

Alumni Perspectives on the Impact of a K-12 STEM Pathway Program: A 20-Year Look Back and Model for the Future

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Abstract

Structural barriers beyond academics might explain why academic interventions have not significantly increased the representation of historically underrepresented groups in STEM fields. For the past 20 years, the Saturday Academy (SA), a STEM partnership between a university, a community college, and an urban school district, has embraced a holistic approach to academic enrichment. We report alumni perspectives on how SAs affected their professional paths. An 88-item retrospective survey focused on career literacy, personal development, socioemotional learning, and resource access was administered through a private Facebook group and completed by 96 alumni. Descriptive statistics were used to estimate effect sizes, identify patterns, and generate insights into participants' perspectives. The largest shifts were noted for self-efficacy, professional network development, and relationship development. Moreover, those reporting lower baseline career literacy, personal development, or resource access reported the greatest improvements after SA. Program design recommendations and study limitations are discussed.

Keywords: STEM, mentorship, socioemotional learning, urban schools, underrepresented students



The health care industry will likely lead to the growth of the U.S. economy in the next decade as our population continues to grow, age, and become more diverse. Health care industry employment is projected to grow much faster than the average for all occupations, adding approximately 3.8 million new jobs by 2024 (Martiniano et al., 2016). Moreover, its rapid growth has been coupled with serious shortages. By 2030, one million nurses will retire, and the demand for physicians will exceed supply by a range of 42,600–121,300 (Daniel & Smith, 2018). The need for health-care workers extends beyond physicians and nurses. Healthcare support occupations are projected to grow rapidly, including home health and personal care aides and physical and occupational therapy assistants (U.S. Bureau of Labor Statistics, 2022). At

the same time, workforce projections suggest that the supply of workers may not keep pace with demand in some healthcare occupations (National Center for Health Workforce Analysis, 2025).

Despite ongoing efforts to diversify the health care workforce, significant underrepresentation persists within the health care industry. Although they constitute 32% of the U.S. general population, compared with their White (67%) and Asian (13%) counterparts, only 9% of the STEM workforce identifies as Black and 8% as Latine (Pew Research Center, 2021). These patterns are even more alarming when examining the physician workforce: 5% of doctors identify as Black and 6% as Latine, whereas 56% identify as White and 17% as Asian (AAMC, 2018). Increasing workforce diversity has the potential to significantly contribute to reducing health disparities (Jetty et al.,

2022; Marrast et al., 2014; Parker et al., 2017; Shen et al., 2018). Health care professionals of color are more likely to work in impoverished areas. Moreover, linguistic and racial concordance between patients and providers, particularly those patients who are more likely to experience health disparities, leads to improvements in the quality of care for all.

Although the health care workforce crisis is undeniable, the complexity of the problem continues to increase. *Urban intensive contexts* are school districts in large metropolitan areas where population scale and density strain resources and services, directly influencing what occurs inside schools (Milner, 2012). Such districts disproportionately serve students of color and receive approximately \$1,600 less funding per student than the national average (EdBuild, 2019). Research shows that underrepresented minority students are indeed interested in STEM (Simpson, 2001; Xie et al., 2015). However, a lack of access to a rigorous curriculum, including AP courses, is one of the unintended consequences of such a resource gap and a deterrent to pursuing a STEM career. White students represent half of the AP course enrollment (Xu et al., 2021). Even when access to an AP course is available, 30% of Black and Latine students enrolled in at least one AP course do not take any AP exams, whereas 25% of White students and 15% of Asian students do.

