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Addressing Racial Disparities in STEM: A Pilot Mentoring Program for Racially Minoritized Out-of-School Time Staff in a Midwestern Urban Community

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ABSTRACT: Out-of-school time (OST) programs serving predominantly racialized minority communities can help reduce racial disparities in STEM as they provide a culturally affirming learning environment that includes supportive staff of similar ethnic identities as the youth. However, staff at OST programs located in underserved communities that serve racially minoritized youth, often have limited academic credentials and have constrained opportunities for social mobility. These staff's contributions to informal science learning have largely been neglected by research. A staff mentoring program was piloted to provide professional development in STEM education for racially minoritized staff also referred to as youth development professionals or specialists, at an OST learning organization located in the Midwestern US, that serves predominantly African American low-income communities. The pilot paired three racially minoritized part-time staff (mentees) with three full-time staff including educators and program leaders (mentors) for year-long mentoring relationships. Qualitative data collection tools were used to examine the impact of the pilot program on participants. Results indicate numerous gains for participants including personal and professional skills. These findings contribute to the broader literature on mentoring and suggest that the mentorship program represents a model for access to STEM educational and professional development for OST staff in racially minoritized underserved communities.

INTRODUCTION

The historical exclusion of people of color from educational and professional opportunities has and continues to lead to racial disparities in STEM fields (Funk and Parker, 2018). For example, many schools were segregated during the Jim Crow era, and people of color were often denied access to higher education (Davies, 2021). Even after the Civil Rights movement, systemic racism and racial bias continued to limit the opportunities available to people of color in STEM fields (Davies, 2021; Funk and Parker, 2018). As a result, people of color have been underrepresented in STEM fields for decades. Moreover, STEM occupations, including life and physical sciences, are highly regarded, high-income earning, and socially prestigious, especially at the post-secondary level of employment (Xie et al., 2015; Carnevale et al., 2015; U.S. Bureau of Labor Statistics, 2022). While STEM education is often viewed as a pathway to social mobility and success, particularly for economically under resourced populations (Xie et al., 2015), African American workers represent only 9% of the US STEM workforce (National Science Board, 2021). Black or African American workers at 10% are also underrepresented among STEM workers without a bachelor's degree (National Center for Science and Engineering Statistics, 2023).

One approach for diversifying and broadening participation in STEM fields is to increase the representation of racially minoritized STEM instructors in Out-of-School Time (OST) learning environments, particularly in under resourced communities; such as through staff professional development in STEM education. OST programming refers to supervised events and activities attended by young people when not in school and includes before and after-school programs as well as Summer programs (Centers for Disease Control and Prevention, nd.). Research has characterized OST staff as having hardly any formal education training,

often lacking STEM teaching expertise or experience resulting in a lack of confidence in teaching STEM, and lacking academic and, professional development opportunities (Clark et al., 2021; Cohen, 2016; Freeman et al., 2009; Halpern, 1999; Mahoney et al., 2010). In under resourced, predominantly racialized minority communities where most staff are often racially minoritized, with only a high school diploma, they are often relegated to counselor/ chaperone roles with constrained opportunities for social mobility (Zarrett et al., 2018). For OST programs in predominantly racialized minority communities, workplace based educational mentoring in STEM teaching should be an accessible, transformative professional development approach for broadening participation in STEM. Mentoring has been deployed as an effective professional development approach in teacher education due to known benefits such as improved teacher retention and integration, gains in pedagogy knowledge, and enhanced communication skills (Hudson, 2013; Irby et al., 2017). Mentoring relationships draw out hidden talents, and the unrealized potential of racially minoritized individuals, and counter images and stereotypes that suggest they are not scholarly (Bigelow, 2002; Griffin and Toldson, 2012; Hobson et al., 2012). Thus, mentoring is a well-established and effective strategy for supporting minoritized individuals' career development and advancement (Eby et al., 2008). Moreover, mentoring also fosters academic success and socialization and provides the support needed to navigate learning environments that are often hostile, intimidating, and doubtful of the abilities of racially minoritized individuals (Griffin and Toldson, 2012; McGee, 2013).

Mentoring has been heavily deployed and studied in formal teacher education programs to support novice teachers (Hansford et al., 2004; Iancu-Haddad and Oplatka, 2009; Ewing, 2021). However, in non-formal education environments such as OST learning, mentoring has been mostly limited to students/youth; especially in low income and under resourced communities (Fabiano et al, 2006, Grineski, 2003; Hammack et al., 2014; Kekelis et al., 2017; McDaniel et al., 2016). Gaps exist in the research literature on mentoring outcomes for racially minoritized adult OST staff in OST learning programs.

Objectives. While youth outcomes and future success are the ultimate goals of all OST programs, our study focuses on supporting the staff members that ultimately interact with youth participants in OST settings. The objectives of this year-long pilot study therefore were:

- to examine the impact of a year-long OST mentorship program for youth development specialists at an OST organization that serves a predominantly racially minoritized, under-resourced community; on the STEM Educational and professional development skills of participant mentees (part-time youth development specialists) and mentors (full-time educators and program leaders)
- to examine the mentors and mentees' perceived benefits of the mentorship to their OST organization community
- to elucidate the mentors and mentees' perceived challenges of participating in the mentorship program

Theoretical Framework. This manuscript's theoretical framework is based on social learning, social exchange, and self-determination theories. Social learning theory posits that individuals learn from their social environment, including modeling, reinforcement, and observation (Ryan and Deci, 2000). Mentoring provides opportunities for mentees to observe and learn from their mentors' behaviors, skills, and attitudes. Social exchange theory posits that social interactions involve exchange and reciprocity, whereby individuals give and receive resources, such as support, advice, and feedback. Mentoring involves a social exchange between mentors and mentees, whereby mentors provide resources to mentees, and mentees reciprocate by engaging in productive behaviors and achieving goals (Ryan and Deci, 2000). Self-determination theory posits that individuals have innate psychological needs for autonomy, competence, and relatedness and that meeting these needs promotes motivation, well-being, and performance. Mentoring can enhance mentees' sense of autonomy, competence, and relatedness by providing support, feedback, and opportunities for growth and connection (Ryan and Deci, 2000).

Our work is guided by participatory research practices in which our participants are collaborators in the design and methods of our research (Cornwall and Jewkes, 1995; Vaughn and Jacquez, 2020). Participatory research takes many forms across disciplines but is commonly agreed to improve the science and research process when participants are seen as partners and not subjects (Balazs and Morello-Frosch, 2013; Horowitz et al., 2009; Warren, 2018). Participatory practices can occur during all stages of the research process from partnerships to develop and design the research protocol, to assisting in analyzing, disseminating and acting on data outcomes to make changes to organizations and communities (Vaughn and Jacquez, 2020).

METHODS

Study Location. This study was conducted at an OST organization for K-12 youth located in a midwestern, suburban post-industrial community with a long history of poverty. The community has a predominantly African American pop-

Table 1. *Mentoring pilot participant demographic information at the start of the mentorship.*

Pseudonym	Gender	Ethnicity	Age	Highest Educational Attainment	STEM Educational Background	Work Status
Mentees						
Silas	Male	Black/ African American	21	Some college classes in Accounting	College courses in Accounting, Statistics, Public Speaking, African American Studies, and College Algebra	Part-time
Colby	Male	Black/ African American	37	High school diploma	High school STEM classes	Part-time
Kyle*	Male	Black/ African American	34	Some college courses	High school STEM classes	Part-time
Mentors						
Dawn	Female	White/ Caucasian	34	MPh	Bachelor of Science, Environmental Science; Master of Public Health, Health Promotion and Policy	Full-time
Stacey	Female	Black/ African American	48	Bachelor's Degree, Business Administration; Associate's Degree, Math	Collegiate certifications in Information Technology and STEAM Education; Associate's Degree, Math	Full-time
Courtney*	Female	Black/ African American	42	Ph.D.	Bachelor of Science, Business Administration/Management; Bachelor of Science, Health Promotion; Doctor of Philosophy, Curriculum and Instruction	Full-time

* *Joined the pilot mentorship in the Fall of 2022.*

ulation (>90%) (Census.gov). It comprises the three poorest zip codes in its state and includes a populace with high poverty and low socioeconomic status. Almost all students in the community qualify for free or reduced lunch. Economic disparities along racial lines also prevail in the city and statewide.

The OST organization employs a predominantly African American staff of 32 adults aged 15 to 59, over 70% of this staff are female; for > 60% of staff, the highest educational attainment level is a high school diploma and nearly all are part-time employed. The OST program serves over 500 K-12 youth annually in after-school and summer programs, over 96% identify as African American and 99% of school children qualify as low-income. The OST organization provides onboarding training for all staff, and quarterly continued professional development on human resource policies and procedures, mandatory reporting, sexual harassment, active shooter training and CPR. All staff are trained twice a year in a communication and life skills curriculum that is incorporated into all youth programs.

The Pilot Mentoring STEM Education Professional Development Program. This pilot mentorship paired three racially minoritized male OST part-time staff (mentees) with three OST full-time educators and program leaders (mentors) for year-long mentoring relationships (Tables 1 and 2 provide more information on the pilot program mentees and mentors). Mentors are full-time instructors at the OST organization and were recruited because of their informal and formal STEM education backgrounds, including college degrees. All mentors had previous experience working in underserved communities. Mentees were all employed part-time as youth development specialists for OST programming at the start of the pilot project. Mentees were nominated into the mentorship program by leadership at the OST organization. During the pilot program, we tasked mentors with choosing mentees they felt would be the right fit as co-teachers at the OST organization (See Table 2 for the mentor-mentee pairs). This was done to support the mentor's autonomy in choosing a mentee, the mentors work closely with all the part-time OST staff, often referred to as counselors, youth development professionals, or youth development specialists, and therefore know their personal and career goals, their natural inclination for instruction and rapport with the students well. While this creates bias in the teams, it also ensures that the teams have mutually agreed to work together from the beginning. This rapport aids the development of the mentoring relationship. Mentors were trained on conducting culturally responsive pedagogy through a workshop, co-teaching experiences with mentees, and by interacting and teaching the youth at the OST facility.

The pilot mentoring program for racially minoritized OST time staff was based on several mentoring frameworks that are effective in supporting diverse individuals in STEM fields. These frameworks include traditional one-on-one, group professional development, and peer mentoring (Blake-Beard et al., 2011). The pilot mentoring project was informed by the principles of culturally responsive teaching, which include using the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse students to make learning encounters more relevant to and effective for them (Gay, 2018). The pilot project ran from Summer 2022 through Fall 2022 to Spring 2023.

