to share their experiences with other girls. This led to a discussion about creating a short video and producing a public service announcement (PSA) to provide a glimpse of their experience, raise awareness about the importance of youth activism, and educate community

members on issues affecting their school and community. The following passages are from the team's action plan submitted to the School Social Worker and Lead Teacher for the senior class at Shine High.

In Fall 2016, we planned to recruit and train approximately 15-20 incoming members. We need to recruit new members to help us complete our project. We will lead training sessions to inform the new members of the research project we conducted during the spring semester. We will also tell the new members about the Action Plan. Our Action Plan, shown below in Table 4, "Who Knows It?" is divided into three parts:

Part One	We will create a freshman orientation to teach incoming students about some of the challenges they may have at Shine High. We will give them advice and suggestions on addressing these challenges, like how to solve problems with other students and how to change their schedule if they need a new class. We will also use this time to make girls aware of special tracks like STEM and Early College, school resources like the graduation coach and social worker, who can help them find the things they need to succeed in school.
Part Two	We plan to create a social media account to allow girls to discuss issues they have with older girls who can provide advice. We will create an Instagram and Kik account to reach other girls and increase positive discussion amongst girls at Shine High.
Part Three	We plan to create a short video about youth-led research and our research findings. The video's purpose is to show other students how we used our research to help other girls in our school. We will also use the video to show our teachers and administrators what youth are capable of doing.

Table 4. *The Action Plan*

During our final meeting, Shadonna asked the girls why they thought it was vital for them to create a freshman orientation. The girls explained that they needed to be the ones to tell other girls what they need to know. They referenced previous workshops explaining that adults, like Shadonna, do not know how to convey messages in a way that young people will understand. They provided examples of times when they had to translate statements for other youth to understand. They even talked about times when they rewrote words to make them more relatable for high school girls. For example, when the team created their recruitment flyer, they used Shadonna's flyer as a template and discussed words that probably prevented girls' interest in the afterschool YPAR study. The youth researchers also expressed that they must connect with younger girls before they start Shine High because they wanted to intervene before freshmen girls form relationships with negative social groups, preventing them from doing well in school. Finally, the girls used survey results to identify school issues that can be prevented through freshman orientation, connecting younger girls, and supporting them through their school experiences.

The youth researchers' action plan is the outcomes of the girls' engagement in a research study that focused on revealing racial and gender disparities along the educational pathway to STEM fields while teaching how to conduct a YPAR project. In some ways, this process facilitated the student's capacity and will to respond to injustices in their school. For instance, the project allowed them to develop a comprehensive plan focused on educating and training other

Black girls to be peer leaders in their school. The action plan indicated that these girls intend to use their new knowledge of school-based issues and the underrepresentation of Black girls in STEM during orientations with younger girls. The data collection and analysis process helped them identify ways to help their peers successfully navigate high school.

Discussion

This inquiry's significance is that it adds to the growing body of research focused on how to increase awareness of STEM fields and the state of Black girls' education. The underrepresentation of Black girls in STEM fields has captured the attention of education researchers, federal funders, public education leaders, and the nonprofit sector. These entities seek program models, interventions, and strategies that have successfully engaged Black girls in STEM-focused interventions. Moreover, STEM education researchers provide curriculums for engaging Black girls in STEM learning. However, few researchers facilitated research projects that aid Black girls' critical examination of the issue. Other research projects are grounded in prescribed methods conducted by the researcher. YPAR is different; it is a promising social science approach for researchers seeking to engage and develop youth who have been most affected by injustice (Cahill, 2006; Cammarota & Fine, 2008; Ginwright, 2008). This was evident in this project when the girls participated in workshops that promoted their critical examination of personal experiences and exposure to racial and gender inequities while theorizing about the education to career pathway for Black girls.

When exploring their knowledge of STEM fields, the girls' responses mirrored other studies (Buchmann et al., 2007) because they had little interest in STEM courses and careers. Moreover, their answers revealed that they had little knowledge of the growing concern regarding the low number of Black girls along the educational pathway to STEM fields. Participants repeatedly shared their assumptions and overestimated Black girls' preparation and participation in STEM classes and careers. However, as the girls learned national statistics, which revealed Black girls' bleak reality in STEM fields, they became increasingly concerned about Black girls and more engaged in the YPAR workshops.

This study also found similar evidence of educators' beliefs about Black students and the negative impact on their academic trajectory (Condon, 2007; Hughes et al., 2005). In this case, one of the participants was advised to drop out of Early College when she experienced personal challenges that caused her to fall behind on coursework. The students also discussed a lack of access and exposure to STEM courses and Black professionals in STEM fields. The lack of exposure to research and STEM education was evident when the girls provided examples of research conducted using search engines such as YouTube, Pinterest, and Google. The girls had one fond memory of a research presentation facilitated by the library and a few examples of class assignments that required research. The girls did not know anyone personally who worked in STEM fields.

Despite their limited knowledge and lack of exposure to STEM fields, these girls gained a greater understanding of the field's importance after participating in the workshops. The girls, who believed it was too late for them to change their predicament, were concerned about helping young girls have a better experience. As the girls progressed through the project process, they developed a plan for raising awareness about the need for STEM education and solutions for navigating high school.

Conclusion

This qualitative study reveals that YPAR can be used to promote critical inquiry, uncover deeply rooted beliefs, broaden participants' perspectives of youth-focused issues, and aid them in the development of action plans that seek to promote social justice. This approach to social justice-focused research is significant to researchers, educators, and practitioners who conduct evidence-based practices. While others may seek top-down methods rooted in traditional paradigms, social justice researchers seek transformative approaches to create a catalyst of change that emerges from the people who are most affected by injustices. King's (2016) article explains our social and moral obligation to employing research as a democratic practice that contributes to racial and social justice. King explains that we are morally responsible for developing democratic teaching methods that can facilitate our students' capacity and their will to respond to injustice. She also posits that researchers from marginalized communities can use critical collaborative inquiry to decide social issues for young people (p.167).

It is imperative to engage youth in social inquiry and problematize knowledge about a topic by situating research in social experiences. To fully understand a phenomenon or issue, an in-depth inspection of lived experiences must occur. It is also imperative to move away from traditional paradigms that fail to create democratic spaces that position youth as experts. This research project used YPAR to promote youth engagement in a critical examination of their lives. Moreover, this study aimed to use workshop activities to prompt the participants to learn about STEM fields while completing a YPAR project. A fundamental tenet of YPAR is the process of critically theorizing, which seeks to challenge deficit theoretical explanations, such as Black girls are not in STEM because they are opting out. YPAR is a tool for exposing flawed theoretical explanations and taken-for-granted interpretations. In this case, the girls engaged in weekly workshops, causing them to think critically about their school experiences and the possibilities for Black girls to progress along the pathway to STEM fields. The girls participated in a self-reflective process, learned more about STEM fields and social science research. They learned that course offering prevented girls from progressing along the pathway. After weeks of engagement in YPAR workshops, their critical examination ruptured their thinking about what is possible for urban Black girls and promoted them to identify solutions for change. They also identified solutions for school issues, including providing information and mentorship during peer-led freshman orientations.

This project may benefit the school as it will provide an educational youth development model that is student-centered. It may give a better understanding of students' perceptions of school experiences using a solution-oriented framework. Schools should also create more youth opportunities to share their experiences with other students, sharing the lessons learned. Moreover, group work using YPAR tenets and pedagogical approaches can provide interventions to address underlying issues that affect academic performance and student behavior. Another benefit of the study is that it seeks to provide researchers with a pedagogical approach to bridge two inquiry lines, examine individual and group experiences, and promote social change.

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