

Mentoring roles in an afterschool STEM mentoring program: an investigation of why mentors enact different roles

Mentoring
roles in STEM
mentoring
program

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Received 15 November 2021
Revised 7 April 2022
3 May 2022
14 May 2022
Accepted 15 May 2022

Abstract

Purpose – The purposes of this study were to describe the roles mentors enacted as part of an afterschool science, technology, engineering and mathematics (STEM) program and how those roles varied across three sites and to explain those differences.

Design/methodology/approach – The authors used a comparative case study design and collected data primarily from interviews with program mentors and observations of the sessions.

Findings – The authors found that the mentors played four roles, depending on the school site: teachers, friends, support and role models. Mentors interpreted cues from the environment in light of their own identities, which ultimately led them to construct a plausible understanding of their roles as mentors.

Research limitations/implications – The authors identify four mentoring roles that are somewhat consistent with prior research and demonstrate that the roles mentors enact can vary systematically across sites, and these variations can be explained by sensemaking. This study also contributes to research on mentoring roles by elaborating each identified role and offering a framework to explain variability in mentor role enactment.

Practical implications – The authors recommend that mentoring program directors discuss the roles that mentors may enact with mentors as part of their training and that they engage mentors in identity work and also recommend that program managers create unstructured time for mentors to socialize outside STEM activities with their mentees.

Originality/value – This study contributes to mentoring research by using sensemaking theory to highlight how and why mentoring roles differ across school sites.

Keywords Mentors, STEM afterschool Program, Sensemaking, Comparative case study

Paper type Research paper



The authors acknowledge the useful and thorough comments from the anonymous reviewers.

Funding: The study was supported in part by a grant from the National Science Foundation (No. 1760311).

Introduction

Mentors enact multiple roles as they work with mentees (Goldner and Maysseless, 2008; Keller and Pryce, 2010, 2012; Lakind *et al.*, 2015; Rhodes *et al.*, 2006; Tolan *et al.*, 2020). It is an inherently flexible activity that shifts for several reasons, including the mentees' needs, the mentors' beliefs, and the passage of time (Goldner and Maysseless, 2008; Herrera *et al.*, 2013; Lakind *et al.*, 2015; Lucas, 2001; Spencer, 2007). Our interest in mentor roles arose from the differences we observed in undergraduate science, technology, engineering and mathematics (STEM) students' enacted roles as they mentored students in an afterschool STEM program. We questioned whether and how the local context of mentoring shaped the relationships. We used sensemaking theory (Weick, 1995) to extend recent investigations into how the context of mentoring shapes the roles that mentors choose to enact. Understanding the relationship between context and mentoring can help researchers and practitioners develop a deeper understanding of the variation in the quality of mentoring and, therefore, design better mentoring supports.

Program description

The afterschool STEM mentoring program was created in 2013 in the United States to expose young African American and Latino boys to engineering and increase their interest in STEM studies and careers through mentoring relationships. Though boys generally are not underrepresented in STEM, African American and Latino men are underrepresented in STEM majors in the United States (National Center for Education Statistics, 2019) and STEM careers (National Science Foundation, 2020). For this reason, the program served predominantly Latino and African American boys until autumn 2020 when the program expanded to include girls.

The program ran for eight weeks during the fall and spring semesters, with sessions occurring three times a week – twice after school for an hour and a half and on Saturday mornings for two hours. Mentors, whom the program paid as of spring 2018, must attend the three sessions and a weekly mentor meeting. The mentors are assigned to one site per semester but are not assigned to specific mentees. The typical ratio of participants to mentors is 5:1 but can be higher or lower depending on the number of young students at each site and daily attendance. In a typical weekday session, mentors welcome the boys, have them sign in, and then sit at tables or grouped desks to help them with the first activity, the mathematics problem of the day. After that, if it is a Tuesday, the mentors introduce the STEM professional of the week, an African American or Latino person who worked or continues to work in a STEM field, to provide additional role models for the students. The bulk of the students' time across the three days centers on hands-on activities related to the week's concept (e.g. electricity or DNA) or the week's design challenge. They engage in an activity that allows them to explore the central topic on Tuesdays. On Thursdays, the mentors present the students with a design challenge, and the students must work together to design and test a solution. On Saturdays, the students redesign and test their solutions with the help of family members (Manuel *et al.*, 2018).

Mentor recruitment and training. The program recruits mentors from across a single minority-serving university by distributing a flyer through departmental listservs, engineering courses, campus-based professional organizations such as the National Society of Black Engineers, and college-wide email blasts. Interested STEM majors complete an application and then are invited for an interview with the program manager. The program provides two training days each semester and holds weekly staff meetings. The training covers a range of topics, including the program's history, program objectives and expectations, the purpose of mentoring, classroom management techniques, daily procedures, and culturally responsive mentoring. The training mixes direct instruction with group discussion. During the weekly meetings, mentors meet with the program manager to discuss ongoing challenges, potential solutions, and future sessions. The mentors are assigned to school sites to ensure there are diverse mentors (i.e. not all Latino mentors at one site) and at least one experienced mentor at each site.

