DEMYSTIFYING THE MAGIC: INVESTIGATING THE SUCCESS OF UNIVERSITY-COMMUNITY PARTNERSHIPS FOR BROADENING PARTICIPATION IN STEM

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This study investigates a university-community partnership focused on broadening participation for girls in science, technology, engineering, and mathematics (STEM). Stakeholders across partner organizations (an informal learning community organization and a public research university) call the success and longevity of the collaboration "magic" because of the commitment required to maintain it despite partnership complexities and few formal incentives. Using qualitative inquiry and sensemaking/sensegiving frameworks, this article elucidates the "magic" behind the partnership. Findings emphasize individual motivations and behaviors, program collaboration obstacles, and collective partnership identity impacting the program's sustainability (i.e., magic). This study can inform research and practice related to improving access into STEM pathways for underrepresented populations through education partnerships that often experience resource constraints alongside the organizational complexities of cross-sector engagement.

KEY WORDS: *qualitative, sensemaking, STEM education, university-community partnerships*

1. INTRODUCTION

Efforts to broaden participation in science, technology, engineering, and mathematics (STEM) education contribute to both the pursuit of educational equity and the cultivation of a highly trained, diverse workforce (Harkavy et al., 2015; James and Singer, 2016). Historically, these efforts have focused on the improved recruitment and retention of students with minoritized identities (particularly women, Black, Indigenous, Latinx, and Pacific Islander students) within STEM pathways (Holloman et al., 2018). How-

ever, empirical findings related to broadening participation interventions and initiatives in K-12 and higher education have generally been mixed—with overall improvements in the STEM success of underrepresented students, but less research-driven understanding of when and why programs are successful or not, as well as key factors necessary for scaling, replication, and sustainability (Leggon, 2018; Malcolm and Feder, 2016). An empirical understanding is critical given the urgency of closing gaps in STEM access and achievement for underrepresented students (Holloman et al., 2018; National Science Board, 2020). This urgency demands an approach that brings together multiple institutions engaging in cross-sector collaborative interventions, involving multiple stakeholders to have increased impact (Kezar, 2011; Malcolm and Feder, 2016).

Most existing education research on broadening participation in STEM has focused on individual student experiences in STEM or on specific learning contexts such as classrooms, schools, colleges, or universities (Broadening Participation in STEM, 2010; Leggon, 2018). Far less research has taken an organizational behavior approach to examine structures and communication practices within and between organizations that work together to reduce barriers and enhance STEM educational opportunities. Organizational analyses can point to institutional values, goal alignment, roles, relationships, communication, and funding necessary for programs to be successful and endure (Bolman and Deal, 1997; Kezar and Holcombe, 2016). That information is missing from student-level and program-level research on STEM education programs. Research on the collaborative infrastructure bringing people and organizations together can provide a way to identify effective communication practices and organizational structures for partners working to improve student recruitment, retention, and success in STEM. Organizationally focused research contributes to determining why some broadening participation in STEM partnership efforts succeed while others fail, as well as to ascertain the specific mechanisms without which partnership efforts are less likely to succeed or endure.

To contribute to this evidentiary base, we present a qualitative analysis of data from a larger mixed-methods study focused on a multi-organization STEM education collaboration in New England. Our study specifically emphasizes the university-community partner relationship within the collaboration. These partners collectively work on the STEMSUCCESS program (pseudonym), which has successfully enhanced girls' engagement and success in science as they transition from middle school to high school and beyond in racially diverse and economically underserved communities. Most notably, the collaboration has successfully achieved positive outcomes over time, in spite of many organizational constraints and complexities.

Stakeholders within these two organizations call the success of sustaining the support, engagement, and resources for the program "STEMSUCCESS Magic" because individuals and organizational units commit to the costs of maintaining the collaboration (e.g., staff and volunteer time, donated resources, materials) without many formal incentives and despite cross-sector partnership complexities. To investigate STEMSUCCESS Magic, we considered how individuals engage in sensemaking (Bess and Dee, 2012; Weick, 1995) to understand what stakeholders described as the magic behind

the STEMSUCCESS program partnership. Sensemaking examines how individuals develop meaning and shared understanding when there is a gap between expectations and reality (Maitlis and Christianson, 2014)—here, sensemaking helps explain why the STEMSUCCESS partnership is viewed as successful. Specifically, we examined how individual backgrounds, motivations, and goals influenced how participants engaged in personal sensemaking as well as sensemaking about the program. Our analysis emphasized unpacking the idea of STEMSUCCESS Magic by focusing on how participants understood the success of the program and how it was developed. The research questions guiding our analysis are the following:

- How did participants describe the partnership's STEMSUCCESS Magic?
- What explanations did participants give for the existence of STEMSUCCESS Magic?
- What factors influenced sensemaking of the partnership's STEMSUCCESS Magic?

2. LITERATURE REVIEW

To situate our study, we review education research related to broadening participation in STEM and university-community partnerships. Extant research on STEM access and success for minoritized students often emphasizes student-level and programmatic-level outcomes, rather than an organizational focus. The limited higher education research that examines how STEM education programs function often focuses on individual universities or multi-university initiatives, rather than partnerships between universities and community organizations. Research on university-community partnerships offers some considerations for understanding these collaborations, but less is known about how these partnerships function in the context of STEM education. Our study reinforces a connection between research on broadening participation in STEM and research on university-community partnerships.