Considerable amounts of funding have been funneled into urban high school pipeline programs as an approach to increasing the number of underrepresented minority students in health sciences and addressing the inequitable educational experiences that students are likely to encounter (Brown, 2021; Holden et al., 2014). These programs have often focused on fixing “leaks” in the pipeline by providing academic enrichment in subjects such as math and science that are perceived as gatekeepers to careers in STEM. This approach has failed to produce the desired outcomes (Cannady et al., 2014, p. 444). Critical perspectives in STEM have pushed for culturally relevant programs that go beyond academics. Within this approach, the focus is on the sociocultural factors that affect a student’s experience in navigating STEM academics and careers, such as stereotype threat, lack of social capital, or the culture and climate of STEM, with the goal of nurturing urban youth to see themselves as future STEM professionals (Beasley &

Fischer, 2012; Garvin-Hudson & Jackson, 2018; McGee et al., 2021; Ong et al., 2011). This article describes the Saturday Academy (SA), a 20-year-old STEM after-school enrichment program that incorporates socioemotional learning in its design and directly addresses the barriers that students growing up in urban intensive contexts may face as they attempt to pursue higher education in STEM fields. The primary goal of this study is to understand how Saturday Academy participation has impacted alumni by identifying patterns and generating insights into the career literacy and awareness, personal development, socioemotional learning, and resource access of Saturday Academy participants. Moreover, this article provides a unique contribution to the field by sharing alumni’s perspectives about which aspects of SA have critically influenced their professional paths.

Program Description

Starting more than 20 years ago, the Saturday Academy was the foundational program of the K-12 Initiative, a partnership between the University of Kansas School of Medicine, the Kansas City Kansas Community College, and the Kansas City Kansas Public Schools, USD 500. The mission of the K-12 Initiative is to increase diversity in health and STEM professions by providing high school students with academic and socioemotional learning opportunities that are evidence-based and contextualized to students’ realities. The Saturday Academy serves middle and high school students in Kansas City Kansas Public Schools, USD 500, an urban school district located in the most diverse county (Wyandotte County) in Kansas. The student population of more than 22,000 students comprises approximately 50% Latinx, 29% African American/Black, 11% White, and 7% Asian students. Sixty-five different languages are spoken by students in the district, making it one of the most linguistically diverse school districts in the nation. The percentage of students eligible for free or reduced-price lunch is currently 77%, which puts the district into the “high poverty schools” category according to the National School Lunch Program (McFarland et al., 2019). The district holds the lowest 4-year high school graduation rate (73.6%) in the state.

Saturday Academy Structure

The curriculum is composed of three key

student development pillars—academic, workforce, and self-development—and is designed by teachers from the school district and STEM industry professionals from the Greater Kansas City area. A framework created by the Collaborative for Academic, Social, and Emotional Learning (CASEL-5) provides the foundation for the design and structure of SA. The framework comprises five areas of competence for socioemotional learning: self-awareness, self-management, relationship skills, responsible decision-making, and social awareness (CASEL, n.d.; Faria et al., 2017; Weissberg et al., 2015). The Collaborative for Academic, Social, and Emotional Learning defines social and emotional (socioemotional) learning as

the process through which all young people and adults acquire and apply the knowledge, skills, and attitudes to develop healthy identities, manage emotions and achieve personal and collective goals, feel and show empathy for others, establish and maintain supportive relationships, and make responsible and caring decisions. (CASEL, n.d., para. 5)

Although many educational frameworks aim to support student development (e.g., positive behavioral interventions and supports, emotional intelligence), the CASEL-5 social and emotional learning (SEL) framework

stands out for its robust empirical support and practicality (Greenberg, 2023). A large meta-analysis of 213 universal school-based SEL programs involving over 270,000 PreK-12 students showed that interventions that addressed the five core competencies increased students’ academic performance by 11 percentage points, compared to students who did not participate (Durlak et al., 2011). In another more recent review, 424 studies from 53 countries (totaling over 575,000 students) affirmed that universal SEL interventions led not only to improvements in SEL skills and school climate but also to higher academic achievement (Cipriano et al., 2023). Moreover, the positive impact of SEL on academics is long-lasting: Years after participating in SEL programs, students’ academic performance remains, on average, 13 percentage points higher than that of students who did not participate (Taylor et al., 2017). Thus, CASEL-5’s combination of specific competencies, strong evidence across contexts, and academic effects gives it an advantage over more limited frameworks.