Description of cases

The afterschool STEM program is for fourth- and fifth-grade students (ages 9 to 11) in three elementary schools in the same large city in a southern state. The schools have very different student populations (see [Table 1](#)) and have received different state accountability ratings, which are a rough reflection of students' academic achievement across multiple subject areas [1]. Two schools (A and B) are traditional public schools that qualify as Title I schools under US federal education law [2]. Both traditional public schools are located near a large public university in neighborhoods that, according to the most recent [U.S. Census Bureau \(2019\)](#), have poverty rates over 20% (Social Explorer, 2019). In both neighborhoods, fewer than 30% of adult residents (over age 25) have a college degree, and fewer than 50% have a high school degree. School A's neighborhood is predominantly Black and US-born, while school B serves a predominantly Latinx and immigrant community. School C is a university-affiliated K–5 public charter school [3]. Some students have parents who work at the affiliated university as faculty or staff, and so some, but not all, students have high levels of exposure to STEM outside of the school setting. School C draws families and students from across the city as a charter school.

Literature review

Defining youth mentoring

Researchers have offered multiple definitions for mentoring. Shared characteristics of mentoring relationships include that they occur between one or more mentors and one or more mentees, with some power or structural difference between the mentor(s) and mentee(s), they extend over a period of time, and the mentee is in a position to learn and benefit from the relationship ([Tolan et al., 2020](#)). Youth mentoring is an “individualized relationship between a young person and a non-parental adult that promotes positive development” ([Lakind et al., 2015](#), p. 52). Mentoring can be informal or planned, occurring through programs that recruit and match mentors to mentees ([Kwan and Lopez-Real, 2005](#)). Notably, the relationships between a mentor and mentee differ from other relationships because they are “mutual comprehensive, informal, interactive, and enduring” ([Hardcastle, 1988](#), as cited in [Lucas, 2001](#), p. 24).

STEM mentoring

Mentoring in the areas of STEM is one of the fastest-growing forms of youth mentoring and is seen as a way to overcome some of the barriers to greater STEM participation among girls and students of color ([Kupersmidt et al., 2018](#); [National Academies of Science Engineering and Medicine, 2019](#)). STEM mentors support their mentees in academic work, psychological and social domains, goal setting, career choice, and role modeling ([Byars-Winston and Dahlberg, 2019](#)). Research on STEM mentors remains limited despite the proliferation of K–12 STEM school-based mentoring programs.

School	Type	Enrollment	African American	Latinx	White	Other	Economically disadvantaged	State accountability ratings
A	Public	420	85%	14%	<1%	1%	100%	C
B	Public	490	2%	98%	<1%	<1%	95%	B
C	Charter	140	34%	43%	14%	9%	49%	D

Note(s): Data from the State Education Agency, 2018–2019

Table 1.
Demographics of
school case sites from
2018 to 2019
academic year

Mentoring roles

Addressing mentees' social and emotional needs is among the most cited mentoring roles. For example, Rhodes *et al.* (2006) explain that mentors can enhance young people's social relationships and emotional well-being. This might include having fun and helping the mentee cope with stress and/or regulate their emotions. Goldner and Maysless (2008) label this role the "therapist", arguing that it describes when the mentor acts as a caring authority figure in a relationship centered on caring, empathy, and resolving conflicts. Lakind *et al.* (2015) identify two mentoring roles that fall into this category. First, mentors can counterbalance the lack of positive support and role models, instability, and limitations of families. Second, mentors can supplement or complement what other adults (e.g. parents, teachers, social workers) are doing in their mentees' lives (Lakind *et al.*, 2015). Finally, Tolan *et al.* (2020) also describe a support role, where mentors act as companions who care for the mentee.

Closely related to the support role is the role of friend. Goldner and Maysless (2008) argue that the friend role centers on how mentors encourage their mentees and play games and do activities with them. Similarly, Keller and Pryce (2010, 2012) write that the friend role emphasizes fun and getting along.

Within youth mentoring, the academic role also is typical. Rhodes *et al.* (2006) write that mentors can improve their mentees' cognitive skills through teaching. This might include new learning opportunities, challenging and guiding the mentee intellectually, and promoting the mentee's academic success. Keller and Pryce (2010, 2012) call this the tutor role, and Tolan *et al.* (2020) describe it as the teacher role because the mentor teaches the mentee new knowledge or skills.

Mentors also can act as role models. Rhodes *et al.* (2006) argue that mentors as role models promote positive identity development among their mentees. Tolan *et al.* (2020) describe the role modeling role as one where the mentor seeks to be someone who the mentee looks up to.

A final role that researchers have highlighted is as an advocate. Lakind *et al.* (2015) contend that mentors can be advocates for their mentees, engaging with other adults and systems on their behalf. Tolan *et al.* (2020) describe this role as speaking up for the mentee's interests, helping them gain access to opportunities or navigate systems in which they are embedded.