2.1 Broadening Participation in STEM

In an examination of the state of broadening participation in STEM, Leggon (2018) noted that original initiatives focused primarily on increasing numbers of Black, Indigenous, and Latinx students, later expanding to women and students with disabilities. Currently, broadening participation initiatives focus on increasing numbers of underrepresented groups and enhancing their experiences in STEM learning. Leggon noted that while many early efforts were framed through a deficit model that placed the onus of persistence on individuals, a shift in programs and research now focuses on environmental and structural limitations that maintain historic barriers and exclusionary practices. Yet, despite this work, women, Black, Latinx, and Indigenous students continue to be more likely to leave STEM than their male, white, and Asian American counterparts (Park et al., 2020). In 2008, the National Science Foundation (NSF) published *Broadening Participation at the National Science Foundation: A Framework for Action*, outlining

both internal and external strategies for broadening participation in STEM (NSF, 2008). In many ways this report, and the work of NSF, set the national direction for broadening participation efforts at all levels of STEM education (K-12, higher education, workforce development). However, persistent gaps in participation remain, suggesting that more research is needed to understand how to scale and sustain successful programs.

Much of the research on broadening participation in STEM focuses on reviews of specific programs (e.g., Doerschuk et al., 2016; Ikuma et al., 2019) or the overall efficacy of programmatic support (e.g., Tomasko et al., 2016). For example, living learning communities, where students live together while sharing curricular and cocurricular experiences, can promote STEM retention through academic conversations, faculty interactions, and socially supportive residential environments (Soldner et al., 2012). Other research has focused on the characteristics of these programs. Lane (2017) found that a STEM enrichment program promoted retention with underrepresented students by providing guidance, authentic relationships, and a focus on STEM identity development. Within these programs, it is also beneficial to incorporate specific elements into STEM education to broaden participation, such as kindness and affirmation of social inclusion (Estrada et al., 2018) and metacognitive reflection (Franklin et al., 2018). Literature beyond programmatic pieces affirms the importance of key actors, such as faculty (Bensimon et al., 2019; Park et al., 2020) and peers (Salomone and Kling, 2017) that directly interact with and shape student experiences.

However, individual institutional programs can experience many challenges, such as limited, short-term budgets, a focus only on students instead of campus climate, and a lack of incentives for faculty to participate or support the programs (Baber, 2015). In order to make efforts towards broadening participation sustainable, there is a need to extend beyond supporting individual students and education institutions. One idea has been the need to create communities of practice (COP) across institutions to engage with broadening participation in STEM by developing effective policies and implementation (Kezar et al., 2017; Kezar and Gehrke, 2017; McNeely et al., 2018). Originally coined by Lave and Wenger (1991), COP first were examined in the context of apprenticeship where the COP was the community of trades people that served as a living curriculum for the apprentice. More recently, the concept of COP has been used to examine the institutional, regional, and national communities that center innovation in STEM education (Kezar and Gehrke, 2017). For example, Kezar and colleagues (2017) found that for COP to achieve maximum success, they needed to have a clear philosophy and nurture personal interactions. COP that were successful in sustainably scaling up reforms in higher education used features including leadership development, a viable financial model, professionalized staff, feedback mechanisms, research and assessment, and a clear community strategy (Kezar and Gehrke, 2017). Similarly, research on multi-institutional networks found that participation requires involved stakeholders to identify knowledge and resources, bring inter-organizational knowledge to campus, modify information to local context, and gain institutional support (Hill, 2020). Moreover, while these networks and communities can be powerful tools, they require support and intentionality to create sustained change (Kezar et al., 2015). Our study contributes to un-

derstanding how STEM education networks, particularly among diverse organizational types such as university-community partnerships, function to support STEM access, and retention.

2.2 University-Community Partnerships

The widespread adoption of university-community partnerships by higher education began in the 1980s and was further spurred by the "engaged scholarship" movement into the 1990s, which called for higher education to become more responsive to society's needs, return to its public service agenda, and be redesigned to engage in community work in shared and reciprocal ways (Boyer, 1996; Kellogg Commission, 1999). There are numerous "types" of university-community partnerships, but some of the most popular models include service-learning, community-based participatory research, community-based training program, and partnerships centered on developing goals or solutions (Fitzgerald et al., 2010; Russell and Flynn, 2000). Research on these partnerships demonstrate that "community" can also be defined in different ways and at different levels including, "individuals (neighbors), institutions (school or community agencies), or social groups (geographical, functional or virtual communities)" (Strier, 2014, p. 156). Therefore, in university-community partnerships, faculty and students work in collaboration with community members, staff, and leaders in a variety of community settings and programs from grassroots groups and community-based organizations, to human service agencies and schools.

While diverse in terms of scope, length of partnership, resources, and stakeholders, overall university-community partnerships are characterized by an interest among both parties in improving community conditions (Baum, 2000). These partnerships can involve short-term or one-time projects in which the partnership dissolves at the completion of the project or be reflective of longstanding relationships that drive the partnership rather than singular projects. Scholars emphasize that the primary characteristics of successful university-community partnerships include mutuality, supportive leadership, trust, respect for community knowledge, ongoing flexibility and communication, community asset- and -capacity building, joint resource allocation, university immersion in the community, and community-defined needs, goals, and project ownership (Silka, 1999; Strier, 2014; Suarez-Balcazar et al., 2004; Taylor et al., 2004). These characteristics reflect the participatory nature of university-community partnerships that often diverge from traditional research in which the academic researcher is the primary expert.

Researchers have addressed the benefits of university-community partnerships, the process of developing a culture of community engagement among universities, and how to maximize learning and development within university-community partnerships (Buys and Bursnall, 2007; Strier, 2014). Scholarship also highlights the role of institutional difference and power dynamics as a barrier to these partnerships. Specifically, scholars emphasize the importance of bringing together two contexts that by tradition are different in terms of having distinct cultures and missions, organizational structures, and communication practices (Baum, 2000; Suarez-Balcazar et al., 2004). In addition,

although university-community partnerships are meant to move away from universities taking an "expert" response to community problems in a top-down, one-way fashion, inequal access to resources, privileging certain skills and knowledge, and lack of mutual benefit can lead to unbalanced power dynamics in these partnerships (Guillen and Zeichner, 2018; Strier, 2011). Yet, there is still limited empirical work addressing how these institutional differences and dynamics can be transcended, and how organizational and interpersonal factors are involved in that process.