The mentor-mentee pairs participated in mentoring, culturally relevant and responsive STEM professional development training programs, and STEM co-teaching as part of the pilot (Table 3). The mentor-mentee pairs co-planned and co-taught OST STEM curricula, including but not limited to the physical and life sciences, agricultural sciences, environmental sustainability, and food nutrition, to K-12th

Table 2. *Description of study participants.*

Pair 1: Dawn and Colby	
Mentor: Dawn Dawn is an extension educator employed by the state's land-grant institution and assigned to the program as a full-time urban agriculture and nutrition educator. She joined the project at it's inception as the first full-time instructor. Dawn's educational background was not focused specifically on instruction and education nor on working in underserved communities. Dawn brought a deep passion and knowledge of agriculture as it relates to nutrition and health outcomes, creativity, an ability to find and adapt resources to the program and perseverance in the face of program challenges. She had previously expressed challenges around connecting with and being accepted by the students as her soft-spoken nature, difference in race/ethnicity, and formative background, was in contrast with other staff and the students at the program.	*Mentee: Colby* Colby joined the program as a Youth Development Specialist to which he brought high enthusiasm, excellent communication, leadership, and relationship building skills by using extensive knowledge accumulated from previous roles and studies in Youth Sports and mentoring. He had held many retail and "odd-jobs" over his life and work experiences in the restaurant industry. He has a background in sports, athletics, and improvisational theater which is a great strength when connecting with the youth. He also brings a passion for health and wellness and a growth mindset. He was identified as having a natural ability as a leader and informal instructor with the youth and expressed an interest in building these skills in the field of education. He has a huge interest in STEAM programming, and a passion for working with the youth. As Colby has limited formal education background and had a difficult relationship with the educational system during his youth, he also expressed challenges in implementing "formal" pedagogy in the classroom. This challenge has turned into a strength as David relates to some of the youth who similarly feel disenfranchised by the formal educational system. He has been looking for opportunities to enrich his love for education, teaching, coaching and mentoring the youth.
Pair 2: Courtney and Kyle	
Mentor: Courtney Courtney is employed as the Director of a communication skills curriculum program run at the OST organization and implemented nationally. Her responsibilities include managing all aspects of the program, including curriculum development, training, grant writing, resource development, program implementation at various sites across the country, budgeting, and finding new partnerships. She had experience in youth development through sport, physical education, and physical activity, writing and implementing nutrition, health and wellness curriculum, utilizing positive youth development strategies and culturally relevant pedagogies. Prior to the OST program, Courtney supported student-athlete nutrition, athletic performance, taught PE and health education.	*Mentee: Kyle* Kyle had worked in retail and owned a dog breeding company for many years before landing as a Youth Development Specialist at the OST organization. He also has a background in sports and athletics and showed a passion for teaching students through care, compassion and boundaries. Kyle had no formal education training prior to this program and little formal leadership experience.
Pair 3: Stacey and Silas	
Mentor: Stacey Stacey has IT certification and was hired as a STEAM Instructor/ Office worker at the OST organization. Prior to that she worked as a STEAM educator and as a certified EPIC software Product Specialist. Stacey worked in IT for 9 years. Stacey grew up in an environment like most of the children she serves at the OST organization. Stacey brings her work and childhood experiences collectively with the skills she has acquired while working at the OST organization to assist to educate and nurture youth. Stacey got transitioned to her current role as a STEAM Educator at the OST organization recently. Although Stacey had prior teaching experience, she notes that her new role has brought all her past experiences together and taught her how to organize and effectively use all her experiences.	*Mentee: Silas* Silas was employed as a youth development professional at the OST organization, to teach the youth conflict and anger management strategies and particularly trauma informed communication strategies and provide homework help and tutoring in specific subjects. He had experience in the restaurant industry and in administrative office work related to budgets and finance. Silas felt like he would be a great STEM educator especially with a background in technology and math. He had a passion for educating small children on disciplines that aren't being taught at school such as budgeting, banking, and taxes that are essential to everyday life. He wanted to be one of many to help prepare the youth for life after school.

grade students attending the OST organization. The OST STEM curricula taught incorporates activities that teach the students science, technology, engineering, art, and math concepts, to emphasize their importance to the urban community this OST organization serves. As part of the professional development training pilot, the mentees participated in bi-weekly mentoring and teaching training sessions and quarterly STEM professional development workshops. The subjects of these training sessions were determined from a pre-program needs assessment (Figures 1 and 2) and ongoing conversations with the mentees about their specific career-related needs. Table 3 includes the monthly activities and topics included in the mentoring pilot.

Research Methodology. This qualitative study used the case study approach to intensively examine the mentoring outcomes of each of the three participant mentor-mentee pairs (Table 2). Qualitative methods are recommended by researchers for studying, describing and understanding mentoring relationships (Patton, 2002; Iancu-Haddad and Oplatka, 2009). The case study approach allows for in-depth understanding of phenomena and comparisons of differences and similarities across multiple case studies (Heale and Twycross, 2018). Our work follows the case study definition of Yin (2018) by investigating the phenomenon of the mentoring program within the real world context of the afterschool program, recognizing that the boundaries between the mentoring program and other afterschool program contexts are not clearly evident. Our study is bound to the location of the OST program, including the mentees and their mentors who are program employees, and bound in time by the length of the mentoring pilot lasting one year. The unit of analysis is the individual mentor-mentees pairs within the pilot project.

The case study design included opportunities to collect data from written reflections, interviews, training transcripts, and field notes (Table 3). The researchers used weekly written reflections (Summer 2022) with guided prompts to assess gains from the mentorship for the mentors and mentees.

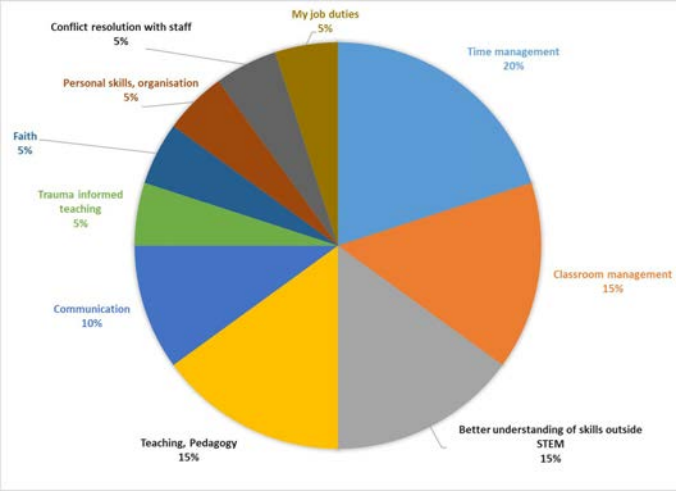

Figure 1. Participants' responses to the prompt: *Skills and knowledge I would like to learn to do my job better.*

When participants complete weekly reflections, they can express their experiences in their own words. Reading the written weekly reflections provides insight into the participants' learning experiences from their mentor or mentee (Walker, 1985). The reflection prompts explored the mentor's and mentees' current OST experiences with teaching and learning STEM. The mentor-mentee pairs completed the weekly reflections online and via email through a secure link. Weekly reflection prompts included.

1. *Please describe in great detail one experience that impacted your science, technology, engineering, and mathematics (STEM) journey.*
   - *How has this experience impacted you, and*
   - *How has this experience impacted your journey?*
2. *Write about your week and describe in detail one experience that impacted your learning and teaching.*

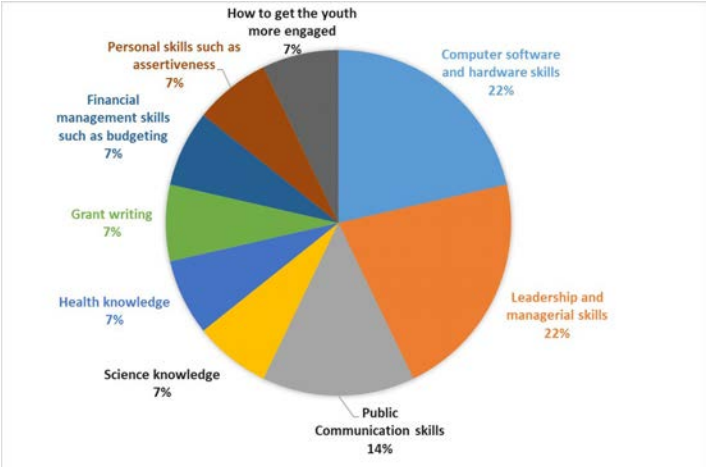

Figure 2. Participants responses to the prompt: *Skills and knowledge I would like to learn for career advancement or goals.*

Table 3. *Mentoring Pilot Program Activities.*

Activity / Event	Occurrence
Co-teaching: Mentor-Mentee pairs	M-F, after-school hours (Fall and Spring); All day, (Summer)
Needs Assessment Process*	May 2022
Mentoring Training: Introduction to Mentoring	May 2022
Mentoring Training: Mentor and Mentee roles	June 2022
Mentoring Training: Goal setting, communication, discussing expectations	July 2022
Career Goal Setting Workshop	July 2022
Culturally Relevant STEM PD Training (Modeling, story-telling, hands-on learning)* Culturally Relevant STEM Pedagogy Culturally Responsive Teaching- The Hill pedagogies	August 2022
Participatory-based Needs Assessment	September 2022
Process-Oriented Guided Inquiry Learning (POGIL) POGIL is a teaching strategy that utilizes student teams with distinct roles to complete classroom activities. During the mentorship program, mentees went through a session of POGIL training which included explanation and examples of the students' roles, possible classroom activities, and application. The training allowed participants to learn about using POGIL in the after school environment as well as gave them opportunities to participate in a POGIL activity for practice and to see the students perspective.	October 2022
Exploring Continuing Education Pathways in Higher Ed	November 2022
Identified and differentiated between the various components of the Mentoring Framework and led an evaluation activity of participant perceptions of their knowledge and attitude changes. Both processes used arts-based participatory evaluation practices	December 2022
Workshop on Trauma-informed Teaching Discussion on Mentoring in OST	January 2023
Attended Black Educators Symposium Discussion on Community Cultural Wealth (Yosso, 2005) of OST staff	February 2023
Re-assessment of participants' professional development needs Formative evaluation of the mentorship program	March 2022
Classroom Management and Classroom Design Training	April 2022

**Events included mentorship pairs and entire OST staff at the OST organization.*

Additional data sources included an arts-based participatory evaluation in the form of drawings. Mentees were prompted to draw two pictures, one representing themselves before participating in the mentorship program and the second representing themselves currently (See Figures 3-5). Utilizing arts-based research methods can elicit information from participants that may not have been expressed otherwise verbally or written (Leavy, 2023).

Interviews with the mentees were conducted to engage them in a conversation about their experiences working with their mentor and what they gained from participating in the program. The data collected from the interviews were used to evaluate the program's impact on the participants through the mentee's description of their experience (Adams, 2015; Goodrick and Rogers, 2015).

Data was also collected from oral presentations given by mentors and mentees each month that were a compilation of highlights from their mentorship relationships and experiences from their professional roles at the OST organization the previous month (Table 4). The oral presentations allowed

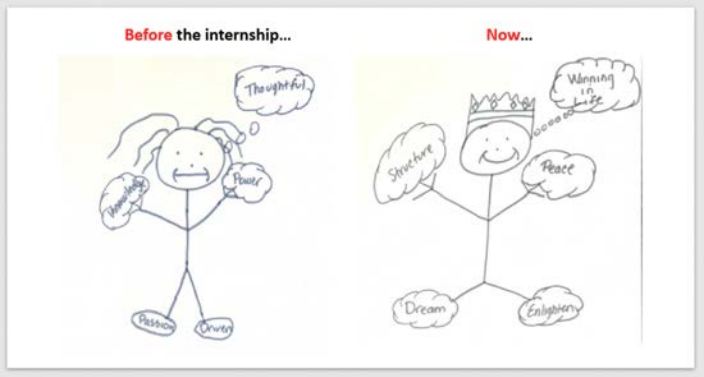

Figure 3. Mentee Colby's depiction of himself before participation in the mentorship program and at the time of the reflection (after participation).