Factors shaping mentoring roles

Spencer (2007) found that two mentor perceptions mattered: whether there was a gap between mentors' expectations and their actual experiences with their mentees and mentors' perceptions that their mentees were not motivated (Spencer, 2007). Lakind *et al.* (2015) concluded that the "mentors' perceptions of the youth they serve can dramatically inform the shape their mentoring takes" (p. 52). Similarly, an analysis of the role of youth risk profiles in the mentoring relationship found that mentors who perceived their mentees as at higher risk of adverse outcomes were more likely to select activities that sought to change a behavior than those who perceived their mentees as lower risk (Herrera *et al.*, 2013).

The broader context of the mentoring relationship also matters. For example, the physical setting can influence mentors' enacted roles by limiting or facilitating deep conversations by providing more or less privacy (Lucas, 2001). Mentees' backgrounds also can shape the mentors' roles. For instance, mentors matched to youth facing more external challenges (e.g. problems at home, perceived unsafe community) may find mentoring more challenging (Herrera *et al.*, 2013). Similarly, Spencer (2007) found that mentors matched with mentees whom they perceived as more at risk were more likely to feel overwhelmed and disengage.

Mentors' styles shape the roles they choose to enact. For example, Styles and Morrow (1992) contrasted youth-focused mentors and those who were mentor driven. Youth-focused

mentors waited for mentees to open up and moved at the mentees' pace, focusing on the mentees' needs. Mentor-driven mentors believed their role was to transform their mentees and, as a result, pushed their mentees to confide in them (Styles and Morrow, 1992). Hennissen *et al.* (2008) argue that their typology of mentoring styles shapes the types of roles that mentors are more (or less) likely to enact. They place mentors in one of four categories depending on where they fall along two dimensions, how directive they are, and the degree of input they solicit from the mentee. These styles can influence mentors' emphasis on different roles, such as teacher (advisor) vs friend (initiator) (Hennissen *et al.*, 2008).

The final influence on the mentors' enacted roles comprises their goals and expectations. Hamilton and Hamilton (1992) located mentors along a continuum based on the extent to which their goals were instrumental vs developmental. Meeuwissen *et al.* (2019) pointed to different mentoring goals. They were able to differentiate three sets of goals: to enhance the students' personal and professional development, to verify the students' compliance with program requirements, and to offer guidance about becoming a doctor.

Theoretical framework: sensemaking

We draw on sensemaking theory to answer our second question, which asks about the factors that shaped mentors' varied enactment of different roles. Commonly applied to explain variability in education policy and program implementation (e.g. Coburn, 2001, 2005; Palmer and Snodgrass Rangel, 2011), sensemaking theory argues that individuals, or groups of individuals, come to understand a phenomenon, event, or change they have experienced or are experiencing through a dynamic, ongoing process. In that process, individuals consciously or unconsciously draw on specific external cues and beliefs to assign meaning to and create an explanatory narrative about what they have experienced (Weick, 1995). Individuals select cues from available information based partly on existing understandings and beliefs and the social communities or networks in which they are embedded (Coburn, 2001). The explanatory narratives that emerge may not be accurate as they represent an amalgam of one person's or group's previous experiences and beliefs.

Weick (1995) identified seven properties of sensemaking. These include identity, retrospect, enactment, social, ongoing, extracted cues, and plausibility. The sensemaker's *identity* is defined relative to their context and how they understand themselves. It acts as a cognitive filter for viewing the world around us (Coburn, 2001). *Retrospect* refers to reflecting on what has happened and attributing meaning to those events or experiences. *Enactment* is the action(s) we take due to how we interpret our environment and what has happened. *Social* refers to the construction of meaning through interactions, conversations, and shared norms. *Ongoing* means that sensemaking is a continuous process in which we constantly encounter new information. *Extracted cues* refer to the pieces of information that we focus on in the environment and that help narrow our attention. *Plausibility* characterizes the narratives or explanations we settle on, which tend toward explanations or narratives that we deem plausible – not necessarily accurate – according to our prior knowledge and beliefs. We use sensemaking theory's properties – the external cues that were salient to the mentors, how their sensemaking was ongoing as some of them changed program sites, and identity – to argue that the local context in which mentoring takes place, together with the mentors' beliefs about the context and their mentees, shape the roles the mentors enact. The following research questions guided our study:

RQ1. What roles did the mentors enact, and how did their role enactment differ across program sites?

RQ2. What factors help explain those differences?

Methods

Design

We used a comparative case study design for this study. Case studies allow for the in-depth examination of a phenomenon or process as they play out in “real life” (Merriam, 1988) and for developing and exploring hypotheses (Gerring, 2006). Case studies assume that what is studied can be bounded in its context (Miles and Huberman, 1994) and that the context in which the process or phenomenon plays out is essential to understanding its complex nature (Yin, 2017). *Comparative* case studies allow the researcher to identify differences and similarities across more than one case (Merriam, 1998). Though we are studying a single program, we have defined our cases as the three elementary schools where the program was being implemented.

