

Supporting Near-Peer Women Mentors in Out-of-School Time STEM Programming

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Abstract: This study examined the experiences of near-peer women mentors in an out-of-school time (OST) STEM program for middle school girls of color. 11 mentors reported and reflected upon their overall experiences in interviews. Key findings include that, for example, training is an essential part of mentors' work; they wish to have more training on pedagogy and more opportunities to bond with other mentors. This study extends the literature on STEM mentoring in OST environments, deepens the understanding of mentors' experience in STEM programming, and provides important implications for mentor training and OST STEM program design, such as providing opportunities for reflective practices to understand mentor needs, supporting mentors' non-STEM skill development, involving mentors in working towards the program goal, and fostering community building among women mentors.

Introduction

Studies indicate that women mentoring girls' learning and career development is a promising means of promoting girls in science, technology, engineering, and mathematics (STEM) (e.g., Stoeger et al., 2016). Intentionally recruiting women as mentors and role models creates an inviting out-of-school time (OST) environment for girls to participate, build confidence, and develop interest in STEM. This study shines the spotlight on supporting women mentors in near-peer women-girls mentorship in OST STEM space. Near-peer women mentors, who are normally college or high school students, are also traditionally underrepresented in STEM. Getting a better understanding of how near-peer women mentors perceive their mentoring experience informs the design of an effective mentoring program that benefits both women mentors and girls. Here, we seek answers to these questions, "How do near-peer women mentors perceive their experiences in an OST STEM program for girls?", and "How might we support them?"

Literature review

Peer or near-peer mentorship

The definition of mentoring has grown since the 1980s, and there is no one widely accepted definition because of its complexity. Mentors perform three primary functions: (1) providing vocational or skill support that directly enhances their career; (2) offering psychosocial support via counseling, friendship, confirmation, and encouragement; and (3) functioning as role models by demonstrating appropriate behaviors (Kram, 1985).

Peer or near-peer mentors have been perceived as more relatable than mentors with hierarchical status (e.g., Vandal et al., 2018). In education, such mentorship has been linked to student success in many aspects, such as socialization (Allen et al., 1999), and engagement in STEM (Wilson et al., 2012). The engagement of peer or near-peer mentors has also been frequently reported as a potential structural solution (e.g., Zaniwski & Reinholz, 2016) to solve the issue of mentor scarcity and mentee retention, which is critical for women in STEM.

Near-peer women-girls mentorship in STEM

Identity is particularly important for those who are traditionally underrepresented in STEM. Women, for example, experience significant discouragement or isolation in a climate with few role models and mentors, a dearth of female peers, and perceived bias against women in STEM (Seymour & Hewitt, 1994). Strengthening girls' STEM identities, near-peer women-girls mentorship helps them develop a sense of belonging (Inzlicht & Good, 2006) by connecting with same-gendered role models who are close in age, knowledge, and experience (Stout et al., 2013). Women mentors help girls alleviate negative stereotypes and build confidence in STEM because women appreciate those who understand their experiences and unique challenges (Bernstein, et al., 2010) and are able to see that others "like them" can be successful in their field.

Impact of mentoring on mentors and contribution to the literature

As is shown in the increasing but still lacking literature (e.g., Petersen et al., 2020), near-peer mentoring in STEM has been proven to be beneficial for mentors, through such means as solidifying mentors' prior STEM knowledge and skills (e.g., Garcia et al, 2021), enhancing leadership skills (Gunn, Lee, & Steed, 2017), and developing professional networking (Lim et al., 2017). Additionally, heavy reliance on survey-based data collection methods also raises validity concerns (Allen et al., 2007). In this study, we mainly conducted 1-1 interviews to obtain a deep understanding of mentors' experiences.

Methods

Research context and participants

The Digital Youth Divas (DYD) is an on-going project for middle school girls of color in a mid-sized racially and socioeconomically diverse community. Since its inception in 2013, the DYD has been implemented in various configurations, including weekly workshops, summer camps, and showcases. It has trained around 40 near-peer women mentors who have taught approximately 500 girls. Each session involves hands-on learning experiences designed to make connections between STEM and girls' own interests, such as art, fashion, or music.

In this study context, 13 mentors facilitated 16-week workshops for a total of 47 10-12-year-old girls. The girls were racially diverse: approximately 30% identified as African American, 26.42% Latino or Hispanic, and 11.32% Caribbean Islander. Among 11 mentors who agreed to take part in this study, all identified as women, the average age was 18, 7 were high school students, and four were undergraduate students (see Table 1).