While STEM university-community partnerships are not new, research on these partnerships predominantly focuses on student and community outcomes as well as curricular/cocurricular design. Exceptions include studies by Delaine and colleagues (2015, 2019, 2021), which highlight the importance of understanding each system within STEM education partnerships (community, program, and individual), the power dynamics within those partnerships to further support reciprocity and success, and the importance of stakeholders who work across university and community partners to build partnership capacity. Thompson and Jesiek (2017) and Sadler et al. (2018) emphasize the structural factors impacting STEM outreach programs between universities and community partners including how initiatives are organized and implemented and the impact on stakeholder engagement. These studies, like the work of Delaine et al. (2021) demonstrates that partner power differentials and differing needs, priorities, and resources can create challenges to partnerships. Our study builds upon existing scholarship by examining how multiple stakeholders, whose formal affiliations reside with either the university or the community organization, are able to develop "magic" as a shared, engaged, and sustained commitment to a STEM education program despite their different institutional cultures, incentive systems, and organizational structures.

3. THEORETICAL FRAMEWORK

To investigate this partnership's "STEMSUCCESS Magic," we considered how individuals within the partnership engaged in sensemaking—a social process by which people use and respond to information within a given circumstance in order to develop meaning and shared understanding, recognize their role or position, and strive for plausibility, all of which informs their future behavior (Bess and Dee, 2012; Weick, 1995). While multiple definitions exist, and different social scientific disciplines are devoted to a variety of ways of collectively constructed social meaning, research largely agrees that sensemaking is a social process triggered when there are gaps between expectations and reality and focused on actions that individuals take (Maitlis and Christianson, 2014). In this study, the discrepancy between the projections of the STEMSUCCESS program (e.g., anticipated low engagement from faculty because of its lack of extrinsic rewards) contrasted with the lived reality of its high degrees of success and commitment, creating a unique opportunity to examine sensemaking.

Weick (1995) developed one of the original sensemaking frameworks to explain how individuals and organizations give meaning to events. There are seven characteristics of sensemaking: it is a process centered on identity construction, focused on and

by specific cues and stimuli, driven by possibilities rather than precision, retrospective, contextualized within distinctive environments, social, and ongoing. These characteristics position individual understanding within an organizational context. Definitions vary in whether sensemaking occurs within or between individuals or serves as a cognitive or social process (Maitlis and Christianson, 2014).

Identity and power are key elements of sensemaking. Helms Mills and colleagues (2010) reaffirmed Weick's (1995) focus on identity construction, noting that it influences both individuals and the six other characteristics. Their model moved towards a more critical version of sensemaking, focusing on organizational power and the distribution of privilege across individuals. The dynamic of power also ties into distinctions made between sensemaking and sensegiving, the latter of which focuses on shaping the meaning construction of others to fit an organizational goal (Gioia and Chittapeddi, 1991; Kezar, 2013). Sensegiving and sensemaking influence one another and are particularly important to understand in contexts where there are not top-down directives for change (Kezar, 2013). Here, we use sensegiving and sensemaking to understand how the various individuals involved in STEMSUCCESS develop shared understanding of the program and its effectiveness.

4. METHODS

We utilize qualitative analysis of interview data from a larger mixed-methods study focused on a multi-organization STEM education collaboration in New England. The purpose of the larger study was to examine the coordination of the STEMSUCCESS partnership and program over two years via in-depth stakeholder interviews, document analysis, and a social network survey to enumerate patterns of key stakeholder relationships.

4.1 Research Sites and Sample

STEMSUCCESS is a national program that was developed by a U.S. nonprofit organization serving girls 6–18 years of age. It is hosted nationwide by over 70 local affiliates of the nonprofit organization and their university partner sites. However, each partnership between a local affiliate and university has its own organizational and cultural nuances driven by its local context, stakeholders, and participants. The STEMSUCCESS program that we focus on in this analysis targets the primary program partners: (1) the community organization engaged in informal learning for girls that is the local affiliate of a national nonprofit (AdvocacyOrg. – pseudonym) and (2) a large public research university (Flagship U. – pseudonym). We consider this program to be a university-community partnership due to its longstanding and focused collaboration between AdvocacyOrg. and Flagship U. The partnership centers on a typical goal of university-community partnership, which is to develop goals and solutions for improving community conditions (Baum, 2000; Fitzgerald et al., 2010; Russell and Flynn, 2000). Specifically, the partnership has successfully responded to the persistent gender and racial disparity in STEM

by targeting this problem early in development through the engagement of adolescent girls in a five-year science program from the 8th grade through high school graduation. Participating girls are mostly low-income Black and Latinx students from three adjacent school districts in New England.

STEMSUCCESS logistics and coordination associated with recruiting and retaining girls are facilitated by AdvocacyOrg., while Flagship U. faculty, staff, and graduate students create and implement the bulk of girls' workshops, classes, and other programing. For example, for the first two consecutive summers after their 8th and 9th grades, girls are immersed in month-long summer science workshops taught by Flagship U. faculty and graduate students on the Flagship U. campus. AdvocacyOrg. staff offer additional programming from a curriculum pertaining to the "whole" girl, focused on health and wellness, academic success, and networks of support, developed by the national non-profit organization. During their third summer, after the 10th grade, girls participate in a science, engineering, or technology internship at a local business or Flagship U. research lab. In their final summer after the 11th grade and before high school graduation, girls take a college course. Throughout the academic year in the 8th through 12th grades, the same girls attend Saturday workshops in science and technology. These sessions are often facilitated by university faculty, staff, students, and local business partners.