Participants

We used purposive sampling to identify and recruit program mentors to participate in the study (Lincoln and Guba, 1985). The mentors, who all attended the same minority-serving university [4], had to be a current mentor in the program. We recruited participants only from among mentors who participated in the afterschool program, which limited the total potential sample size we could have. We recruited mentors to participate in the study by presenting the research to them during a beginning of the semester mentor training session and then emailing them consent forms after the training session.

Across three semesters, we recruited 20 (of 24) mentors for the study (see Table 2; all names are pseudonyms). Seven of the 20 mentors participated for more than one semester and, importantly, were able to reflect on and speak to program differences across the sites. The program experienced relatively high turnover as fewer than half of the mentors returned for a second semester. Four identified as women, six identified as Latinx, 11 as Black, one as White, one as South Asian American, and one as South Asian. One mentor participated as an alumnus of the university, while a second mentor was a graduate student. The remaining 18 mentors were undergraduate students, all but two of whom were engineering majors. Only two of the mentors were first-generation college students, and many had at least one parent

Mentor	Participation	Gender	Race/Ethnicity
Tanasia	Autumn 2018	F	Black
Anthony	Autumn 2018–Spring 2019	M	Black
Ricardo	Autumn 2018	M	Latino
Anne Marie	Autumn 2018–Autumn 2019	F	Black
George	Spring 2017, Autumn 2018	M	Black
Mateo	Autumn 2018–Autumn 2019	M	Latino
Armando	Autumn 2018–Autumn 2019	M	Latino
Sujeeta	Autumn 2018	F	South Asian
Andrew	Autumn 2018–Autumn 2019	M	Latino
Dave	Autumn 2018	M	Black
Shawn	Spring 2017, Autumn 2018	M	Black
Adric	Spring 2018	M	Black
Josiah	Spring 2018	M	Black
John	Spring 2018	M	White
Samuel	Spring 2018	M	Latino
Darrian	Spring 2018	M	Black
Marcel	Spring 2019	M	Black
Daniela	Autumn 2019	F	Latina
Isaac	Autumn 2019	M	Latino
Jady	Autumn 2019	M	Black

Table 2.
Description of
participating mentors

who worked in a STEM-related field. As a result, though many mentors shared a racial or ethnic identity with the students they mentored, mentors were much less likely to come from a similar economic background at schools A and B.

Data collection

Data came primarily from one-on-one interviews with the mentors across three semesters beginning in spring 2018 and ending in autumn 2019, prior to the COVID-19 pandemic. We collected data from schools A and C across all four semesters but at school B only in fall 2019 because that is when the school joined the program. We obtained permission to conduct all aspects of the study from the university Institutional Review Board and assent from all youth participants, permission from their parents, and consent from all mentors. After reviewing the literature on mentoring and STEM mentoring, the team developed the interview protocol. The protocol, which asks the mentors about themselves, prior mentoring experience, and their experience during and preparation for the program, was piloted among mentors serving at school C in the spring and fall of 2017. At the end of each semester, two team members interviewed mentors either in an office or a small conference room on the university campus. The two team members conducted interviews together for approximately two-thirds of the interviews, allowing for consistency across interviews and interviewers. Interviews lasted between 30 and 60 min, and all were audio-recorded.

We also observed each school site for two weeks (six sessions) each semester. The purpose of the observations was to capture what students were doing during the sessions, what the mentors were doing, and how students and mentors interacted. We rotated around each group of students every three to four minutes to observe and video record student–mentor and student–student interactions across all students and mentors each session. This strategy yielded a representative sample of interactions for analysis. We utilized the observations to support our interview data.

Data analysis

All interviews were transcribed professionally and coded twice by two team members – a faculty member and a graduate student. The first time we read through our data, we identified the mentors’ enacted roles by allowing them to emerge inductively through their descriptions (Onwuegbuzie and Combs, 2010). During our second read through, we used the properties of sensemaking to generate and apply a limited set of *a priori* codes (Yin, 2017). These codes served as general categories that we further disaggregated as we re-read the transcripts. Finally, we analyzed the interview data within each case and then across the school sites. We conducted all coding using ATLAS.ti software.

Trustworthiness. We sought to enhance trustworthiness through triangulation, conformability, and prolonged engagement in the field (Creswell and Miller, 2000). We triangulated across the mentor interviews and observations to look for examples of interactions and roles that the mentors described. We sought to establish conformability by meeting every two weeks throughout data collection to share and reflect on the observations and coding a random subset of transcripts together at different time points of the coding process to ensure that our understandings and applications of the codes were consistent over time. We also engaged with the afterschool program for a prolonged time (i.e. since the program’s inception in this city, 2017).

Researcher positionality

Though not a thorough reflection on our identities and positionalities, we want to share about ourselves and our relationship to the afterschool program. The first author is a White woman

and an education professor. As a White woman and an outsider to the practice of engineering, she has worked closely with her team to identify and mitigate her biases. The second author is a Black male, an engineering professor, and the program's co-founder. He helped start the program in 2013 because he benefited from Black engineering mentors. The third author is an Asian American female graduate student within a higher education program and a director of an educational nonprofit that exposes middle school students to technical careers. She was part of the two-member research team. The fourth author is a Black man, a program co-founder, and the program manager. As with the second author, he benefited from supportive mentors and sought to provide those experiences for young Black and Brown students interested in engineering. The fifth author is a South Asian American female and an instructional assistant professor of science education. She works in a teacher education program that prepares secondary mathematics and science teachers.