Table 1
Background Information of 11 Mentor Participants

Participant ID	Gender (W=Women; M=men)	Age	Education level
P1	W	22	Undergraduate
P2	W	20	Undergraduate
P3	W	19	Undergraduate
P4	W	21	Undergraduate
P5	W	17	High School
P6	W	17	High School
P7	W	16	High School
P8	W	18	High School
P9	W	17	High School
P10	W	16	High School
P11	W	15	High School

Data collection and analysis

Due to the COVID-19 pandemic, we conducted the interviews via Zoom, and each lasted 60 minutes. We asked questions such as "What are some things that you wanted more of in this position?" "Do you feel you've gained any skills in this position?" Interviews were audio-recorded, and extensive notes were taken. 96-page transcripts in Word were analyzed using a thematic approach. I read through all transcripts and notes and looked for patterns to find overarching themes. A four-question self-assessment was also distributed via Qualtrics asking about their work performance, engagement, work preparation, and acknowledgement received at work. I manually calculated the percentages of the 11 valid responses for each item. In this paper, we present preliminary results that describe how near-peer women mentors perceived their experiences in a same-gendered STEM learning environment and design implications that help create a supportive environment for women mentors.

Preliminary results

We provide preliminary results from this work by briefly describing mentors' responsibilities, experiences they enjoyed, challenges they faced, and personal growth.

Mentors' responsibilities

Mentors mentioned three major aspects of their work; training, facilitating, and making connections with girls. All participants saw training as an essential task for a mentor. Unlike undergraduate mentors who perceived their job as "teaching STEM knowledge or skills" or "helping with projects," high school mentors focused more on making personal connections with the girls.

Enjoyable experiences

Both interview and survey data indicated that mentors actively participated and enjoyed a comfortable and supportive same-gendered working atmosphere. High school mentors often looked up to the undergraduate mentors for guidance and help. P6 said, "I really liked how there was just like a big community of girls and women who wanted to do STEM and liked [that] they can all relate to each other."

Challenges

Mentors brought up two areas as the greatest source of challenges, training and communication. First, despite the fact that all mentors felt that training was beneficial, 73% of the mentors ($n=8$) pointed out some training logistics for improvement (e.g., "there was not much training after the program started"); and over half of the mentors said that the training content should be deeper and broader, covering pedagogy and communication, for example. P4 would love to learn more about "making conversations with girls and creating an inclusive learning environment".

Second, 55% of the mentors hoped to get more informed about the program overall. P1 brought up, "we weren't clearly communicated about everything that was going on [in the program]." Furthermore, around half of the mentors claimed that they desired more bonding time with other mentors. P7 said that "[having] dinner together really created a group identity", and they felt more motivated at work. High school mentors were interested in more bonding time with undergraduate mentors to seek resources and advice on college and career.

Personal growth

More than half of the mentors ($n>5$) claimed they experienced personal growth in STEM knowledge, career, communication skills, and confidence. All mentors claimed that they gained STEM knowledge and skills during programming, such as 3D printing, coding, etc. They also explicitly claimed that working as a mentor helped with their professional development (e.g., leadership skills). P9 said it "helped me learn how to navigate a workplace setting". More than half of the mentors (55%) further indicated that their social and communication skills improved. P5 said, "I've always struggled to be more open. I feel like this job made me step up a little bit [by] giving me more responsibilities. This job made me more confident."

Reflections and implications

This study supports and extends the literature with high school and undergraduate women mentors anecdotally expressing their personal development and challenges. Tasks mentors described reflected Kram and Isabella's (1985) description of peer mentor functions, including knowledge and information sharing, emotional support, and friendship. Reflecting on mentors' perceived experiences, we proposed these design principles.

(a) Provide opportunities for reflective practices to understand mentor needs: Reflective practices (e.g., biweekly survey) help program designers develop more effective interventions and help mentors recognize the value of their work and boost their confidence and motivation.

(b) Support development of mentors' non-STEM skills: Effective mentor training that equip mentors with important skills is one of various factors that determine the success of mentoring interventions (Stoeger et al., 2019). Mentors in this study felt that training on pedagogy and communication were important but lacking.

(c) Involve mentors in working towards the program goal: Providing a clear picture of the program, ensures that everyone on the team works closely towards a communal goal in a supportive and motivating work environment. Ambiguity about the program results in a weak connection (Garcia et al., 2021) among everyone in the program, which prevented mentors from fully participating in and growing with the program.

(d) Foster community-building among women mentors: Women mentors in this study enjoyed working with and bonding with other women mentors outside of the work occasion. Interestingly, high school mentors considered undergraduate mentors as "role models" and were willing to seek advice for their future academic and career development. The bond can be created, fostered, and strengthened in a safe and supportive community.

As a limitation of this study, we acknowledge that we present findings from a small data set using mainly one qualitative method, one-on-one interview. With a vivid picture of women mentors' experience even at this small scale, we are inspired and motivated to explore more deeply how girls and parents perceive such mentorship and how women mentors grow in their future STEM learning and career pathways.

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