We purposefully sampled 61 organizational actors across the two organizations including community organization staff from AdvocacyOrg; university staff, faculty, and graduate instructors from Flagship U.; and girls participating in the STEMSUCCESS program. Within our sample, we categorized participants by how central or peripheral they were to the operation of the STEMSUCCESS partnership. In this paper, we focus specifically on interview data from 15 participants who are or were critical to the functioning of the STEMSUCCESS program and have a strong sense of, or involvement in, how the program works as a whole. This included AdvocacyOrg. staff, Flagship U. outreach staff, and Flagship U. and AdvocacyOrg. founders of the STEMSUCCESS partnership. Participants included stakeholders who contributed to the functioning of STEMSUCCESS at one point in time but were no longer involved in the partnership at the time of interviewing as well as participants who were actively involved in STEMSUCCESS at the time of interviewing (for pseudonyms and roles, see Table 1).

4.2 Data Collection

We conducted two individual interviews with each participant lasting, on average, 40 minutes per interview. The first interview addressed participants' role within the STEMSUCCESS program collaboration, their relationships with other program partners, and what makes the overall program successful as a collaboration. Examples of interview questions included, "Tell us about your current role in STEMSUCCESS," "With whom do you work frequently as part of the STEMSUCCESS program?," and "What resources, processes, or people work to create a successful partnership within STEMSUCCESS?"

TABLE 1: Research participants

Pseudonym	Organization	Role
Agnes	Flagship U.	Associate Dean of Faculty Development
Alexandra	Flagship U.	Faculty Liaison (Former)
Beth	AdvocacyOrg.	STEMSUCCESS Director
Diana	Flagship U.	Directory of Faculty Development
Hillary	AdvocacyOrg.	STEMSUCCESS Assistant Coordinator
Janet	AdvocacyOrg.	Executive Director
Jennifer	Flagship U.	Faculty Liaison and Extension Professor
Kimberly	Flagship U.	Campus Logistics
Kristin	AdvocacyOrg.	Director of Administration and Evaluation
Lindsay	AdvocacyOrg.	STEMSUCCESS Director (Former)
Margaret	AdvocacyOrg.	Associate Executive Director
Nina	AdvocacyOrg.	Associate Academic Dean of College of STEM
Sofia	AdvocacyOrg.	STEMSUCCESS Coordinator
Sonia	Flagship U.	Faculty Evaluator
Valeria	AdvocacyOrg.	Director of School Programs

The second interview was conducted approximately 8 to 12 months after the first interview and focused on participants' perspectives of our initial findings and key ideas that emerged from the first round of data collection. This included the concept of "STEMSUCCESS Magic." For example, we asked, "As we reviewed the transcripts from our first round of interviews, we realized that the phrase "STEMSUCESS Magic" was used a lot by participants, but not always clearly defined. Is that a term you've encountered during your time involved in the partnership?" "If so, in what contexts?" "Whether you've heard the term before or not, what do you think it means?" Both interviews utilized a semi-structured protocol, but interviewers were given considerable latitude to ask follow-up questions—both scripted and unscripted—as participant responses warranted. All interviews were audio-recorded and transcribed.

4.3 Data Analysis

Each interview transcript was coded using NVivo qualitative data analysis software. The analytic strategy employed combined the constant comparative method (Charmaz, 2014) and use of *a priori* concepts from the overarching study, which served as deductive codes. We chose 24 *a priori* codes reflecting key concepts from the interview protocol and theoretical framework. Examples of *a priori* codes include "Supports to Program," "Benefits to Individual," "Mutually Reinforcing Activities," and "Change Over Time." In addition to *a priori* codes, we employed the constant comparative method outlined by Charmaz (2014). In this approach, we first engaged

in initial coding by noting quotes that demonstrated individual and organizational attempts to provide meaning or engage in meaning making about STEMSUCCESS Magic. The two lead authors then read through these codes and wrote memos that reflected initial impressions and salient points within the data. These memos were discussed collectively and led to the identification of focused codes such as "maintenance of interpersonal relationships," "doing the right things," and "the role of key ambassadors." Focused codes were then examined in comparison with deductive codes until themes relating to individual partner motivations and behaviors, program collaboration obstacles, and collective partnership identity emerged as consistent patterns. Finally, we examined these codes through the lenses of sensemaking and sensegiving to understand the processes that guided collective understanding and action, here the concept of STEMSUCCESS Magic. These themes were then written using the data as evidence of interpretations and analysis (Guest and MacQueen, 2008).

4.4 Protection of Vulnerable Populations

Virtually all data collected for this study are subject to human subjects protection, particularly due to the sensitivity of many participants' discussing their workplace as part of data collection. Our team followed all Institutional Review Board (IRB) expectations and received approval by IRB to conduct this study. All participants were provided full information about the study, including any potential benefits and risks, through the informed consent process. During the consent process and interview we reminded participants that they may: (1) cease participation at any time; (2) withdraw consent at any time; (3) choose not to answer any question; or (4) answer a question "off the record" or designate an answer as "off the record" once it is given. We have used pseudonyms for all participants and their institutional affiliations as another way to maintain their confidentiality. In addition, given that many of the participants were discussing the organization in which they were employed, we ensured that participants were not asked to participate in the study by people with whom they had an existing supervisory relationship.

4.5 Author Positionalities and Study Trustworthiness

Several steps were taken by the research team to enhance the trustworthiness of our findings (Lincoln and Guba, 1985). We integrated analyst triangulation through the participation of multiple researchers (Denzin, 1978; Krefting, 1999). This allowed us to illuminate findings and engage with the data in a more comprehensive way than if the study had been conducted by an individual researcher.