Findings

Role and differences in roles

In this first section, we address the first research question: What roles did the mentors enact, and how did their role enactment differ across program sites? We found that mentors' enacted roles varied by site. Here, we briefly describe the four roles we heard about and observed at the school sites: mentors as teachers, friends, role models, and support. Table 3 summarizes which roles were present and in which school. An "X" means that we heard about or observed a particular role.

Mentors as teachers. Completing work. Almost all mentors across all three school sites offered several examples of how they helped students learn the content and complete their work. Mateo, a long-serving mentor across all three school sites, explained that he found he had to help students with warm-up math problems. He recounted that "the first few weeks [of the program], it was more like us just being almost as a teacher . . . I feel like they felt like we were just helping them out with math problems and stuff like that like a teacher would". We observed that the form the assistance took differed depending on the activity. For example, we regularly observed mentors helping students at all three schools with the math problem of the day by sitting with students who were struggling and helping them break down the problem into smaller chunks or identifying important information. We also observed the mentors sitting with small groups of students at all three schools to assist them with designing and constructing their builds.

Challenging students. We observed this type of interaction only at school C; almost half of the mentors serving at School C spoke about how they sought to challenge students. Armando explained how the mentors tried to identify the students at school C who needed "to be pushed" in different areas. We also observed how the mentors at school C challenged the

Roles and interactions	School A	School B	School C
<i>Teachers</i>			
Challenging students			X
Helping students complete work	X	X	X
Disciplining students	X		X
<i>Friends</i>			
In-session fun	X	X	X
Outside of sessions	X	X	
Support	X		
Role model	X	X	X

Table 3.
Distribution of
mentoring roles

students beyond the material covered in class, though we did not see this role as frequently as helping students. For example, we saw it at Anthony's table one afternoon in the fall of 2018 as the students were building a circuit. Because the students could complete the circuit quickly, he asked them to manipulate it in different ways – for example, connecting the clips to different materials (e.g. a coin, a piece of chalk) to test the information he had just provided them about conductors of electricity.

Discipline. Mentors addressed discipline issues at schools A and C, though the problems differed somewhat across schools. At both schools, mentors described, and we observed, that students did not always follow directions, called out without raising their hands, or distracted each other with off-topic tasks or conversations. For example, Mariam, who mentored at school C in fall 2018, described how she struggled to manage disengaged students: "Sometimes they are sitting or doing something, maybe taking a Sellotape and pasting it on their arm removing—this type of stuff. I have been finding it a little bit hard to manage those students". A unique behavior concern that just over half the mentors at school C described was that the students frequently cried if they got an answer wrong or if the mentors did not call on them to answer a question. For example, in one session we observed how, after the mentors finished introducing and describing the scientist of the week one day in spring 2019, Mariam asked them to recall details from the presentation. Some students raised their hands while others called out the answers. One of the students who had raised his hand put his head in his hands and began to cry because one of the students who had called out had "taken" his answer.

In contrast, all the mentors at school A described more students' behavior as challenging. All the mentors who served at school A and another school described students' behavior as more challenging than what they experienced at the other campus they had mentored. For example, the mentors recalled that a handful of the students at school A talked back to the mentors and even bullied other students in the program. For example, George, who served at schools C and A, struggled to manage the students' behavior at school A. After his first semester at school A, he described how "some of [the students] would even talk back to me and the staff during that time disrespectfully" (F18). In contrast to our observations of challenging behavior at the other two schools, we did not observe the more egregious behavior that some of the mentors described at school A.

Mentors as friends. In-session fun. Across all three school sites, three-quarters of the mentors described having fun with students. Adric captured this role when he described a memorable moment during his first semester at school C, adding that the ability to joke helped cultivate strong relationships with the students. He said, "The memorable moment was when students are laughing at the mentors because [laughter] not only are they mentors but also their friends. So, we tell jokes, and basically, it's like almost I'm like their big brother". We also observed the fun mentors had. For example, Andrew enjoyed making drawings for the students at the two schools where he worked, and we were privy to seeing a handful of them as he handed them out to students, a surprise the students always enjoyed.

Friendship outside of the sessions. Two-thirds of the mentors described how they became friends with students as they chatted or played sports before or after sessions. Because these interactions occurred outside of the regular sessions, we could not observe them. Importantly, mentors only had this opportunity at schools A and B. At school A, mentors picked up the students during school dismissal, which was about 15 min before the sessions started, and sometimes played basketball with the students, drove or walked them home as parents often were not able to pick them up, or waited with them for parents to arrive (the program created a permission slip so parents could consent to this). We heard about basketball from half of the mentors and the students at school A, who loved having this informal time together. The mentors at school B described similar enactment of the friend role. For example, Isaac explained how the mentors often played soccer with the students after the session: "So, the

last 20 min, we took them outside just to run around, play soccer, and these kids really love soccer” (F19). In contrast, at school C, the sessions started immediately after the school day, and parents picked up all students at the end of the sessions, leaving no informal time to develop the friend role.