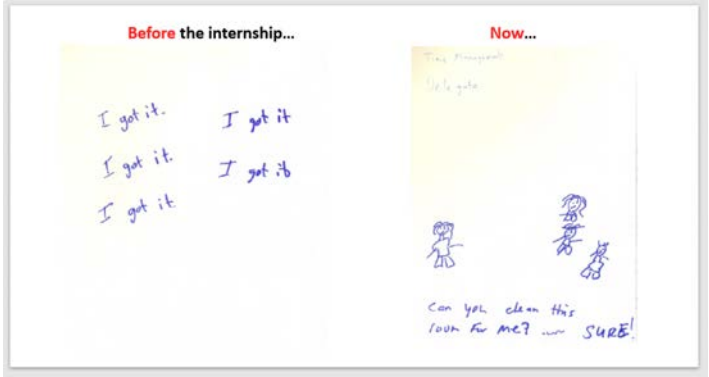

Figure 5. Mentee Kyle's depiction of himself before participation in the mentorship program and after participation, showing gains in ability to delegate tasks at work.

mentors and mentees to display recent successes and how the mentorship program contributed to them. The data collected from the presentations and video transcripts was used to describe individual gains and include mentor and mentee stories of their accomplishments as part of the data establishing participant outcomes (Krueger, 2015).

We also conducted a formative evaluation of the mentoring program during one of the monthly meetings using open-ended prompts listed below, for the participant mentors and mentees to provide their input into the program design:

- *What do you like about what we are doing right now? What works and what doesn't work? What don't you like?*
- *How can we best use our time together? How would you like to be engaged?*
- *What would you like to get out of this mentoring program?*

After completion of the mentorship pilot, we surveyed mentors for their outcomes from the mentorship using the open-ended prompts below:

1. *How did you benefit, both personally and professionally, from being part of the mentoring pilot?*
2. *What, if anything, do you do differently or think about differently after participating in the mentoring pilot?*
3. *Please share any other additional thoughts from your participation in the mentoring pilot program.*

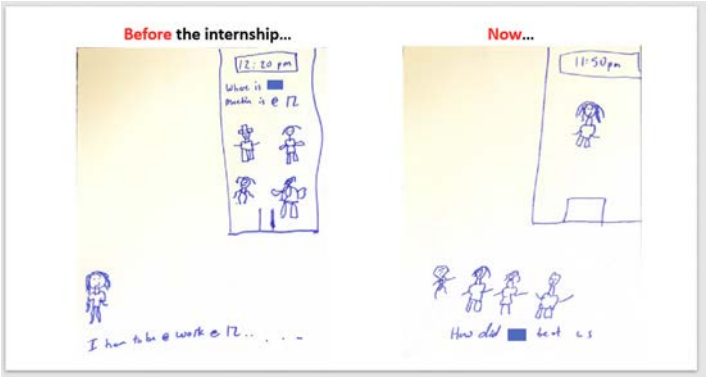

Figure 4. Mentee Kyle's depiction of himself before participation in the mentorship program and after participation showing positive changes in his time management skills at work.

Researchers kept field notes during each monthly meeting during oral presentations to capture information shared by all participants. Field notes can be utilized as a reference to supplement video transcripts in collecting data (Phillippi and Lauderdale, 2018). Our field notes informed the video transcription and served as an additional data point when during analysis, researchers had varied perceptions of the various mentoring activities.

All data were collected to triangulate qualitative data,

Table 4. *Pilot Mentoring Program Data Sources*

Data Sources	Time of Collection			
	Total Number of Artifacts	Summer 2022	Fall 2022	Spring 2023
Weekly Written Reflections (mentee and mentor)	14	X		
Arts-based Participatory Evaluation (mentee and mentor) - Drawings: Mentees asked to draw a picture of themselves before participating in the mentorship and at the current time, which was about eight months into the mentoring pilot program.	8		X	
Mentee Interviews	2			X
Monthly Mentoring Sessions (mentee and mentor) - Video transcripts and artifacts, including oral presentations	5		X	X
Participants evaluation of mentorship	1			X
Mentor's post-mentorship survey	1			X
Field Notes	14		X	X

validating findings using multiple sources (Merriam and Tisdell, 2016). Prior to publishing our findings, we utilized member checking (Candela, 2019) by sharing the analysis for each mentor and mentee with the individuals for their consent and approval.

Data Analysis. Semi-structured interviews and audio recordings of meetings were transcribed electronically. All qualitative data, including the weekly reflections, interview transcripts, survey responses and transcripts from meetings were coded using Dedoose, a qualitative coding software by multiple coders using deductive and inductive coding procedures (Tesch, 2013; Saldana, 2016). This entailed the coding of each transcript in its entirety by two researchers independently who identified emergent themes in the data through iterative cycles of open and axial coding (Corbin and Strauss, 2015; Saldana, 2016). For the mentee transcripts, initial coding was guided by the process-oriented model of mentoring by Eby et al. (2013) to identify the various categories of mentee outcomes emphasized in Eby et al.'s model to obtain themes. The model stipulates that mentoring outcomes are categorized as performance, motivation, attitudinal, behavioral, career- related and health-related. The two coders met multiple times to discuss their codes and emergent themes from all the data to build consensus before, during, and after coding. Additionally, two coders reviewed all data sets, providing multiple perspectives as another form of data triangulation to add to project validity (Merriam and Tisdell, 2016).

RESULTS

This study sought to examine the gains in STEM Education and professional development skills of OST staff from a year-long mentoring program; what they perceived as the benefits of the mentorship program to their OST organization community and challenges experienced with the mentorship program. Data analysis revealed numerous themes as detailed below for each mentee–mentor pair.

Colby and Dawn

Educator Positioning of the Mentee by the Mentor. Colby discussed benefitting from being positioned as a STEM educator through classroom discourse with his mentor Dawn. He reflected on how lesson co-planning and co-preparation with his mentor facilitated that positioning below:

> *Dawn may even challenge me to where it's like. Okay, well, Coach Colby has great information. So hey, Coach Colby, would you like to share your part? Okay, you putting me on the spot. Once again, I'm very familiar with the information that she sharing. So, I'm capable of* [collaborating] *with her to make it understandable for everyone.* (Colby)

Harnessing his previous work experience as a trainer in the restaurant industry, Colby reflected further on how his mentor Dawn, positioned him as a business educator at the youth-led farmer's market at the OST organization:

> *So, shout out to Miss Dawn, Miss Dawn actually helped bring that out of me by introducing me to the farmer's market. So that's why I've begun, you know, teaching kids salesmanship, how to how to pitch a sale, how to gravitate towards people all these sorts of things.* (Colby)

Through the positioning as a STEM educator, Colby was empowered to utilize his community cultural wealth (Yosso, 2005), specifically linguistic capital in the form of poetry in STEM instruction:

> *One of my strongest suits, would be poetry. Okay, so we have students who created their own poems to display about agriculture. But I must share one by a student who I would say he became motivated. Not knowing much about poetry or even agriculture itself. Found ways to help inspire him to understand what agriculture really is.* (Colby)

What stands out in Colby's reflections is the mentor's role in pulling out the hidden talents of the mentee and her intentional positioning of the mentee as an educator in the classroom. For Colby this positioning appears to have enhanced his identity as a STEM educator, increased his educator self-efficacy and empowered him to utilize his community cultural wealth in OST STEM teaching to reach diverse learners.

Gains in Pedagogy Skills, Including Creativity in Lesson Design and Reflectiveness. Colby reflected on learning pedagogy skills, including creative lesson design, to engage all learners, by observing his mentor Dawn. He reflected below:

> *She created a wheel. Okay, for like a lunar cycles for the moon. In adult terms, I know exactly what that is, you know. But she made it kid friendly. Meaning. She took this wheel, and what she did was she. Instead of the little circles, the lunar cycles of the moon. She broke it down to a season. You know, and they use fruits and veggies that you can grow in that seasons to kids to identify within the wheel. Same as the lunar cycle of the moon. I thought it was extraordinary. Because it's visual, and the kids get to use their finger to go around, and they'll be able to see, you know, from January to December. But I thought that was fascinating.* (Colby)

Additionally, Colby discussed being introduced to edu-

cator reflectiveness by his mentor and gains in professional skills such as preparation and organization by watching his mentor role model these practices below:

> *She helped me shape my life all around the board, you know, with our little meetings like we have reflection time after class, and before work and even in planning. So, like, she has helped me tremendously. My mentor She is way over prepared, so she's showing me how to be prepared, how to be a lot more organized. Well spoken, and most importantly, she's consistent.* (Colby)

Colby's drawing (See Figure 3.) shows how he viewed himself as a youth educator before participating in the mentorship program. Passion and drive are drawn as feet because those two represent what influences his actions. When working with youth, he took the approach of "ruling with iron fists," which is why he holds knowledge and power. Lastly, thoughtfulness is a thinking bubble because that is the primary descriptor he uses to describe himself. In contrast, his current time drawing shows that he is walking on enlightenment and a dream, representing his goal to mentor and coach the youth he works with. Now, Colby uses structure and peace when working with youth. He says that power has shifted from his hands to his head, so he identifies the crown as representing the change. Colby's reflections and drawings indicate an awareness of the key educator practices being modeled by his mentor Dawn which he is trying to emulate as he recognizes aspects of his ideal self in his mentor (Weinberg, 2019).

Behavioral Outcomes: Gains in STEM Subject Matter Knowledge and Inspiration for Learning. Colby discussed gaining content knowledge in the life sciences from his mentor in addition to inspiration for learning. He further elaborated on the value and potential impact of the knowledge he acquired for his family and the youth in his community at the OST organization:

> *I have learned about beets with my mentor. She helped me with the knowledge of* [this]*vegetable and how it's packed with vitamin B, helps the blood flood, and increases...performance with athletes. I've learned about how carrots are great for making smoothies, easy to drink, and fun to share with others through any season but not with a lot of spice. Learning how this vegetable can help prevent cancer is key for me due to losing a family member to cancer. She has inspired me to give more time toward learning science, teaching science and why we should love science.* (Colby)

We see from Colby's reflection a demonstration of how educational mentorships in OST programs can lead to knowledge acquisition for mentees as co-teachers that not only benefits them but also the youth they serve and their communities. Moreover this knowledge acquisition also stimulated interest in STEM learning for Colby.

Gains in Professional Skills Including Communication, Responsibility, and Accountability. Colby reported gains in professional skills, including communication, collaboration, responsibility, and accountability from the mentorship:

> *I'm learning how to become a better speaker, how to present myself in a better way. Then speak about what it is, who I am, and what I love to do, and what I'm very passionate about—all those things I couldn't share before. Also, I learned about response to people how people respond to me that was another way. Now, I'm just like I don't want to be anywhere else. Oh. I don't. I mean, I don't mind learning other things, but this program has been so extraordinary for myself because I became a better teacher. It's teaching me how to become a better speaker, is teaching me about collaboration, it is teaching me about responsibility, and accountability, not only for myself but for others as well. So, yes, this is definitely helping me. I became a lot stronger. And the kids see it as well, and they respect them as well.* (Colby)

For Colby, the gains in professional skills, including communication, accountability, and collaboration, from the mentorship helped renew his passion and commitment to his role at the OST organization and also have direct impacts on the youth he serves at the OST organization.