Members of our research team included a woman of Color faculty member in a STEM discipline, a white woman STEM education practitioner, two white men faculty members in education, one woman of Color faculty member in education, one white woman faculty member in education, one white man faculty member in sociology, and

one white woman doctoral student in education. Our research team also comprised individuals who had no previous connection to the STEMSUCCESS partnership prior to the study as well as individuals who were involved in the initial development of the partnership, but no longer have an official role. Having both "insiders" and "outsiders" involved in data collection and analysis allowed us to have diverse means of understanding and viewing the data's patterns and themes that would not be possible with a single researcher. Given that some members of our team had a longstanding relationship with the STEMSUCCSS program also allowed us to build greater rapport with the program and ensure that the project was mutually beneficial to both researchers and participants.

Where discrepancies arose, we negotiated them as a research team to achieve consensus. Our second participant interview also acted as a form of member checking (Lincoln and Guba, 1985) in which we shared initial themes and patterns analyzed from the first round of data collection, including the concept of STEMSUCCESS Magic. We used participants' reactions and suggestions to refine our analysis and findings to ensure they accurately reflected participants' lived experiences and understanding of the partnership. Lastly, we utilize thick descriptions wherever possible to ensure that the reader can clearly see the connections between a participant's experience, our interpretations of that experience, and the broader conclusions that we reached.

4.6 Study Limitations

Our findings may be applicable to university-community and/or STEM education partnerships with similar characteristics, but care must be taken in the interpretation. For example, the themes shared here reflect people at the core of the partnership. Many of the participants in this study held leadership roles in the partnership and were passionate about the program and its aims. It is likely that others involved in the STEMSUCCESS program may not have felt as strongly or participated due to professional or financial obligations, positioning their participation more directly within power dynamics. Future research can focus on how these additional stakeholders engage the sensemaking process. Moreover, our findings derive from our analysis of interviews with key leadership in the STEMSUCCESS program; additional studies may consider methods such as ethnography in order to observe sensemaking in action or participatory action research that collectively engages in real-time reflection would extend the findings presented here to provide additional context and insight.

5. FINDINGS

We present the results of our analysis below in three major sections that correspond with our research questions to examine the concept of STEMSUCCESS Magic, its creation, and the practices that support and sustain the partnership magic.

5.1 STEMSUCCESS Magic

The partnership magic was described as a sense of shared understanding across multiple individuals regarding the value and potential of the program, which led to their investment and work. Kimberly, who coordinated logistics for STEMSUCCESS at Flagship U., noted:

> *It's like a certain, like an energy, the air starts to crackle and you can feel endorphins… people just get so excited about the potential of what the program…they seem to get what the program is about [and] are instantly there with it, and want to be involved and then have a creative response to their involvement.*

Kimberly went on to give an example of the prior year, when the organization was given tickets to Michelle Obama's *Becoming* book tour at a nearby city. The STEMSUCCESS program was having trouble figuring where to feed the girls until the Executive Director of AdvocacyOrg. brainstormed with the Board of Directors to use one of Flagship U.'s connections with a restaurant. Not only did the restaurant provide an impressive meal in a high-profile establishment to the girls for a heavy discount, but they ended up opening on a day when they were scheduled to be closed to accommodate the girls. The incident illuminates how "all of these volunteers working together, we can really make something shiny and sparkly happen," or what Jennifer, the faculty liaison at Flagship U., referred to as the "secret sauce."

The anecdote shows a key element of the STEMSUCCESS program. Not only were individuals committed, but they frequently went above and beyond their position descriptions or initial expectations to make the program a success. While AdvocacyOrg. staff were paid for their involvement, most of the broader community for STEMSUCCESS volunteered because they believed in the program. Given the lack of extrinsic reward, these individuals could have put in far less effort but were committed to the STEMSUCCESS program, the broader mission of AdvocacyOrg. and other STEM diversity initiatives at Flagship U. For example, Flagship U.'s faculty involvement reflected the service component of their professional work and service is traditionally valued less than research and teaching in the professoriate (Neumann and Terosky, 2007). However, Alexandra, the original faculty liaison, was so passionate about the project that she was able to get faculty to teach the program. The commitment of faculty grew so much that now "there's a waiting list [because] there are more faculty wanting to participate than there are slots."

In another facet of the program, campus partners were willing to support STEMSUCCESS even though it was not a revenue source for them. For example, Flagship U. dining services provided not only meals at cost for the girls, but also developed a curriculum around dining:

> *There was the baking workshop…On the first day, they [the baking staff] talked to them about healthy eating on campus and what their whole model of thinking*

is around the design of their food courts, for lack of a better word. So that was amazing.

Jennifer, who succeeded Alexandra in her role, guided the program to an online format when COVID-19 eliminated the ability for participants to be on campus at Flagship U. during the summer of 2020. Jennifer convinced the program to make individual science kits for each of the girls to use at home, describing how she assembled the kits by "fill[ing] up my house with these kits, like everywhere, [to] get them all packaged up." She then served as "kind of the online assistant" for each of the STEMSUCCESS classes to help faculty who were uncomfortable facilitating the workshops over Zoom, by attending "every single workshop." Finally, Kimberly, often described as the linchpin for the Flagship U. part of the operations, participated in STEMSUCCESS largely on top of her other responsibilities. A key part of the STEMSUCCESS Magic was that participants saw potential in the program to positively impact girls in STEM, which engaged them and pushed them to be involved. For the majority of staff and volunteers, at both AdvocacyOrg and Flagship U., the mission of STEMSUCCESS aligned with personal values, as well as professional goals. As a result, stakeholders engaged in sensemaking of the STEMSUCCESS program as valuable and fulfilling—one that participants should strive to support (Maitlis and Christianson, 2014; Weick, 1994).