Figure 1 provides a visualization of the intersection between the CASEL framework and the Saturday Academy. The figure shows samples of Saturday Academy activities to show how they are associated with each pillar and social and emotional learning competencies. Most of the components appear more than once, showing

Figure 1. Saturday Academy Pillars of Development and CASEL-5 Core Competencies

Saturday Academy Pillars of Development				
		Academic	Self	Workforce
CASEL Framework	Self-Awareness	Real World Community Topic, Modules	Poetry, Self Care, Teambuilding	Modules, Professional/Career Panel, Teambuilding
	Self-Management	Research Projects	Self Care, Teambuilding	Teambuilding, Research Projects
	Relationship Skills	Modules, Research Projects, Real World Community Topic	Teambuilding	Modules, Field Trip, Professional/Career Panel, Teambuilding, Research Projects
	Responsible Decision-Making	Modules, Research Projects	Teambuilding	Modules, Professional/Career Panel, Teambuilding, Research Projects
	Social Awareness	Modules, Research Project, Real World Community Topic	Teambuilding	Modules, Field Trip, Professional/Career Panel, Teambuilding, Research Projects

that learning activities have multiple uses in developing socioemotional learning and the three pillars. For example, teambuilding fits with relationship skill competency, as students work together and communicate to reach the goal of an activity. At the same time, teambuilding fits self-awareness, as students learn how to work in a team on the basis of their own strengths.

Academic Development

Five core STEM modules—Physiology, Bioethics, Data Science, Risk Factors, and Technology—with corresponding field experiences are at the core of academic development. Each module lasts approximately 20 hours and spreads out over 14 Saturdays. A Saturday Academy session lasts approximately one average school day, five and a half to six hours. Each year a community-based health issue is chosen, with student input, to be the overarching theme for the modules. Previous topics have included obesity and nutrition, cancer, respiratory health, epidemiology, mental health, and chronic illnesses and prevention. The modules break down the topic in relation to the module content areas. The following description represents examples of previous subtopics studied within the modules of the overarching topic. In the Physiology module, students learn what physiological changes occur when an individual is infected with a virus, bacteria, or other pathogen, as well as the anatomical structures and dissection. Afterward, students rotate to Bioethics, where they learn how different groups experience the health care system and how socioeconomic systems work and participate in a mock town hall. In Data Science, students are involved in analyzing, visualizing, and interpreting data such as infection rates. With respect to Risk Factors, students discuss health disparities, community resources, and health access. Finally, in Technology, students learn the topic through a technology medium (e.g., website, coding, geo-mapping, building apps). For a final product, participants bring together their diverse understanding of the topic and develop a community-based research project. Students present their final projects to their families and the community during the annual Closing Ceremony, sharing their research findings with various community stakeholders. Approximately 300 people attended ceremonies in person before COVID-19, and approximately 250 people attended virtually during the COVID-19 pandemic.

This unique, community-focused opportunity empowers students to connect a career in STEM with serving the communities from which they come.

Self and Workforce Development

Self-professional workforce development is integrated into the Saturday Academy through a unique, robust, three-tiered mentoring structure where district teachers, STEM professionals, and college interns work together to provide SA students and each other with interprofessional development and leadership support by increasing networks, learning about each other's industries, and aligning community resources and needs (Figure 2).