Attitudinal Outcomes such as Renewed Motivation, Organization Commitment and Improved Self-perception. Colby reflected on gaining a renewed enthusiasm, improved self -perception, and motivation for his job from the mentorship program, which has further enhanced his commitment to the OST community:

> *But I want to help and be a part of the success of the community and of this program. It doesn't bother me that I extended the extra hour after class, or you know. Or spending time helping them at the OST organization. It doesn't bother me. It is exhausting. But between both the OST organization and the mentorship, like I said, it helped change me. This became a passion and a drive for me each and every day. Like you wouldn't even see me dressed up like. I haven't dressed up like this in years. But because of the way I see myself now. You know, because of the program, because of my mentor, because of the foundation. I have a bigger purpose.* (Colby)

Colby's reflections illustrate the effect of mentorship on

changing his self-perception, further inspiring transformations in his professional conduct and dress code, and leading to a commitment to the mentorship program, OST organization and community.

Dawn

Sense of Affiliation and Belonging. Dawn, Colby's mentor discussed experiencing an increased connection to the OST community, which stemmed from the bond established with her mentee Colby. She also reflected on gaining a sense of belonging at the OST through community building provided by the mentorship pilot. She stated, "*I connected with the whole community more. I bonded with my mentee, and that was a bridge to being more connected to the other staff and youth.*"

Additionally, " ...[a]*nd I've had really the best sense of belonging here this past month than I've had in my whole career. And I think it's because of the things that we've gone through together....*"

Given Dawn's ethnicity as a white female that mentored an African American male mentee, at a predominantly African American OST organization, community, connection and belonging were critical needs that the mentorship helped provide. The mentorship thus provided her a supportive community of mentor-mentee pairs that were able to lean on each other during challenging times at the OST organization. This reflection highlights the role that mentorship programs can play in building community and fostering bridges across racial divides to improve diversity in STEM.

Gains in Teacher Confidence and Motivation. Dawn also reflected on gains in confidence and enthusiasm for her role as a STEM educator at the OST organization, which stemmed from the mentorship and the relationship with her mentee. This gain in confidence empowered Dawn to be more creative and adventurous with her lessons and pedagogy skills. She detailed in the quote below:

> *For our Spark activity, we had this diagram, and we did another activity related to roots, stems, leaves and fruits and seeds. And so, this has been, I guess, a highlight for me because I mean it's a, these are lessons that I've developed more. And it also took a lot for me to sing in front of a group of kids, which is not super in my comfort zone. But yeah, it's been it's been really good. I think Colby says that it's really good. So, I was almost afraid, I was very afraid to do it in front of him. But he has helped me gain confidence....I felt more confident and relaxed and motivated to create innovative programs. I looked forward to coming to work.* (Dawn)

These reflections highlight mentorship's' role in increasing the self-efficacy and motivation of even experienced instructors like Dawn, inspiring her to be more creative with instruction strategies.

Gains in Pedagogy Skills, Culturally Responsive Teaching and Mentoring, Use of Drama in STEM Teaching, and Reflectiveness. Dawn reflected on the positive changes in her teaching skills, including creativity, towards increasing student engagement. She also illustrated elements of culturally responsive mentoring in harnessing her mentee's experience and talents in the performing arts and applying them to STEM instruction.

> *I am more creative and experimental with activities. From talking to Colby, I found out he's really good at improv and putting together plays/skits. I remembered that last year, Tia and I did this fun skit of some things NOT to do regarding food safety, and we needed to talk about food safety with the kids before they made/served smoothies to the whole center on Wednesday, so Colby and I made a new skit more related to our project. We decided on the general things each of us would do, and practiced a little. During class, when it came time to do the skit, Colby was managing some behavior issues and told me to just start it, and I wasn't sure if he was going to be able to join in, but after a couple of minutes, he jumped in, and totally shone. The kids were so excited to tell him what he was doing wrong and what he should do instead, and he was a great actor. It was very fun!* (Dawn)

Dawn also benefited from her mentee Colby's persevering enthusiasm as a co-teacher, in OST STEM instruction as detailed below:

> *We were also talking about how sometimes like, specifically with some of the older kids because they're not always enthused about lessons right up front. And I think Colby's able, better able to power through and see that they'll come around eventually rather than me, I will get more discouraged and feeling more defeated and he's able to keep going and still have his enthusiasm and be able to go through it and eventually the kids can feed off of that.* (Dawn)

Furthermore, mentoring provided Dawn with opportunities to reflect on her own teaching practices, and learn new inclusive strategies for engaging students from her mentee Colby:

> *Colby and I work really well together. After the lessons, he and I talk about what went well and what could improve. I realized that I am focused on the lesson—what I could change to make it more successful—and Colby speaks more about certain*

> *individuals and I can really see how much he cares about their success (not just the program's success). It's a really good reminder of why we're doing this, why we teach. It's about each youth's development. I tend to call on the kids that are already engaged in the lesson, whereas he tries to get everyone to participate, and he praises those less enthused students for giving any answers (not just the "right" ones) or displaying other leadership and values. I'm picking up on these techniques and I think our lessons are already more inclusive and engaging.* (Dawn)

Dawn further elaborated on the changes in her practice as an instructor that have resulted from her participation in the mentorship, including the development of teacher empathy whereby she is more engaged in her students social experiences (Meyers et al., 2019). She stated that "*I more engaged with youth in aspects other than just my programming—sitting with them at meals, seeing their sports games, talking to them in the halls.*"

From these reflections we see changes in Dawn's pedagogy skills from lesson design, to instruction approaches and her development of teacher empathy which resulted from the mentoring relationship with her mentee. Moreover, the mentorship also provided Dawn an opportunity to reflect on and refine her own teaching strategies and goals as an educator.

Kyle and Courtney

Behavioral Outcomes: Gains in Professional Skills and Conduct Such as Time Management. Kyle discussed receiving advice from his mentor Courtney, about professional habits such as time management. He also received coaching on preparation for meetings and recording of important information for later recall. He shared:

> *She helped me be on time. My time management, I haven't been late in a long time, it feels good to be on time. I'm seeing now while people told me to be on time because you walk in, and they already started the meeting, and everybody looking at me like, you gotta be on time. So, we have a lot of meetings now, in my role. Most definitely was a big thing, meetings, so it got me ready to be able to sit in meetings, taking notes, my mentor takes great notes.* (Kyle)

Kyle's drawings of his habits before the mentorship (See Figures 4 and 5.) depict a meeting where he is arriving late in contrast to post-participation in the mentorship, where he arrives earlier than any of his colleagues. From Kyle's reflections and drawings, we see how the mentorship program supported growth in his professional development through constructive feedback and advice on his time management skills, preparation for meetings and role modeling of professional skills like recording of important information.

Career-related Outcomes: Career Sponsoring, Motivation, Career Advancement Preparation, and Promotion. Kyle discussed his recent promotion to a leadership role at the OST facility, which he attributed to preparation, motivation, and professional assistance with resources and tools, such as a computer, from his mentor Courtney:

> *My biggest highlight of the month is that I was promoted to program manager. I have a new position. And this mentorship helped prepare me for the new position. I didn't even realize that I was being prepared for a new position. My mentor also helped me get prepared for my position, she would drop hints, and she would motivate me to do the right thing. And she does help motivate me. She helped me. Like she gave me my computer, I did this presentation on it. She made sure I was ready with that and just being on point. Like I said about her is, she is very on point.* (Kyle)

What stands out from Kyle's reflection is the role that his mentor, who occupies a senior managerial position at the OST organization, played in his career advancement and promotion from a youth development professional position to a leadership role at the OST organization. Kyle describes his mentor Courtney's career sponsoring support in preparing him for the leadership role through feedback and advice on his time management skills, getting him ready for meetings, and role modeling of leadership skills. Moreover, his mentor also provided motivation, support and assistance with physical resources such as a computer.

Organization Socialization, Collaboration and Leadership Skills Such as Delegation. Kyle described benefitting from the social network of the mentorship program and learning leadership skills like delegation with his promotion to a managerial role at the OST organization. He reflected below:

> *If I needed help with a scientific project, coding receipts, planning field trips, ordering a bus I could ask Miss Stacey. Even though I might not be supposed to because that's not her job anymore. But she is a wonderful person inside and out and she is down for the OST organization and she is down to help and she will help me even if she's not supposed to. And I'm going to use that resource. If I needed to do some Ag, I know that Miss Dawn and Colby would plant a sweet potato bigger than your head.* (Kyle)

Further, Kyle illustrated that another skill he learned as a part of this program was the ability to delegate and collaborate with the social network of mentor-mentee pairs in the mentorship program (See Figures 4 and 5). Before participating in the mentorship drawing, he wrote, "I got it,"

since he said that he would often do all of the work himself, whereas, after the mentorship, he can delegate tasks to those he works with.

Courtney

Opportunity to Serve as a Career Sponsor, Promoter, and Supporter. In their mentorship pairing, Courtney the mentor took on career-related mentoring functions performing roles such as career coaching, sponsoring, exposure, and visibility for her mentee Kyle. She described these functions and how she advocated for her mentee's job promotion:

> *I'm always going to be here cheering for you. Speak your name in rooms when you're not there and make sure that everything that you need preparing for it. Because we, the day he was promoted I had a conversation with the organization's CEO and we're just talking about these new positions because you hadn't started yet, and we just thought you know what should we do? Should we wait till you come on and then you'd be part of that process of hiring a program manager or should we promote from within? And then start both of them together at the same time. And, you know, some other people have put in their bid for the position and that. So I used that as an opportunity to make sure that they knew that Kyle. I think if we're going to promote from within I think Kyle is the person to do it. And so I talked to Kyle about it that day just like, hey, you know, are you interested, just, you know, think about those things and some other stuff that you should be thinking about. Because things tend to move really fast and we'll talk about staff and we'll talk about it and talk about it and then all of a sudden it's done. And that same afternoon, I didn't even know it was happening that fast. But it did in that same afternoon, we made the announcement to Kyle. It's been awesome.* (Courtney)

From Courtney's reflection we see a clear illustration of career-oriented mentoring functions of career sponsorship, exposure, and visibility that she took on. Courtney provided her mentor Kyle targeted feedback on how to advance in his career at the OST organization, and shared information on a new role that was a good fit for him, and provided connections for her mentee to leaders in the OST for consideration of a promotion.

Organizational Socialization and Opportunities for Collaboration. Courtney discussed benefiting from opportunities to collaborate with colleagues in the mentorship pilot:

> *Tomorrow we have a staff and partners training…. And so, as part of that training, I'm doing breakout sessions. And so, we have some of our mentees and mentors leading breakout sessions.... But I think the main reason I'm bringing this up is I think that if it wasn't for this program, I wouldn't be comfortable with this. Or I think people are more able to kinda step in on a moment's notice because we've been doing it like this is nothing different than what you all have been doing.* (Courtney)

From this reflection, we see Courtney benefiting from the social network provided by the mentorship program to advance her current role, forge working relationships and collaborations with the other mentor-mentee pairs to facilitate her professional roles and responsibilities at the OST organization.