Lastly, an important element of the STEMSUCCESS Magic was rooted in some unique facets of the Flagship U. and AdvocacyOrg. partnership. While STEMSUCCESS had other branches nationally, each program was different based on the team running it, resources available to them, and the vision of the partnership. One AdvocacyOrg. leader described this as "if you've seen one STEMSUCCESS program, you've seen one STEMSUCCESS program." The context of STEMSUCCESS was important to understand why participants viewed the program as successful, dynamics which may have been different within different organizations and resources (Helms Mills et al., 2010).

5.2 Creating the Magic

Across roles, participants described STEMSUCCESS as a program that made individuals feel good about their contributions. Even when data did not clearly demonstrate a direct return on investment (e.g., although STEMSUCCESS students enrolled in college and STEM programs at high rates, Flagship U. rarely saw these students end up enrolling in their university), the mission of the program was something that resonated with many individuals, and was making an impact on the girls enrolled in the program. Margaret, the Associate Executive Director at AdvocacyOrg., described this as "an easy sell." Additionally, the visibility of the program made it easy for partners and donors at both the AdvocacyOrg. and Flagship U. network to gain positive publicity from their participation. Indeed, the marketing aspect was key to getting STEMSUCCESS off the ground. Janet, Executive Director at AdvocacyOrg., shared a story where the kick-off event for STEMSUCCESS was coming up and AdvocacyOrg. had not heard back from a grant funder. The Executive Director called the funding organization to let them know

about the event and the publicity, and the organization then confirmed the grant that launched STEMSUCCESS.

The STEMSUCCESS initiative was seen as successful in part because it was able to create a unified vision of the program shared across collaborating partners while still being flexible, allowing individuals to pursue their own interests and motivations. Educational equity was the unifying vision, something that staff, faculty, and volunteers at AdvocacyOrg. and Flagship U. shared. This passion buoyed the collective and also kept individuals committed. Kimberly reflected that "we're fortunate to really share the same goal and the same vision." Collectively, there was a sense of the program as one that inspires girls to "see college as a realistic part of their future" and "to make education accessible." The STEMSUCCESS program coordinator described, "we have a clear understanding of like what we want to provide the girls like college readiness and college access in STEM-related workshops." This bolstering of the unified vision was the experience of the girls in the program, an experience affirmed by the long-term nature of the program spanning five years. As a result, sensemaking occurred across cognitive, intrapersonal, and interpersonal domains as participants described STEMSUCCESS as a public and individual good (Maitlis and Christianson, 2014).

The focus on access to STEM, particularly for girls and women of Color, was a goal that resonated across program leaders, but each had their own individual understanding as rooted in their own identities and positions (Helms Mills et al., 2010). Jennifer described that she "did my dissertation on women and leadership. So, I have always been thinking about opportunities for women, at whatever age group, so this was near and dear to my heart." Sonia saw STEMSUCCESS as synergy between her scholarly interests and passions to advocate for equity in education, describing it as both a research and social justice goal. Moreover, the program was personal for several participants. Alexandra recently saw her niece express that STEM was not for her. Many members of the AdvocacyOrg. staff, the majority of whom identify as women, saw themselves in the girls in the program. The Executive Director shared that "I'm a first gen. college student [and] my parents had no idea what that whole process was like…I wish I had STEMSUCCESS because that would have been amazing to go on college field trips." Sofia, the STEMSUCCESS coordinator, had participated in a similar program to STEMSUCCESS and resonated deeply with the mission because "I know what it did for me when I was growing up. If this program was around when I was younger, I know I would have been a part of it, and so just being able to impact young girls' lives, it's just what kept me coming back."

5.3 Explaining Elements of the Magic

Participants in the study across both organizations described that the magic in the program was sustained in this team through a combination of three key factors: the right people, convergence of interests, and constant communication.

Across interviews, participants spoke frequently of the STEMSUCCESS program as a product of the right people coming together. Alexandra described this, noting:

What made the partnership was that there were a group of people who were invested in it. And it was just like, we hit a sweet spot in, in a group of people saying, Oh, this is something that we should do, and everybody was willing to do it.

Everyone played some role in the synergy as "the staff. The families. The girls… all of us coming together to make the program work." The support from upper leadership at Flagship U., particularly from the Dean at the time of the program's implementation, provided leverage for the program to gather support. The Dean of the Flagship U. College of STEM (pseudonym), where STEMSUCCESS was ultimately housed at the time of the partnership's creation, although uninvolved in the coordination or operations of the project, was widely known as a supporter of the program. Approval from the Dean's office put authority behind the project and opened up avenues related to faculty buy-in and support from campus partners. For example, the Flagship U. staff coordinator (Kimberly) was the central conduit between Flagship U. and AdvocacyOrg., a role she was able to take on because of support and endorsement from the Dean's office for STEMSUCCESS. Janet described Kimberly as "a visionary and she's strategic and she makes things happen." One Flagship U. staff member shared that Kimberly "made the trains run on time" and without her involvement "I don't think [STEMSUCCESS] could have happened." Kimberly described herself as "the hub of the many spoked wheel" who knew how to work within the bureaucracy of Flagship U to make things happen. She provided an example of navigating with campus safety protocols to create a junior-level training regarding lab precautions that were appropriate for the girls in the program that still met Flagship U. goals around training and compliance. Regarding the academic aspects of the program, Alexandra was described as the impetus for faculty to become involved with the program. One Flagship U. colleague described that:

She was incredible. She was focused. And, you know, this was a volunteer thing for her [as a] faculty member. And my understanding is that she was involved with girls and…actually was spending time down in [the community where AdvocacyOrg. is located] You just couldn't say no to her. And she developed the original list of faculty…And asked and persuaded [them] to be part of the program. And that first year without Alexandra just wouldn't have happened. Without a doubt.