Mentors as support. A quarter of the mentors at school A described serving as a support for students by taking them home and letting students share with them [5]. During those rides or walks home, students often confided in the mentors, as Mateo described here:

At [school A], I feel like they see me as an older brother. I feel like they see me as someone they can talk to because we even sometimes have to bring them home to drop them off. They're seeing us every Tuesday and Thursday. We're the ones bringing them home. So, I think it develops a much more of a personal connection (S19).

As a result, some of the mentors felt closer to the students than those who either did not have the same informal interactions (school C) or where the program was newer and mentors had not had enough time to get to know the students (school B). Armando explained, “You're able to understand them outside of a school setting and how they really think through things if that makes sense” (S19, school A). We were not privy to most of the opportunities during which the mentors enacted a supportive role, though we did observe mentors step outside of the classroom with students to talk after disagreements or tears.

Mentors as role models. Last, three-quarters of the mentors spoke about wanting to set an example for the younger students or to help them see that becoming an engineer was possible. Because acting as a role model is not a single action but a collection of behaviors, interactions, and dispositions, it is difficult to pinpoint specific moments when we observed the mentors being role models. We argue that the mentors enacted the role of role model when they engaged in the activities – demonstrating science and engineering as (mostly) People of Color, showing the students that working in STEM is possible for people with similar racial and ethnic identities (Rangel *et al.*, 2021). Half of the mentors went further than a general statement about role modeling to describe the importance of being role models for Boys of Color, who otherwise might not see many people who look like them in STEM or engineering. For example, Dave (F18) described his role as “showing [the students] that there's other things that you can do, there's other career paths that you can pursue, I think it's really important overall especially for minority males”.

Explaining differences in role enactment

To answer research question two, “What factors explain differences in roles?”, we used sensemaking theory's properties – the external cues that were salient to the mentors, how their sensemaking was ongoing as some of them changed program sites, and identity – to argue that the local context in which mentoring takes place, together with the mentors' beliefs about the context and their mentees, shaped the roles the mentors enacted.

Extracted cues. Across the three schools, mentors described things they noticed – cues – about the students, the schools, and the schools' communities. What stood out to the mentors about students was their knowledge about and interest in STEM and the challenges that some students faced at school and home (or that the mentors assumed they faced challenges). Their observations were not distributed evenly across the three schools. Instead, mentors who were surprised by the students' existing STEM knowledge primarily were those working at school C. Those somewhat shocked by the students' school and the often deficit-oriented assumptions they made about their home lives were at school A.

Students' STEM knowledge and excitement. Almost all mentors observed that some already knew a great deal about STEM and that many of the students were incredibly excited to engage in the projects. In the spring of 2018, Mateo told us, “What surprised me is how

much the kids really care about STEM". He went on to serve at all three schools and shared similar sentiments about all of them. For example, he expressed surprise that the students at school B were consistently excited about the sessions: "I mean, like I said, it was every day!"

Mentors at school A also expressed surprise at the unexpected student excitement and knowledge at school A. For example, Jadyne recounted how he discovered that the students were good at math: "They are good at math because they do the worksheets, and the math we're giving them is like a grade ahead of what they're actually supposed to be doing and they can do that" (F19). He elaborated, "Kids are—they're hyper but they're also really passionate because once you get them interested in something, they will latch on to that thing and think about it in really creative ways".

Students' school and home contexts. Mentors also extracted cues based on what they learned and their assumptions about the students' schools and home lives. The mentors' perception that the students at school A faced additional challenges at school and home led them to enact a supportive role. At school A, mentors noticed that the school had fewer resources than they expected or thought a school should have and noticed that students faced many challenges outside of school. Two-thirds of the mentors at school A observed the school's lack of resources and the perceived lack of support from the school's administration. For example, Darrian compared the school to where he had gone to elementary school, confessing that he had not been aware that schools in the United States lacked resources the way he thought school A did. He recounted,

In the beginning, it was a lot—a little bit of a shock, in all honesty, because I went to a different elementary school completely versus this one who really doesn't—they really—I think they lack a lot of supplies and basics that I grew up thinking that everyone had in America. (S19)

Mentors at school A also were discouraged by what they perceived as a lack of parental involvement, particularly because parents were invited and encouraged to attend the Saturday sessions but often could or did not. Mateo expressed this with empathy, telling us, "The parents, I feel like it's just hard for them. Maybe they're taking in extra hours at night and they can't because a lot of them can't even pick them up, they're probably at work still" (S19). Marcel, however, was less forgiving and expressed disappointment about parents not attending the Saturday sessions. He said, "It's unfortunate to see sometimes the parents do not even show up, the parents do not even know really what STEM is or what we're doing in that—in our program" (S19).