Silas and Stacey

Behavioral Outcomes: Gains in Pedagogy Skills and Ability to Try out Diverse STEM Instruction Techniques, Including Culturally Responsive and Relevant Pedagogy. Silas reflected on gains in pedagogy skills, such as the use of student-centered instruction strategies to increase student engagement, while working together with his mentor Stacey:

> *I learned that giving kids leadership roles help them better understand what they're learning and it gets them more engaged about the activity ahead because they love to showcase what they learned themselves and taught to the class. When Mrs. Stacey and I talked about the Circulatory System with 11-12, we allowed them to get in small groups and explain a section of the presentation. After we elaborated on what was said and got right into the activity and they were so engaged.* (Silas)

Silas further elaborated on the ability to apply afro-futurism techniques (Dery, 1994; Barber et al., 2015) in STEM teaching during the mentorship with a lesson on the Detroit water crisis, in addition to utilizing culturally relevant and responsive pedagogy practices such as highlighting racially minoritized STEM role models using the film *Hidden Figures.*

> *We talked about the Detroit water crisis.... We had the kids create their own Urban City on a poster board to show how their ideal city would look like. I was pretty surprised at how much attention to detail they put into it, from pedestrians walking across the street to cars yielding to them. It just shows how aware the kids really are to their surroundings.*
>
> *We discussed and talked about aerodynamics.... We then showed a few clips on how aerodynamics work with the film Hidden Figures.* (Silas)

In these reflections Silas highlights benefitting from the support of his mentor in trying out and experimenting with

different instruction strategies to increase student engagement, including assignment of leadership roles to youth and empowering of the youth as co-teachers with agency over their instruction and the learning process. Silas was also able to model for his mentor Stacey the use of culturally relevant and responsive practices as well as afro-futurism in STEM teaching where he engaged students in speculating on a better future for racialized minority urban dwellers.

Gains in Self-confidence and Leadership Skills. Silas reported gains in personal and professional skills including self-confidence, communication, and leadership and identity. He described growth in skills as a teacher, OST program counselor, mentor to the youth, and role model that he acquired during the mentorship as illustrated in the quote below:

> *At the end of the Summer, I received the Most Improved Counselor of the Year Award. Looking back on it, when I first started the Summer before, I wasn't outspoken instead, I was closed off and only done just enough to get by. With that being said, this program has helped me become a leader, spokesperson, mentor to the youth, role model, and a better, improved person. Thank You so much for the opportunity!* (Silas)

Stacey, his mentor, reiterated the personal and professional gains, saying "[m]*y mentee was a wonderful participant. In my opinion, my mentee has gained more confidence in how to deliver and teach in a non-traditional setting. My mentee also learned how to develop activities and lesson plans.*"

From these reflections we see the positive personal and professional transformations Silas experienced from participating in an educational mentorship program and in his role as counselor and youth development professional at the OST organization, these outcomes have resultant benefits for the youth at the OST.

Stacey

Gains in Pedagogy Skills, Including Innovative Teaching Strategies. The mentorship provided Stacey with an opportunity to improve her STEM teaching skills and practices, such as lesson planning, and to be exposed to new innovative teaching strategies. She reflected below:

> *With myself and with Silas. Scheduling. Planning things is very important. And it's also good to notify others of what you're doing and not doing so that they can plan accordingly. Planning helps alleviate high traffic environments stress. What I mean by that, if lessons are already planned in advance and materials already bought, it helps to lessen the stress, in an already stressful area. And I learned that here. I learned in this mentor-mentee program.* (Stacey)

Stacey also described gains in her pedagogy skills that included exposure to innovative ways to teach, by her mentee Silas, such as the incorporation of a game in a STEM lesson to reach diverse learners and increase student engagement and enjoyment of STEM learning:

> *Silas introduced me to Kahoot and I love Kahoot it's a very good pre-game. It's also a good icebreaker. So if you looking for something, to reel the children in, this is the way to bring the topic of that activity, put it into question form. So that way they're having fun while learning. Oh, this is amazing, amazing. And I just put what Kahoot was, how the kids love it.* (Stacey)

What these reflections demonstrate is the value of mentorship programs to mentors who are experienced educators like Stacey in improving their current practices, such as lesson planning and exposing them to new and innovative forms of instruction to increase STEM learning and engagement.

Opportunity for Educator Reflectiveness and Self-evaluation.The mentorship program also provided Stacey as a mentor, currently employed in an educator role, with an opportunity to practice educator reflectiveness and self-evaluation. Stacey developed her communication skills to facilitate educator reflectiveness practices with her mentee. She stated, "*Things that I have developed is communication. It's very important to discuss things, some concerns. Things that you liked about particular lessons*."

Additionally, Stacey reflected on how the mentorship pairing provided an opportunity to evaluate her own leadership skills, areas of weakness, and opportunities for growth:

> *This cohort allowed me to see the areas I need to improve in order to be a great leader. It has also allowed me to see areas where I needed to nourish and pay more attention to in order to be successful at my position and to allow my talent to shine. Additionally, this program has also exposed the areas of opportunities for myself and my mentee. I really enjoyed learning, growing, and improving myself and the work I produce.* (Stacey)

What this suggests is that practicing STEM educators at OST programs are perhaps often lacking opportunities to improve their instruction skills and to self-evaluate and collaborations built such as through mentorship are well poised to meet that need.

Perceived Benefits of the Mentorship Program to the OST Organization and Community.

More Knowledgeable Educators, Better Role Models, and Mentors to the Youth at the OST Organization. Mentees reflected on the potential resultant impacts of the mentoring program on the youth they serve at the OST program that included knowledge transfer. Mentees also reflected on becoming role models and mentors to the youth, better and more knowledgeable educators excited to impart newly acquired knowledge on food nutrition and healthy choices with the youth towards better health outcomes:

> *Dawn and her style of mentor has help and encouraged me to become a better educator in health and food safety this week for myself and also I've have many ways to help student athletes to become more healthier and how it would help there performances in and outside of sports.* (Colby)

> *This program has been so extraordinary for myself because I became a better teacher. It's teaching me how to become a better speaker, is teaching me about collaboration, it is teaching me about responsibility, and accountability, not only for myself but for others as well. So, yes, this is definitely helping me. I became a lot stronger. And the kids see it as well, and they respect them as well.* (Colby)

> *This program has helped me become a leader, spokesperson, mentor to the youth, role model, and a better, improved person. Thank you so much for the opportunity!* (Silas)

Staff Professional Development Training Tool. Participant mentors recommended the mentorship program as a much-needed staff professional development approach for the OST organization that could help grow professional and educational skills, unleash hidden talents and also serve as a path to career promotion as detailed below:

> *I really think this is something that is needed in an Afterschool setting in order to keep improving employees' performances, professional develop of employees moving forward. In my opinion, this program will allow hidden talents in employees to shine and grow.* (Stacey)

> *I've kind of been thinking about this mentorship program is, it's been a really good vehicle for professional development, and for training, and really like a pathway for promotion. So, you know, with Kyle being part of it, you know, starting out at, you know, youth development specialist, now program manager. And even Colby, you know, still youth development specialist in the broader sense. But then the program has given him an opportunity to surely be a specialist in a way of like learning different things.* (Courtney)

Source of Talent for New Hires at the OST Organization. Courtney, one of the mentors that had a leadership role at the OST organization reflected on how the mentorship could serve as a talent pool for new recruits and candidates for job promotion. She reasoned that this was due to the supportive functions of mentoring relationships and the social network formed from the participant mentor-mentee pairs.

> *And so, as we were like talking through like strategic planning and flow charts and hiring. You know, having this mentorship program helps to better see that and kind of move things around it's like, oh okay, well, this person. it'd be good to kind of promote them, because then I know they have the support of this program to be able to help get them integrate them into their role instead of you know, because often in a lot of organizations like this, one is not unique in that way people get put into position, and it's like get out there. Yeah, who knows what that means? But go ahead and do it. And so, I think this you know, I feel more confident about, you know, putting people in different positions, because, knowing they have the support and this program to be able to you know help them to learn and grow, and which ultimately helps all of us. And the kids benefit from it.* (Courtney)

Staff Sense of Community and Team Building Tool. Dawn, a Caucasian mentor, and a racial minority at the predominantly African American serving OST organization, reflected on how the mentorship program fostered team building and a supportive network among mentorship participants. The supportive network was pivotal to sustaining mentorship participants through the challenges of staff turnover at the OST organization.

> *I don't think it's any secret that we've had a little bit of a tough month as far as staffing turnover and lots of kids, so. And so, it's been a really great experience as well. I mean, it's been challenging, but it's also been really good and relying on other people in the team. So, I know Stacey like there was one day that both Colby and Silas were gone, and I came into the room with you during that time with the young kids and you came into the agriculture program with me. Kyle like even just like when we both have groups of kids, but we're walk and by each other and you're checking on me or like I remember there was one day there was we have very few staff and you just came over on the walkie talkie. You were like, we're doing such a great job. We're all working really hard, and those kinds of things are still really inspiring and really helped me get through the challenging times. And what this is all made me realize too, is that,*

Figure 6. Word cloud from participants' formative evaluation of the program.

> *I mean, those challenges are really great bonding experiences as well.* (Dawn)

Perceived Challenges of the Mentorship.

Time-consuming and Emotionally Draining. For some of the mentors, mentoring was costly in time and in emotional support. One detailed, "*It was a lot of my time though. Maybe too much for how much I am being compensated. It's a lot of emotional energy in addition to just time.*" (Dawn)

Assessments. Quantitative surveys were perceived as irrelevant, participants also experienced apathy towards some of the assessment instruments and recommended capstone projects.

Mentorship Program Design and Structure. Participants felt that some of their high-need professional development training topics were not covered during the trainings. Additionally, participants had numerous suggestions for adjustments and improvements to the structure, style, content, and timing of the mentorship meetings (Figure 6).

DISCUSSION

Mentors provide instrumental support by guiding their mentees through their responsibilities, introducing them to other people to create essential connections, offering resources, and providing challenging tasks; the mentor is also seen as a role model in their actions. Mentees receive psychosocial support through their mentor's encouragement, advice, feedback, and affirmation (Eby et al., 2013). Our study revealed gains in pedagogy skills for the mentees, including student -centered teaching strategies and creativity in lesson design through role modeling by mentors, classroom discourse and educator reflectiveness. Research studies from teacher education programs have similarly reported improved pedagogical skills among pre-service teachers engaged in mentorship programs as mentees (Hansford et al., 2004). This is perhaps because pedagogical knowledge including teaching strategies is a dominant feature of the mentoring advice given by mentors to mentee teachers (Bradbury et al., 2007). Mentor role modeling of educational and professional skills as practiced by our mentors is also a recommended method for improving instructional practices of novice teachers (Sowell, 2017). The mentorship also provided opportunities for the mentees to be positioned as STEM instructors by their mentors during OST STEM classroom discourse, further contributing to their professional identity development as educators. Researchers contend that mentors positioning themselves as co-learners and co-teachers in collaboration with their mentees in the mentor-mentee relationship (educative mentoring) supports gains in professional development (Trevethan, 2017). For Colby, classroom discourse created opportunities for competence to be constructed, agency in STEM learning to be nurtured and for him to be positioned as a STEM educator. Research on teacher education recommends the positioning of novice teachers as authors and agents in STEM learning and teaching in order to facilitate transference of the same to their students when they assume teacher roles (Lampert et al., 2015). Silas demonstrated this by positioning students/ youth at the OST as agents in STEM learning by assigning them STEM topics to co-teaching.