Thus, while there was some sensegiving from organizations like Flagship U. around basic requirements or general support for STEMSUCCESS, it was participants' navigation within those parameters that helped fully articulate the value of the program and encourage participation.

The identification of key individuals fit into a larger perception of convergence across both Flagship U. and AdvocacyOrg. For example, AdvocacyOrg. had looked into several different colleges and universities to partner with when first proposing STEMSUCCESS. After examining other programs offered at each academic site, the

range of potential resources, and other factors, Flagship U. emerged as the best option: "it really filled out quickly that [Flagship U.] seemed to be the most optimal campus partner." As a large research university, Flagship U. had many possible faculty partners and campus facilities and did not have any competing programs already on campus. For Flagship U., there was movement towards working on STEM equity when the possibility of STEMSUCCESS was first broached. Particularly, the College of STEM, to which AdvocacyOrg. made its original pitch, "had identified a need to recruit more women more women of color into their STEM pathways." As Kimberly shared,

> *This kind of community outreach was a goal of the college for a long time, but it's not always easy to do that. As this program was described to us, it just looked like it made so much sense. That's why it was an easy yes.*

The STEMSUCCESS program met the needs of both Flagship U. and AdvocacyOrg. at a time when both were looking for similar types of opportunities, creating a shared sense of value across both organizations.

While the foundations for STEMSUCCESS were aligned, the leadership across both organizations kept this congruence through constant communication. The core of this communication occurred between Beth and Kimberly, the two administrative leaders for the program at AdvocacyOrg. and Flagship U., respectively. They spoke weekly to bridge the gap between the two entities, to work on logistics for the program, and to troubleshoot arising issues. Beth described that partnership as crucial to the program:

> *[Kimberly] is the person that I most interact with. She looks at Flagship U. and sees all the possibilities and then comes to me and says, 'oh I met this really cool person.' So we have a weekly meeting to kind of, she's sort of my portal into like, what are the opportunities and potential partnerships. She's that person that does the logistics, she organizes the buildings…*

While the frequency of the communication was valuable, the characteristics of the communication were seen as fueling the program's success. As Jennifer noted, "it's a really open, comfortable, clear communication." AdvocacyOrg. also engaged in frequent communication across their staff to coordinate and direct the program. In some cases, these communication networks involved broader groups of people. For example, AdvocacyOrg. regularly involved its Board of Directors in issues the STEMSUCCESS program faced, which helped them to troubleshoot problems. Communication was not always smooth across all of the stakeholders, but there was a shared commitment to addressing issues and keeping channels open. Kimberly described the ongoing work as dedication to "understand the complexity of the various communication obstacles that could be in our way and have the willingness to work through that."

6. DISCUSSION AND IMPLICATIONS

Our goal was to investigate STEMSUCCESS Magic, thereby demystifying the elusive "black box" of partnership success from one STEM broadening participation alliance among many that often experience constraints in time, funding, and resources alongside the organizational complexity of cross-sector engagement. An important takeaway from several decades of research and policy around closing gaps in STEM access and achievement for minoritized students is that programmatic initiatives siloed within organizations are insufficient to making a dent in this problem (Holloman et al., 2018; National Science Board, 2020). Cross-sector initiatives that involve multiple stakeholders engaged in collaborative interventions are critical bridges needed to support minoritized students as they transition from one life stage (high school) to another (college), when attrition from STEM is highest (Kezar, 2011; Malcolm and Feder, 2016).

6.1 Sensemaking and Collective Identity

Our findings demonstrate that STEMSUCCESS Magic can be operationalized as the development of a collective identity, which optimally incentivizes the personal and professional motivations of individual partners and reinforces the alignment of their mission, goals, and values in ways that buffer against other challenges that arise within the partnership. This is aligned with the notion that identity construction is a primary aspect of sensemaking (Helms Mills et al., 2010; Weick, 1995), influencing other aspects of the process. At a collective level, participants expressed the sentiment that this work was good to do, innovative, and that supporting girls in STEM was a key goal. At an individual level, not only were the same sentiments salient, but in addition, participants connected the goals of the STEMSUCCESS program to their own specific motivations. Some stakeholders saw this, for example, as an opportunity to pay it forward for something they benefitted from in the past, while others saw it as aligned with their goals of supporting women in leadership. These distinct individual motivations were in synergy with the collective identity in most cases. These two layers of sensemaking for participants align with the multiple locations of sensemaking outlined by Maitlis and Christianson (2014)—within individual (intrapersonal) and between individuals or relational (interpersonal).

 The implications of these insights for future practice are valuable. The implementation of STEM programs such as the one we studied should focus on the intentional development of collective sensemaking among stakeholders in STEM university-community partnerships. Doing so can foster a common vision for partners and/or connect the collective vision to the personal values and motivations of individuals. Such an approach would have a central focus on collective identity development but would also be intentional about inclusion of the other facets of the sensemaking process [e.g., being retrospective, driven by possibilities rather than precision (Weick, 1995)—to perhaps foster each program's own "magic"].

There are also implications of this work for future research on organizational partnerships. Scholars should focus on the ways that collective identity develops and is experienced in these types of collaborations, particularly through the lens of sensemaking. While it has been recognized that there are various locations of sensemaking, the aspect of identity construction as a collective endeavor is a rich area for more conceptual development and empirical study.

6.2 Broadening Participation through University-Community Partnerships

6.2.1 Roles and Relationships

While our findings are primarily at the level of the collaboration as a whole, there are key roles and relationships that appear to have helped lead to success. At the leadership level, there was a clearly defined liaison in each organization. This was supported by leadership and advocacy from the Executive Director of AdvocacyOrg. as well as the Dean and Associate Deans of the College of STEM. Additionally, there was a clearly defined faculty organizer at Flagship U. Similar to Delaine et al.'s findings on boundary spanning within university-community STEM partnerships, we found that strong trust and lines of communication among these key individuals who liaised across partner organizations helped strengthen stakeholder motivation and engagement.