The Saturday Academy's staff consists of members from academic partners: Kansas City Kansas Public Schools, the University of Kansas Medical Center, and the Kansas City Kansas Community College. Additionally, most staff are members of the students' communities and alumni from the program, and at least 75% of the SA staff identify as persons of color. Racial/ethnic and gender concordance in mentoring relationships has been shown to be important for students (Kricorian et al., 2020). Our alumni mentors enrich the SA program by combining subject-matter knowledge with lived insight into the obstacles and contexts our students encounter, offering socioemotional support and guidance that resonates deeply because it is grounded in experience and shared understanding. The first tier of the mentorship model consists of industry professionals working in the program: teachers; STEM professionals (in fields such as nursing, finance, engineering, health research, computer science, entrepreneurship, and public health); and graduate educators (in areas such as biomedical research, medical school, and mental health). In the second tier, graduate students provide support, advocacy, and insight to college interns who are interested in graduate and/or professional schools. Most are members of student communities and bring a unique knowledge base and content expertise to curricula and insight into the workforce. For undergraduate students actively pursuing degrees in STEM and health, their mentors are professionals working in these fields. This relationship allows undergraduate students to learn from working professionals and, in turn, provides similar mentorship to SA middle and high school students. Undergraduate students

Figure 2. Saturday Academy Mentorship Tiers

MENTORSHIP TIERS			
ACADEMY GROUPS	Tier One PROFESSIONAL STAFF	Tier Two COLLEGE INTERNS	Tier Three STUDENT MENTORS
PROFESSIONAL STAFF	Provide interprofessional development	Provide interprofessional exposure	The Academy Way is modeled & practiced
COLLEGE INTERNS	Provide workforce & networking support	Provide peer to peer support	The Academy Way is modeled & practiced
STUDENT MENTORS	Provide alignment of major and career interests	Provide insight into college application and academics	The Academy Way is modeled & practiced
MIDDLE & HIGH SCHOOL STUDENTS	Provide insight into STEM & health careers	Provide insight into college life & schools	The Academy Way is modeled & practiced

provide insight to middle and high school students into “college life” and various college and university opportunities, which are dependent on their career and field interests. College interns provide college application guidance and career-to-major alignment with student mentors (third tier), who are primarily junior/senior-level high school students.

The third and final tier, peer-to-peer mentorship, is provided by high school student mentors to their fellow middle and high school student peers and focuses on relationship building, agency, and belongingness by the student mentors. The student mentors are junior- and senior-level high school students who have typically been at the Saturday Academy in prior years. All the student mentors who work with SA students receive ongoing coaching and training to prepare a yearly cohort of returning and new students for the Saturday Academy. Training consists of cultural competency, a code of conduct, mental health/self-care, mentorship, and programming curricula aimed at enhancing the quality of the program as well as individual mentors’ ability to work with professional colleagues from diverse backgrounds.

Importantly, all the students in programming are taught the *Academy Way*, a term coined by previous students, now alumni, to sum up how students and staff should treat each other with cultural humility, inclusion, respect, and authenticity. Poetry sessions are examples of how students and staff

practice the Academy Way. Reading original poetry allows students to foster empathy, trust, and community (Schoonover et al., 2020). Simultaneously, students use poetry to develop their voices and self-agency (Davis & Hall, 2020). Moreover, connections are made to the skill of writing and its use in various STEM and health careers, research, and academics, providing students with a well-rounded understanding of the importance of writing and its connection to their personal growth and career aspirations, as illustrated in Figure 2.

Methods

Survey Design and Implementation

Given that the goal of this study was to understand alumni’s specific perspectives on the impacts of the SA model, under the guidance of a highly experienced psychometrician, the team developed an 88-item, multiple-choice questionnaire organized around the SA student development pillars—Academic, Workforce, and Self-Development—and the CASEL-5 framework for socioemotional learning (Borowski, 2019). A literature review was conducted to identify existing instruments and potential items for the four domains of the survey: career literacy and awareness (Section 1), personal development (Section 2), socioemotional learning (Section 3), and access to resources (Sections 4, 5, 6, & 7; Valentine & Kosloski, 2021). An educational psychometrician reviewed the survey for common errors such as double-barreled,

confusing, and leading questions and made recommendations. The survey was sent to a small group of trusted colleagues for additional feedback, including time demand. The online survey was distributed to alumni via email, social media, and community connections. The survey was made available through a private Facebook group for alumni at the Saturday Academy and was administered online via Redcap. The survey period lasted for 2 months. The study protocol was reviewed and deemed exempt by the University IRB.