Our findings revealed objective and subjective career outcomes for mentees, including a career promotion at the OST organization for Kyle and enhanced organization commitment with Colby. Ivey and Dupr´e, (2022) similarly documented objective outcomes for mentees, like career advancement, promotion, and subjective outcomes including job satisfaction, greater organization commitment in their comprehensive review of mentoring in the workplace. From our findings, Kyle received career-oriented mentoring support including career sponsoring, and visibility, as evidenced by the recommendation for promotion by his mentor Courtney, in addition to coaching on professional skills such as time management. Career-oriented mentoring support is related to objective career outcomes, and dependent on the level of seniority, experience, and influence of the mentor in the organization (Allen et al., 2004). Kyle's promotion could therefore be attributed to the career-oriented mentoring support he received from his mentor, who holds a senior managerial and leadership role at the OST organization and instrumental support (mentor behavior geared toward facilitating mentee goal attainment) (Eby et al., 2013).

Colby and Silas' career outcomes were however more subjective, including gains in self-confidence, positive attitude and satisfaction with current position and commitment to the OST organization. These more subjective outcomes could be attributed to the psychosocial mentoring support Colby and Silas received including role modeling, acceptance, counseling, and friendship (Ragins et al., 2007; Allen et al., 2004). Psychosocial support refers to mentor behavior that enhances the mentee's perception of competence and

promotes personal and emotional development, e.g., encouragement (Eby et al., 2013).

Mentees reported increased self- confidence, improved self-perception and professional skills including communication, accountability in their personal and professional lives as leaders, educators, counselors and role models to the youth in the OST organization. Previous research studies on mentoring similarly reported increased confidence for mentees (Hansford et al., 2004; McIntyre and Hagger, 1996; Hobson et al., 2009; Priest and Donley, 2014).

Working closely with and co-teaching youth with their mentors who are experts in STEM fields provided opportunities for the mentees such as Colby to benefit from knowledge gains in the life sciences during the mentorship. This was perhaps because his mentor Dawn brought an extensive science background to the mentoring relationship (Bradbury and Koballa, 2007). Previous studies similarly reported gains in subject matter knowledge by mentees, from mentoring relationships (Hardy, 1999; Hansford et al., 2004). Further, Colby's co-participation in instruction and engagement in shared activities with Dawn likely facilitated his learning as a novice instructor (Connell 2010; Wexler, 2019).

Mentors were provided with an opportunity to practice educator reflectiveness during the mentorship, a known positive outcome for mentors in educational mentoring relationships (Wexler, 2019). For example, Dawn described engaging in reflection on her own teaching practice after watching her mentee's strategies for promoting inclusivity and youth engagement in STEM instruction, such as recognition of leadership behavior in addition to correct responses. Reflections on what went well and what could be done differently in the future helps reinforce having a growth-mindset in education as critical practices for success and effectiveness in education (Wexler, 2019). Previous researchers have similarly reported on mentor teachers benefiting from the opportunity of reflective mirrors during mentorships to improve their professional skills (Clinard and Ariav, 1998; Hansford et al., 2004).

Stacey, one of the mentors also gained the opportunity for self-evaluation and honing of leadership skills during the mentorship similar to findings by Priest and Donley (2014).

Additionally, mentors gained a sense of belonging and built community from the network of mentor-mentee pairs in the mentorship program, resulting in increased affiliation with the OST organization and social capital for professional collaboration. For one of the mentors this sense of belonging and community was also pivotal to their perseverance through a challenging period of high staff turnover at the OST organization. Our study findings are in agreement with previous research studies that reported on opportunities for collaborations and relationship building, from mentoring, which help to reduce isolation particularly among mentor teachers (Hansford et al., 2004; Iancu-Haddad and Oplatka, 2009; Clinard and Ariav, 1998).

Mentoring also contributed to gains in confidence and motivation as well as communication skills for the mentors, facilitating educator reflectiveness and advancing their mentoring and teaching skills. Previous studies have similarly documented reports of increased enthusiasm by mentors (Clinard and Ariav, 1998), and enhanced communication skills as outcomes of mentoring other teachers (Hudson, 2013). Courtney, the only mentor in a leadership role at the OST organization, celebrated the opportunity to provide career sponsoring and coaching, to prepare her mentee for career advancement similar to findings by Priest and Donley (2014). Mentors also gained pedagogy skills including lesson planning, creativity with lessons, and use of inclusive interactive strategies in lesson delivery. Researchers similarly reported mentor pedagogical knowledge gains such as lesson planning, new teaching styles and strategies, from mentoring experiences (Hudson, 2013; Lopez-Real and Kwan, 2005; Hobson et al., 2009). Stacey mentioned improving her lesson planning, and benefitting from her mentee's use of an innovative teaching strategy that incorporated the game Kahoot. Researchers have similarly documented mentor teachers gaining new pedagogical ideas from mentees and the opportunity to refine and refresh their pedagogical skills (Hudson et al., 2013; Iancu-Haddad and Oplatka, 2009).

Mentors also gained exposure to culturally responsive teaching practices (Gay, 2018) modeled by their mentees during the mentorship. These included the use of improv, drama, and poetry as frames of reference, use of afro-futurism (Barber et al., 2015), and highlighting of racialized minority contributions in STEM teaching. Culturally responsive strategies including performance styles of racially minoritized students are known to improve the relevance of STEM learning for students (Mensah, 2021). For Dawn this exposure likely led to motivation to be more creative with her own lessons and the development of teacher empathy (Meyers, 2019).

Participant mentors and mentees perceived the pilot mentorship program as a vehicle for staff professional development training, a resource for building community and source of talent for new hires and promotions at the OST organization. Additionally the mentorship was perceived as a tool for providing and surrounding the youth at the OST with more knowledgeable STEM educators and role models.

This mentorship was not without challenges. One mentor described it as costly of time and emotions, and participants critiqued several elements of the mentorship program's style and structure. Researchers have similarly found that mentoring drains the mentor's time, physical, emotional and mental resources (Bullough and Draper, 2004; Iancu-Haddad et al., 2009).

However, as seen from our mentees' experiences, all of whom are African American males and are underrepresent-

ed in STEM, mentoring provided numerous gains in professional skills, STEM pedagogy skills, STEM identity, self-efficacy as STEM educators, and STEM knowledge. These findings suggest that mentoring of OST staff is an accessible and effective approach for broadening participation in STEM education particularly in under-resourced, predominantly racially minoritized communities.

Lessons Learned.

Assessment. We encountered ceiling effects when using quantitative survey instruments to assess participants perceptions of self-efficacy, attitudes towards continuing education, vocational identity, and STEM professional identity overlap measure before the mentorship. This may have been due to participants feeling pressure to provide the "perfect" response instead of an honest one. Mentees may have also displayed a "Dunning-Kruger effect" by rating themselves high on efficacy and interest, to begin with, seeing themselves as already possessing the skills needed to be successful in STEM fields, not because they held expertise in those areas but because they lacked the context of what they didn't know. Similar findings were reported by Clark et al. (2021), who found that OST staff rated their self-efficacy in teaching STEM areas high even as their supervisors reported that they lacked preparation in these areas and would benefit from STEM professional development. Additionally, participants struggled to consistently and promptly complete surveys and weekly written reflections during the Summer of 2022, and some reflections were turned in several months later. We found the use of qualitative tools such as interviews and group discussions, oral narratives to be more successful.

Race-related Discussions. Discussions involving race and racism were found to be upsetting for most of our participants who were majority racially minoritized, African Americans, such as discussions of the different types of community cultural wealth. Future practitioners might benefit from an approach that gives agency to participants from racially minoritized groups to lead discussions on such topics of high sensitivity.

Time Management and Consistency in Attendance of Professional Development Meetings. Our participants struggled with time management and consistency in attending training meetings during the mentorship despite the fact that "free" lunch was provided as an incentive. Some participants were absent at training meeting sessions that addressed certain topics of interest that they then recommended for future meetings in their evaluation of the mentorship program. Practitioners might want to address the importance of time management and consistency of participation at the start of mentorship programs to mitigate this challenge.

Participant Attrition. Unfortunately, one of the mentees quit the mentoring program prematurely. Rigor and reproducibility weren't compromised, as we have since learned from exit interviews that the reasons for early departure were outside of the mentorship. The follow-up discussions with the mentee and his mentor revealed that the drop-out was due to multiple reasons, several of which included personal and family-related challenges outside the realm of the mentorship program. These challenges constrained his commitment to completing the program. Subsequent follow-up discussions with the mentee and mentor, led by leadership at the OST program, have included strategies to navigate these challenges and reiteration of program commitment obligations. This mentee is currently in a stable place in his position as staff at the OST, and is currently being informally mentored by his previously assigned mentor. We will consider recruiting him into the new cohort of mentees in Fall 2023 upon consultation with his current mentor. Additionally, we are revising the mentorship program to include a stronger role for mentoring networks of multiple mentors that contribute to the mentoring relationships in addition to the mentor-mentee dyad pairings. Additional revisions include more frequent check-ins with each mentor and mentee individually by leadership at the OST that is not directly involved with the mentorship project.

Future Plans. These include adjustments to the duration of mentorships to 6-month contracts down from one year, with the possibility for renewal to allow for a shorter commitment of mentees. New or renewed cohorts will start every six months, which will allow for expanding participant recruitment and participation including youth development professionals over time.

Future work might employ a mentoring network of multiple mentors to improve and maximize outcomes for all mentees, engage participants in choosing resources, and use alternative assessment strategies that can elicit more honest and reflective responses. By building on these lessons learned, future mentoring programs can help build a diverse and inclusive STEM workforce and promote community capacity building.

Limitations. This was a limited scale pilot qualitative study, whose objectives were to examine the growth of small group of mentor - mentee pairs over the duration of the mentorship. Our focus was to pilot the study with a small manageable group that we could provide an abundance of resources to make a real change that would then lead to broader organizational culture changes in the OST facility at which this study was located. Moreover since its inception, this mentoring program has and continues to be cited and included in statewide policy discussions to drive culture change i.e. policy shift based on culture shift. Nonetheless, given the high

prevalence of OST facilities nationally, this model can be translated to OST facilities serving youth in under resourced racially minoritized communities, with similar staff demographic profiles including youth development professionals/ specialists and a perennial lack of professional development opportunities.

CONCLUSION

The present study contributes to the broader literature on mentoring in which previous researchers have rarely delved into mentor and protégé/ mentee experiences of adult staff engaged in education at OST learning environments. Our research highlights the potential of mentoring as a STEM outreach and STEM education capacity building approach for racially minoritized adults in OST organizations serving under-resourced, predominantly racialized minority communities, towards broadening participation in STEM. As qualitative researchers we acknowledge the inability to generalize these findings to all OST programs in racialized minority communities, but offer the findings from this study as a way to think about STEM educative mentoring of adults from ethnic groups that are underrepresented in STEM as an approach for capacity building and broadening participation in STEM.