Related to that role, there were specific lessons learned about faculty participation on the University side of the partnership. Despite institutional devaluation, faculty place a high value on relational service and find value in contributing towards outreach to students in local schools and institutional priorities related to STEM diversity (Hanasono et al., 2019) based on value alignment. This is apparent from several participants in our study describing how this type of service was a strong motivator and aligned with their intrinsic goals. Other faculty wanted to become involved because it was easy to feel good about the effort, and fulfilled in a manageable way their desire to share their research and contribute to improving STEM education and equity. Some participants saw this as a reminder of why they got into STEM education and research in the first place. In a less altruistic and more transactional way, some were also eager to have a partner for broader impact statements in NSF research proposals.

6.2.2 Partnership Structure

Beyond individual roles, participants described many characteristics of successful university-community partnerships that scholars have also emphasized (e.g., Delaine et al., 2021; Silka, 1999; Strier, 2014; Suarez-Balcazar et al., 2004; Taylor et al., 2004; Thompson and Jesiek, 2017). Mutuality manifested as a perceived reciprocal benefit for Flagship U. and AdvocacyOrg; supportive leadership was exhibited by the Dean at Flagship U.; ongoing flexibility and communication was evident across two core roles at both organizations; and joint resource allocation. They also described the STEM-SUCCESS program as encompassing traits aligned with existing measures for broaden-

ing participation such as inclusive support, relationship building, and the fostering of a STEM identity (Lane, 2017). The program encountered challenges that exist in the literature too, such as a need to think constantly about funding and how to incentivize faculty (Baber, 2015; Sadler et al., 2018).

The relationship between Flagship U. and AdvocacyOrg. can be described as loosely coupled, where entities "are responsive, but that each event also preserves its own identity and some evidence of its physical or logical separateness" (Weick, 1976, p. 3). Both organizations had their own goals and approaches regarding STEMSUCCESS, but were able to work together in key ways to facilitate the success of the program. Such a model may explain, in part, the strength of the partnership during times of transition. For example, the original champion of faculty involvement who recruited and trained instructors for the program was Alexandra. Despite heavy reliance on Alexandra's charisma and networks to get faculty buy-in initially, this involvement continued to be strong after her departure from Flagship U. and the College of STEM. In Weick's (1976) loosely coupled systems, collaboration persists amidst change because "one element can adjust to and modify a local unique contingency without affecting the whole system" (p. 7). Because of the loose coupling and the non-hierarchical structure of the partnership, there was very little sensegiving—where the sensemaking process is purposefully influenced to try to fit to a preconceived goal (Gioia and Chittapeddi, 1991; Kezar, 2013). The Dean at Flagship U. green-lit the University's participation but did not micromanage the program. AdvocacyOrg. was even less hierarchical, but possessed a strong vision for STEM education and understanding of community strengths and needs.

Overall, findings contribute to the science of broadening participation by describing how future partnership structures can be intentionally organized and optimally incentivized to support the success of minoritized students within STEM. Specific implications of this work for practice include the consideration of an intentional operationalization of a loosely coupled partnership structure. The benefits to ongoing flexibility and resilience may be more beneficial than one that is tightly coupled, which can be mistakenly perceived as a unified approach. University partners may also consider the specific roles of faculty, and explicitly incentivize community engagement through formalized policies and processes in annual reviews, tenure, and promotion to ensure this work is valued beyond simply university rhetoric.

In terms of future scholarship, studies should examine more deeply the ways that STEM community partners navigate the tensions that can exist in university partnerships, given differences in institutional culture and norms. Scholarship could also focus on comparing loosely and tightly coupled STEM education partnerships/university-community partnerships to see if the conclusions of this study are confirmed. More investigation of sensemaking as a potential tool for strengthening such partnerships would also be valuable.

The example of the STEMSUCCESS partnership highlights ways to make success more likely but increasing diversity in STEM is not a simple problem to solve, even with exceptionally strong partnerships. The aspects of university-community partnerships discussed herein are necessary but not sufficient. Like many other pro-

grams, STEMSUCCESS continues to operate with a minimal budget and relies on volunteers and in-kind support. Too often fiscal considerations are created as the ultimate barrier to education, especially in low-resourced environments. Valuing the mission of such work needs to be matched with the value of the dollar. The role of faculty volunteerism and service needs to be valued equally alongside research and publication in tenure consideration and other university promotions. Nonetheless, through a process of sensemaking with stakeholders of this specific program, lessons can be learned about forging positive university-community partnerships in order to create a sense of "magic" that can ultimately help to broaden participation in STEM.

7. CONCLUSION

Equity in STEM continues to be an important issue for higher education and the United States. In this study, we examined STEMSUCCESS, a university-community partnership focused on broadening participation for girls in STEM. Our qualitative inquiry helps to understand why various stakeholders discuss STEMSUCCESS as an important initiative, upholding its value as a program far beyond any tangible metrics (e.g., enrollment, funding). We found that our participants engaged in sensemaking across intrapersonal and interpersonal levels to see STEMSUCCESS as both personally meaningful (i.e., aligned with their goals) and a collective good derived from interest convergence. While the organizations involved could provide some sensegiving by showing support to STEMSUCCESS, it was only through sensemaking collectively across the university-community partnership that individuals fully bought into the STEMSUCCESS "magic." Such findings emphasize the importance of collaboration as a tool for equity, while also emphasizing the need for further structures and resources to make such partnerships sustainable.

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