Ongoing: noticing site differences. In this section, we use sensemaking's notion that the process of making sense of new information is ongoing to focus on mentors who served during multiple semesters and at more than one school. Though many responses are similar to those in the previous section, we argue that these mentors engaged in an ongoing sensemaking process that permitted them to compare and contrast the schools and students, often leading them to enact old roles in new ways or new roles altogether.

The mentors highlighted organizational differences at the schools (e.g. differences in administrative support) and differences in the students themselves. For example, Shawn, who served at both schools A and C, explained how the change caused him to focus more on his role as a disciplinarian at school A:

At [school C], it was a little bit more organized, there were more mentors, the kids were a little bit more well-behaved. It was a different environment, a completely different environment . . . [school A] has something different for me. These kids, they took a little bit more disciplining. (F18)

Armando, who served at schools A and C, also contrasted the students at both schools, helping us understand why he challenged the students more at school C and was more of a disciplinarian at school A. He described the students at school C as "ready to be studious. They come to school every day ready to learn". His perception of the students at school A was

less optimistic: “These kids come to school and it’s like a playground, like, ‘I’m going to do what I want to do’” (F18).

Using identity to shape plausible narratives. We contend that the mentors’ identities led them to enact teacher and role model roles. Strong STEM identities meant they were primed to see themselves as teachers ready to share their knowledge of and passion for STEM. Their STEM identities also prompted many mentors to enact role model roles. The mentors’ mentoring identities also shaped the roles they enacted. They formed these identities in part due to previous experiences and, in part, their experiences in the afterschool STEM program. Their mentoring identities primed them to be role models. For example, Adric explained that his mentoring identity was rooted in the lack of guidance he experienced when he was younger. He told us that “as I was growing up, I really did not have a person to teach me stuff . . . I felt I wanted someone to connect with who was older than me”.

The mentors’ racial and ethnic identities led half of the mentors to see themselves in the elementary students and enact role model roles. Isaac told us, “I can kind of see myself in the children that I worked with. I know they’re all boys but at the end of the day, they all have those shared similarities, backgrounds, and where they came from” (S19). Marcel recognized that his race was instrumental to his identity as a mentor in the program. He explained, “I think the kids like me a lot because I am a Black man. . . . I think they respond very well to see other Black men in learning and trying to teach them right from wrong or new things like STEM” (S19).

Discussion

Mentor roles

Our findings contribute to the extant literature on mentoring roles in four ways. First, our findings are consistent with the notion that mentors play more than one role in their relationships with their mentees (Goldner and Mayesless, 2008; Keller and Pryce, 2010, 2012; Lakind *et al.*, 2015; Rhodes *et al.*, 2006; Tolan *et al.*, 2020). Second, the four roles we identified were similar to those other researchers have identified. However, the roles we identified deviate somewhat from prior research. We observed the mentors acting as advocates as Lakind *et al.* (2015) and Tolan *et al.* (2020) describe. This likely is because the mentors’ interactions with the students were limited to the STEM afterschool program and did not bridge other organizations or agencies to whom the mentors might have advocated for a student. We also did not hear that the mentors enacted the role of sage (Keller and Pryce, 2010, 2012), which may have been the case because the students were still so young and not yet in a position to make their own life decisions. Finally, we did not observe mentors acting as parents to the students (Goldner and Mayseless, 2008), which may have been because of the focus on STEM learning during most of their interactions with the students. We did, however, hear at least two of the mentors refer to themselves as “big brothers” to the mentees, which suggests a similar, caring role.

A third contribution we make is by unpacking the roles. The existing literature treats each role as one set of interactions or goals. In contrast, we observed that each role comprised more than one type of interaction or focus. For example, teaching comprised sharing knowledge, improving cognitive skills, and managing the classroom and discipline issues. Future research should examine the possibility that the more fully defined typology that we identified may be, at least in part, the result of the unique nature of the mentoring context.

Fourth and finally, we found that the mentors’ enactment of these roles differed somewhat across the three school sites. The roles that varied in enactment were as teachers who challenged their students (primarily at school C) and disciplined their students (primarily at schools A and C), as friends outside of sessions (schools A and B), as support (school A) and addressing challenges (A and C). It is not surprising that the enactment of mentoring roles

varied across sites, and other researchers have noted that role enactment can help explain variability in mentoring outcomes (e.g. [Tolan et al., 2020](#)). However, prior research has not considered differences in role enactment systematically as we have. Given the differences we found, we recommend that researchers consider the question of variability in role enactment more rigorously and as a regular part of mentoring program evaluations.

Explaining variability in mentor role enactment

Other researchers have noted the importance of the context in which the mentoring unfolds (e.g. [Karcher and Nakkula, 2010](#); [Kumar and Budhwar, 2020](#); [Lakind et al., 2015](#)), but few have elaborated on what constitutes context and how context matters. We define context in part based on the cues in the external environment that stood out to the mentors ([Weick, 1995](#)). The two cues that emerged as salient to mentors were the students' knowledge and school and home contexts. Similar to [Herrera et al. \(2013\)](#), the mentors' perceptions mattered, though they led them to enact different roles than what [Herrera et al.](#) described. Mentors' perceptions that the students at school A were at greater risk than those at the other two schools led them to enact supportive roles. On the other hand, their perception that the school A students misbehaved and lacked structure at home led them to enact the disciplinarian role. Focusing on salient cues can help researchers better understand and leverage context as an explanatory variable addresses the challenge of deciding what part of the context matters. Future researchers should continue to explore the role of external cues in understanding the roles that mentors enact and mentoring outcomes.