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ABBREVIATIONS

OST: Out-of-School Time; STEM: Science, Technology, Engineering, and Mathematics

REFERENCES

Adams, W. C. (2015). Conducting semi-structured interviews. In K. E. Newcomer, H. P. Hatry, J. S. Wholey (Eds.), Handbook of practical program evaluation (pp. 492-505). John Wiley and Sons, Inc. https://doi.org/10.1002/9781119171386.ch19

Afterschool Alliance, (2014) American Afterschool After 3pm: Afterschool programs in demand. http://www.afterschoolalliance.org/documents/aa3pm-2014/aa3pm_national_report.pdf

Allen, T.D., Eby, L.T., Poteet, M.L., Lentz, E., and Lima, L. (2004). Career benefits associated with mentoring for protégés: A meta-analysis. Journal of Applied Psychology, 89(1), 127.

Babiak, S. and Avina, E. (2017). A framework for creating an effective afterschool program for social and behavioral skills. http://debsedstudies.org/effective-afterschool-program/.

Balazs, C. L., and Morello-Frosch, R. (2013). The three R's: How community-based participatory research strengthens the rigor, relevance, and reach of science. Environmental Justice, 6(1), 9-16.

Baranik, L.E., Roling, E.A., and Eby, L.T. 2010.Why does mentoring work? The role of perceived organizational support, Journal of Vocational Behavior, 76(3), 366-373.

Barber, T.E., Gaskins, N., Guthrie, R., Gipson, G., McLeod, K., Rollins, A., ... and Whitted, Q. (2015). Afrofuturism 2.0: The rise of astro-blackness. Lexington Books.

Bevan, B., Barton, A.C., and Garibay, C. (2018). Broadening perspectives on broadening participation in STEM: Critical perspectives on the role of science engagement. Center for Advancement of Informal Science Education. https://www.informalscience.org/sites/default/files/BPreport.pdf

Bigelow, R.M. (2002). Preservice mentoring: Voices of mentors and proteges. Publication No. 2079576, Doctoral Dissertation, University of Wyoming. ProQuest Dissertations and Theses Global.

Blake-Beard, S., Bayne, M.L., Crosby, F.J., and Muller, C.B. (2011). Matching by race and gender in mentoring relationships: Keeping our eyes on the prize. Journal of Social Issues, 67(3), 622-643. https://doi.org/10.1111/j.1540-4560.2011.01717.x

Bradbury, L.U., and Koballa, T.R. (2007). Mentor advice giving in an alternative certification program for secondary science teaching: Opportunities and roadblocks in developing a knowledge base for teaching. Journal of Science Teacher Education, 18, 817–84.

Bullough Jr., R.V., and Draper, R.J. (2004). Making sense of a failed triad: Mentors, university supervisors, and positioning theory. Journal of Teacher Education, 55(5), 407-420. DOI: 10.1177/0022487104269804

Burciaga, R., and Kohli, R. (2018). Disrupting whitestream measures of quality teaching: The community cultural wealth of teachers of color. Multicultural Perspectives, 20(1), 5-12. https://doi.org/10.1080/15210960.2017.1400915

Candela, A.G. (2019). Exploring the function of member checking. The Qualitative Report, 24(3), 619-628.

Carnevale, A.P., Cheah, B., and Hanson, A.R. (2015). The economic value of college majors. Center on Education and the Workforce, Georgetown University.

Census.gov.https://www.census.gov/quickfacts/fact/table/eaststlouiscityillinois/LND110210

Centers for Disease Control and Prevention. (n.d.) Out of school time. CDC Healthy Schools. https://www.cdc.gov/healthyschools/ost.htm

Clark, J., Bloom, N., Rubino-Hare, L., Barnes, C., and Ryan, S. (2021). Designing professional development resources to meet the needs of OST STEM educators. Afterschool Matters, 34, 30-39. https://www.niost.org/Afterschool-Matters-Spring-2021/designing-professional-development-resources-to-meet-the-needs-of-ost-stem-educators

Clinard, L.M., and Ariav, T. (1998). What mentoring does for mentors: A cross-cultural perspective. European Journal of Teacher Education, Spring,1998.

Cohen, B. (2016). Teaching STEM after school: Correlates of instructional comfort. The Journal of Educational Research, 111(2), 246-255. https://doi.org/10.1080/00220671.2016.1253537

Connell, M.T., (2010). Framing teacher education: Participation frameworks as resources for teacher learning. Pedagogies: An International Journal, 5(2), 87–106. doi:10.1080/15544801003611169

Cornwall, A., and Jewkes, R. (1995). What is participatory research? Social Science Medicine, 41(12), 1667-1676.

Corbin, J., and Strauss, A. (2015). Basics of qualitative research (4th ed). Thousand Oaks, CA: SAGE Publications, Inc.

Davies, S.W., Putnam, H.M., Ainsworth, T., Baum, J.K., Bove, C.B., Crosby, S.C., Cote, I.M., Duplouy, A…Bates, A.E. (2021). Promoting inclusive metrics of success and impact to dismantle a discriminatory reward system in science. PLOS Biology 19(6), e3001282. https://doi.org/10.1371/journal.pbio.3001282.

Dery, M. (1994). Flame Wars: The Discourse of cyberculture. Durham: Duke University Press.

Deutsch, N.L., Blyth, D.A., Kelley, J., Tolan, P.H., and Lerner, R.M. (2017). Let's talk after-school: The promises and challenges of positive youth development for after-school research, policy, and practice. After-School Programs to Promote Positive Youth Development: Integrating Research into Practice and Policy, 1, 45-68. https://link.springer.com/chapter/10.1007/978-3-319-59132-2_4

Eby, L.T., Allen, T.D., Hoffman, B.J., Baranik, L.E., Baldwin, J.B., Sauer, J.B., Morrison, M.A., Kinkade, K.M., Maher, C.P., Curtis, S., and Evans, S.C. (2013). An interdisciplinary meta-analysis of the potential antecedents, correlates, and consequences of protégé perceptions of mentoring. Psychological Bulletin, 139(2), 441-476. https://doi.org/10.1037/a0029279

Eby, L.T., Allen, T.D., Evans, S.C., Ng, T., and DuBois, D. (2008). Does mentoring matter? A multidisciplinary meta-analysis comparing mentored and non-mentored individuals. Journal of Vocational Behavior, 72(2), 254-267. https://doi.org/10.1016/j.jvb.2007.04.005

Eby, L.T., Butts, M.M., Durley, J., and Ragins, B.R. (2008). Are bad experiences stronger than good ones in mentoring relationships? Evidence from the protégé and mentor perspective. Journal of Vocational Behavior, 72(1), 114-127. https://doi.org/10.1016/j.jvb.2010.02.010

Economic Research Service, United States Department of Agriculture (2022, December 9). Food Access Research Atlas. Retrieved April 15, 2023. https://www.ers.usda.gov/data-products/food-access-research-atlas/go-to-the-atlas/

Edwardson, J.A., Gjaja. M., and Steans, R. (2019). The state we're in 2019. A report on public education in Illinois. advanceillinois.org

Eshach, H. (2007). Bridging in-school and out-of-school learning: Formal, non-formal, and informal education. Journal of Science Education and Technology, 16(2), 171-190. https://doi.org/10.1007/s10956-006-9027-1

Ewing, L. (2021) Mentoring novice teachers. Mentoring and Tutoring: Partnership in Learning, 29(1), 50-69. DOI: 10.1080/13611267.2021.1899585

Fabiano, L., Pearson, L.M., Reisner, E.R., and Williams, I.J. (2006). Preparing students in the middle grades to succeed in high school: Findings from Phase IV of the Citizen Schools evaluation. Washington, DC: Policy Study Associates

Fadigan, K.A., and Hammrich, P.L. (2005). Informal science education for girls: Careers in science and effective program elements. Science Education Review, 4(3), 83-90. https://files.eric.ed.gov/fulltext/EJ1049736.pdf

Freeman, J., Dorph, R., and Chi, B. (2009). Strengthening after-school STEM staff development. Coalition for Science After School University of California, Berkeley. https://www.informalscience.org/sites/default/files/Strengthening_After-School_STEM_Staff_Development.pdf

Funk, C., and Parker, K., (2018). Women and men in STEM often at odds over workplace equity. Pew Research Center.

Gay, G. (2018). Culturally responsive teaching: Theory, research, and practice (3rd ed.). Teachers College Press.

Gay, G. (2002). Preparing for culturally responsive teaching. Journal of Teacher Education, 53(2), 106-116. https://doi.org/10.1177/0022487102053002003

Goodrick, D., and Rogers, P. R. (2015). Qualitative data analysis. In K.E. Newcomer, H.P. Hatry, and J. S. Wholey (Eds.), Handbook of practical program evaluation (pp. 561-595). John Wiley and Sons, Inc. https://doi.org/10.1002/9781119171386.ch22

Griffin, K.A., and Toldson, I.A. (2012). Reflections on mentoring for Blacks in academia (Editor's Commentary). Journal of Negro Education, 81(2), 103-105. https://doi.org/10.1002/ajcp.12330

Grineski, S. (2003). A university and community-based partnership: After-school mentoring for low-income youth. School Community Journal, 13(1), 101.

Halpern, D.F., and Murphy, S.E. (2013). From balance to interaction: Why the metaphor is important. In From Work-Family Balance to Work-Family Interaction (pp. 23-30). Routledge.

Halpern, D. F. (1999). Teaching for critical thinking: Helping college students develop the skills and dispositions of a critical thinker. New Directions for Teaching and Learning, 1999(80), 69-74. https://doi.org/10.1002/tl.8005

Hansford, B., Ehrich, L., and Tennent, L. (2004). Outcomes and perennial issues in pre-service teacher education mentoring programs. International Journal of Practical Experiences in Professional Education, 8(2), 6-17.

Hammack, R., and High, K. (2014). Effects of an after school engineering mentoring program on middle school girls' perceptions of engineers. Journal of Women and Minorities in Science and Engineering, 20(1).

Hardy, C. A. (1999). Preservice teachers' perceptions of learning to teach in a predominantly school-based teacher education program. Journal of Teaching in Physical Education, 18, 175-198.

Hobson, A.J., Ashby, P., Malderez, A., and Tomlinson, P.D. (2009). Mentoring beginning teachers: What we know and what we don't. Teaching and Teacher Education, 25(1), 207-216.

Hobson, L. D., Harris, D., Buckner-Manley, K., and Smith, P. (2012). The importance of mentoring novice and pre-service teachers: Findings from a HBCU student teaching program. Educational Foundations, 26(3-4), 67-80. https://files.eric.ed.gov/fulltext/EJ1000231.pdf

Horowitz, C., Robinson, M., and Seifer, S. (2009). Community-based participatory research from the margin to the mainstream: Are researchers prepared? Circulation, 2633-2642. https://www.cdc.gov/healthyschools/ost.htm#print

Hudson P. (2013). Mentoring as professional development: 'Growth for both' mentor and mentee. Professional Development in Education, 39(5), 771-783. DOI: 10.1080/19415257.2012.749415

Iancu-Haddad, D., and Oplatka, I. (2009). Mentoring novice teachers: Motives, process, and outcomes from the mentor's point of view. The New Educator, 5:45–65, 2009.