We also incorporated the notion of "ongoing", which states that sensemaking is a process that unfolds, and therefore changes, over time ([Weick, 1995](#)). Previous researchers have noted that mentoring is inherently flexible and shifts for multiple reasons (e.g. [Hamilton and Hamilton, 1992](#)), including the passage of time ([Lucas, 2001](#)). However, prior researchers do not help us understand how context might intervene to explain why mentors enact different roles across sites and time. We used the property of ongoing to highlight the experiences of those mentors who continued with the program for more than one semester and mentored at more than one school site. The notion of ongoing is a valuable tool because, as with cues, it connects the mentors to their changing context(s). As we argue, and consistent with prior research findings that mentoring is flexible ([Goldner and Mayseless, 2008](#); [Herrera et al., 2013](#); [Lakind et al., 2015](#); [Lucas, 2001](#); [Spencer, 2007](#); [Tolan et al., 2020](#)), the mentors' enacted roles changed over time because they encountered new information about mentoring and the mentees as they changed sites. Researchers should continue to examine how mentors understand their roles and which roles they enact across time and contexts as a function of new information about the context of the mentee. By understanding how the information is changing and what that means for mentors and their roles, we can better prepare and support mentors for the work before and ahead of them.

Finally, we found that the mentors' identities influenced how they interpreted new information from the context. In other words, they created narratives that were compatible with what they believed about themselves. Though there is much research on mentor identity, more research is needed on how mentors' identities shape the roles they enact. Our work demonstrates that mentors' identities can shape how they understand their roles by helping to craft plausible narratives about themselves as mentors. For example, the mentors' strong STEM identities help us understand why the teaching role was so commonly enacted, and their racial and ethnic identities help explain why they enacted the role model role. Future research also should continue to explore how mentors understand themselves, how their identities shape role enactment, and how their identities affect the relationships they develop with their mentees.

Limitations

Our study is limited in five ways. First, the STEM-focused nature of the program may make it difficult to generalize to more general mentoring programs. Second, until the fall of 2020, the program served only Boys of Color, which means that our findings may not generalize to co-educational programs or those that only serve girls. A third limitation is that we could only collect data at school B for one semester because of COVID-19. Fourth, the high turnover of mentors challenged our ability to document the ongoing nature of sensemaking. Finally, we focus on the mentors' perceptions and not the mentees'. Including their voices would have shed additional light on the mentors' roles.

Implications for practice

Our findings have three implications for practitioners who manage afterschool mentoring programs focused on STEM. First, we recommend that program managers encourage mentors to brainstorm and discuss the types of roles they plan to enact as they get to know their mentees. This brainstorming aims to help mentors understand that they will play multiple roles and that these roles serve different purposes. Second, research points to the importance of identity in the motivation to mentor and the formation of meaningful mentor relationships (e.g. [Humberd and Rouse, 2016](#)). Therefore, we recommend that program managers engage mentors in identity work. Mentors should be cognizant of how they understand themselves, how their identities shape their actions and beliefs, and how those identities and resulting actions and beliefs may affect how they perceive their mentees (e.g. [Han and Onchwari, 2018](#)). One approach to engaging in identity work is the social change model, which can incorporate the exploration of identity ([Pendakur and Furr, 2016](#)). Third, we recommend that program designers and directors create a protected but unstructured time for the mentors and mentees to socialize and connect, separate from the formal time working on STEM learning.

Conclusion

The purpose of this study was to document the roles that mentors enacted in an STEM afterschool program and to explain variability in their role enactment. The mentors enacted four roles, though not consistently across the school sites. We argue how the mentors made sense of external cues, changes they observed across school sites, and their own identities. Our findings add to research on mentoring and yield important lessons for mentoring programs.

Notes

1. Most educational regulatory authority lies with state governments in the United States. The federal government requires that states create learning standards and hold districts and schools accountable for students' learning of those standards through annual standardized testing. The state where our study took place has an accountability system where schools are rated A to F depending on annual standardized testing results and growth in student learning.
2. Under U.S. federal education law (the Elementary and Secondary Education Act), the federal government provides additional funding to schools that meet the government's definition of having a large population of low-income students, as measured by the percent of families eligible for the federal government's free reduced school lunch program.
3. Charter schools are publicly funded K-12 schools subject to fewer federal and state regulations in the U.S. context. However, they are still held accountable for their students' learning through state and federal high-stakes testing and accountability regulations.

4. In the United States, the federal government designates institutions of higher education as minority serving if they serve “significant percentages of undergraduate minority students” (<https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html>).
5. After discovering that the mentors were walking or driving students home occasionally, the program added a permission and release form to ensure they were doing so only with their parents’ knowledge and approval.

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