Irby, B.J., Lynch, J., Boswell, J., and Hewitt, K.K. (2017). Mentoring as professional development. Mentoring and Tutoring: Partnership in Learning, 25(1), 1-4.

Israel, B.A., Lichtenstein, R., Lantz, P., McGranaghan, R., Allen, A., Guzman, J.R., Softly, D., and Maciak, B. (2001). The Detroit Community-Academic Urban Research Center: Development, Implementation, and Evaluation. Journal of Public Health Management and Practice, 7(5), 1–19.

Ivey, G.W., and Dupré, K.E. (2022). Workplace mentorship: A critical review. Journal of Career Development, 49(3), 714-729.

Kekelis, L., Ryoo, J.J., and McLeod. E (2017). Making and mentors: What it takes to make them better together. Afterschool Matters, 26 Fall 2017

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Prentice-Hall.

Konczal, L. (2019). St. Louis is home to Missouri's wealthiest – and poorest – ZIP codes. St. Louis Business Journal. https://www.ksdk.com/article/news/local/business-journal/st-louis-zip-codes-wealthiest-poorest/63-b1eb6b1a-fdf4-4057-95ec-4cbd49c76c51

Kram, K.E. (1985). Improving the mentoring process. Training and Development Journal, 39(4), 40-43. https://eric.ed.gov/?id=EJ314819

Krueger, R. A. (2015). Using stories in evaluation. In K.E. Newcomer, H.P. Hatry, and J.S. Wholey (Eds.), Handbook of practical program evaluation (pp. 535-556). John Wiley and Sons, Inc. https://doi.org/10.1002/9781119171386.ch21

Kuperminc, G. P. Seitz, S., Joseph, H., Khatib, N., Wilson, C., Collins, K. and Guessous. O. (2019). Enhancing program quality in a national sample of after-school settings: the role of youth–staff interactions and staff/organizational functioning. American Journal of Community Psychology, 0, 1–14

Ladson-Billings, G. (2014). Culturally relevant pedagogy 2.0: a.k.a. the Remix. Harvard Educational Review, 84(1), 74-84. https://doi.org/10.17763/haer.84.1.p2rj131485484751

Ladson-Billings, G. (1995). Toward a theory of culturally relevant pedagogy. American Educational Research Journal, 32(3), 465-491. https://doi.org/10.3102/00028312032003465

Lampert, M., Ghousseini, H., and Beasley, H. (2015). Positioning novice teachers as agents in learning teaching. Socializing intelligence Through Academic Talk and Dialogue, 363-374.

Leavy, P. (2023). Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches. The Guilford Press.

Lopez-Real, F., and Kwan, T. (2005). Mentors' perceptions of their own professional development during mentoring. Journal of Education for Teaching, 31 (1), 15-24.

Mahoney, J.L., Levine, M.D., and Hinga, B. (2010). The development of after-school program educators through university-community partnerships. Applied Developmental Science, 14(2), 89-105. https://doi.org/10.1080/10888691003704717

Mansur, S. (2020). https://capitolnewsillinois.com/NEWS/senate-committees-discuss-inequity-in-education-employment

Mayan, M.J., and Daum, C.H. (2016). Worth the risk? Muddled relationships in community-based participatory research. Qualitative Health Research, 26(1), 69-79.

Mensah. M.F. (2021). Culturally relevant and culturally responsive: Two theories of practice for science teaching. Science and Children, March/April. www.nsta.org/elementaryschool

Merriam, S.B., and Tisdell, E.J. (2016). Qualitative research: A guide to design and implementation (4th ed.). Jossey-Bass.

McDaniel, S., and Yarbrough, A.M. (2016). A literature review of afterschool mentoring programs for children at risk. Journal of At-Risk Issues, 19(1), 1-9.

McGee, E.O. (2013). High-achieving Black students, biculturalism, and out-of-school STEM learning experiences: Exploring some unintended consequences. Journal of Urban Mathematics Education, 6(2), 20–41. https://doi.org/10.21423/jume-v6i2a178

McGee, E.O. (2020). Black, brown, bruised: How racialized STEM education stifles innovation. Harvard Education Press.

McIntyre, D., and Hagger, H. (1996). Mentors in schools: Developing the profession of teaching. London: David Fulton.

Mensah, F.M. (2021, March/April). Culturally relevant and culturally responsive: Two theories of practice for science teaching. science and children. Science and Children, 58(4). https://www.nsta.org/science-and-children/science-and-children-marchapril-2021/culturally-relevant-and-culturally

Meyers, S., Rowell, K., Wells, M., and Smith, B.C. (2019). Teacher empathy: A model of empathy for teaching for student success. College Teaching, 67(3), 160-168.

National Academies of Sciences, Engineering, and Medicine. 2019. Minority Serving Institutions: America's Underutilized Resource for Strengthening the STEM Workforce. Washington, DC: The National Academies Press. https://doi.org/10.17226/25257.

National Center for Science and Engineering Statistics, 2023. The STEM Labor Force of Today: Scientists, Engineers, and Skilled Technical Workers. https://ncses.nsf.gov/pubs/nsb20212/participation-of-demographic-groups-in-stem

National Science Board. (2021, August). The STEM labor force today: Scientists, engineers, and skilled technical workers. https://ncses.nsf.gov/pubs/nsb20212/assets/nsb20212.pdf

Noam, G. (2008). A new day for youth: creating sustainable quality in out-of- school time. A white paper commissioned by The Wallace Foundation. Harvard University. Cambridge, Massachusetts.

Patton, M. (2002). Qualitative Research and Evaluation Methods (3rd ed.). Thousand Oaks, California: Sage Publications.

Phillippi, J., and Lauderdale, J. (2018). A guide to field notes for qualitative research: Context and conversation. Qualitative Health Research, 28(3), 381-338. https://doi.org/10.1177/1049732317697102

Phillips, T., Porticella, N., Constas, M., and Bonney, R. (2018). A framework for articulating and measuring individual learning outcomes from participation in citizen science. Citizen Science: Theory and Practice, 3(2), 3. https://doi.org/10.5334/cstp.126

Price, J. (2010) The effect of instructor race and gender on student persistence in STEM fields. Economics of Education Review, 29(6), 901-910. https://doi.org/10.1016/j.econedurev.2010.07.009.

Priest, K.L., and Donley, S. (2014). Developing leadership for life: Outcomes from a collegiate student-alumni mentoring program. Journal of Leadership Education, 13(3).

Rabin, C. (2020). Co-teaching: Collaborative and caring teacher preparation. Journal of Teacher Education, 71(1), 135-147. https://doi.org/10.1177/0022487119872696

Ragins, B.R., and Kram, K. E. (2007). The landscape of mentoring. In B. R. Ragins and K. E. Kram (Eds.), The Handbook of Mentoring at Work: Theory, Research, and Practice (pp. 1-24). Sage Publishing. https://doi.org/10.4135/9781412976619

Robinson, D.M., and Reio, T.G. (2012). Benefits of mentoring African-American men. Journal of Managerial Psychology, 27(4), 406-421. https://doi.org/10.1108/02683941211220207

Rooks, R.N., Scandlyn, J., Pelowich, K., and Lor, S. (2022). Co-teaching two interdisciplinary courses in higher education. International Journal for the Scholarship of Teaching and Learning, 16(2). https://doi.org/10.20429/ijsotl.2022.160208

Ryan, R.M., and Deci, E.L. (2000). Intrinsic and extrinsic motivations: Classic definitions and new directions. Contemporary Educational Psychology, 25(1), 54-67. https://doi.org/10.1006/ceps.1999.1020

Saldaña, J. (2016). The coding manual for qualitative researchers (3rd ed.). Sage Publishing.

Siwatu, K. O. (2007). Preservice teachers' culturally responsive teaching self-efficacy and outcome expectancy beliefs. Teaching and Teacher Education, 23(7), 1086-1101. https://doi.org/10.1016/j.tate.2006.07.011

Sowell, M. (2017). Effective practices for mentoring beginning middle school teachers: Mentor's perspectives. The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 90(4), 129-134.

Tesch, R. (2013). Qualitative research: Analysis types and software. New York, NY: Routledge.

Trevethan, H., and Sandretto, S. (2017). Repositioning mentoring as educative: Examining missed opportunities for professional learning. Teaching and Teacher Education: An International Journal of Research and Studies, 68(1), 127-133.

"USDA ERS - National School Lunch Program." Accessed April 15, 2023. https://www.ers.usda.gov/topics/food-nutrition-assistance/child-nutrition-programs/national-school-lunch-program/

United States Bureau of the Census. "Search Results." The United States Census Bureau. Accessed April 15, 2023. https://www.census.gov/

U.S. Bureau of labor statistics. Occupational Employment and Wage Statistics February 4, 2022.https://www.bls.gov/oes/topics.htm#stem

Vaughn, L.M., and Jacquez, F. (2020). Participatory research methods - choice points in the research process. Journal of Participatory Research Methods, 1(1).

Walker, D. (1985). Writing and reflection. In D. Boud, R. Keogh, and D. Walker (Eds.), Reflection: Turning experience into learning. (pp. 52-68). Routledge.

Warren, M.R., Caldoreon, J., Kupscznk, L.A., Squires, G., and Su, C. (2018). Is collaborative, community-engaged scholarship more rigorous than traditional scholarship? On advocacy, bias and social science research. Urban Education, 53(4), 445-472.

Weinberg, F. J. (2019). How and when is role modeling effective? The influence of mentee professional identity on mentoring dynamics and personal learning outcomes. Group and Organization Management, 44(2), 425-477.

Wexler, L.J. (2019). I would be a completely different teacher if I had been with a different mentor': Ways in which educative mentoring matters as novices learn to teach. Professional Development in Education, 46(2), 211-228.

Wright, B.L., Counsell, S.L., Goings, R.B., Freeman, H., and Peat, F. (2016). Creating access and opportunity preparing African-American male students for STEM trajectories PreK-12. Journal for Multicultural Education, 10(3), 384-404. https://doi.org/10.1108/jme-01-2016-0003

Xie, Y., Fang, M., and Shauman, K. (2015). STEM education. Annual review of sociology, 41, 331-357.

Yin, R.K. (2003). Case study research: design and methods. 2nd edn. Thousand Oaks: Sage, 2003.

Yosso, T.J. (2005). Whose culture has capital? A critical race theory discussion of community cultural wealth. Race Ethnicity and Education, 8(1), 69–91. https://doi.org/10.1080/1361332052000341006

Zarrett, N., Abraczinskas, M., Cook, B.S., Wilson, D.K., and Ragaban, F. (2018). Promoting physical activity within under-resourced afterschool programs: A qualitative investigation of staff experiences and motivational strategies for engaging youth. Applied Developmental Science, 22(1), 58–73. doi:10.1080/10888691.2016.1211482.

Zief, S.G., Lauver, S., and Maynard, R.A. (2006). Impacts of after-school programs on student outcomes. Campbell Systematic Reviews, 2(1), 1-51. https://doi.org/10.4073/csr.2006.3