Data Description

In addition to demographics, the survey instrument asked participants to report their perceptions of the effects of SA in four key areas: career literacy and awareness, personal development, socioemotional learning, and access to resources. The participants responded to all statements via a 6-point Likert scale, where 1 signified *strongly disagree* and 6 represented *strongly agree*. Some questions were reverse-coded, so negative responses were assigned a lower numeric value. Two of the four key survey areas, career literacy and awareness and personal development, elicited responses before and after Saturday Academy participation. A retrospective survey design was used to collect data around socioemotional learning (Section 3) and access to resources.

Data Analysis

This study was not powered a priori to detect specific pre-post-Academy changes in the primary outcome: career literacy and awareness. Data were analyzed via descriptive methods, including means, medians, standard deviations, ranges, and proportions. For the primary aim, pre-post differences in scores for career literacy and awareness and personal development were calculated by subtracting each participant's pre-Academy response from their post-Academy response. Pairwise deletion was used for participants who were missing either a pre- or post-Academy response. Effect sizes were estimated by mean difference scores and corresponding 95% confidence intervals. Simple linear regression models were used to describe the association between the secondary data analysis and assess the impact of barriers to resource access, participant self-efficacy (an aspect of personal development) and professional network development (in the domain career literacy and awareness). We used regression

models to examine the association between barriers and outcomes and reported R^2 values to indicate the proportion of variance in outcomes explained by barriers.

Results

The most substantial improvements were observed in professional network development (in the career literacy and awareness domain) and socioemotional learning, including gains in the personal development domain. Additional improvements were noted in career literacy and access to resources. A total of 96 alumni participated in the survey. Among the 96 participants, 36 (37.5%) completed the survey only partially. The average participants were 25–34 years old ($n = 33$, 34.4%), female ($n = 33$, 34.4%), and Black/African American ($n = 27$, 28.1%). Over one third ($n = 36$, 37.5%) of those who completed at least part of the survey reported a bachelor's degree or higher in education, and more than one third ($n = 30$, 31.3%) reported working within a health profession.

Alumni reported experiencing challenges during their childhood, which is typical of an urban intensive context (Table 1, Table 2, Table 3, and Table 4). The most frequently reported challenges were access to technology at home or at school ($n = 37$, 60%); laboratory equipment and STEM supplies to learn ($n = 44$, 71%); access to research, books, and academic resources for academic work ($n = 40$, 64%); and access to updated equipment and computers ($n = 39$, 64%). Alumni also reported a lack of ACT/SAT preparation resources ($n = 40$, 64%) and STEM-focused tutoring ($n = 38$, 62%). Concerns regarding violence in their neighborhood were the item ranked highest for personal concerns ($n = 24$, 39%, median = *Strongly Agree* [this is a concern]).

Within the career literacy and awareness domain, results showed consistent improvements across all items. The survey aimed to understand how participation in the Saturday Academy had impacted alumni's knowledge and understanding of health care and/or STEM careers and career choices and provided support before and after program participation. A positive shift was noted for all items, with the greatest improvements noted in professional network development (Table 5, Questions 7, 8, 10, and 12; Appendix, Figure A1).

Similarly, within the personal development domain, items focused on relationship

development (Table 6, Questions 6 and 7) and self-efficacy (i.e., awareness, management, and responsibility) elicited the greatest shift (Appendix, Figure A2). Additionally, those who reported lower baseline career literacy and personal development levels reported the greatest improvement in these measures after they participated in the Academy (Appendix, Figures A3 and A4). Furthermore, as shown in Table 7, alumni retrospectively reported that participating in programming strengthened their sense of safety and support, increased their sense of possibility for the future, promoted positive relationships with teachers, and promoted stronger feelings of belonging. Finally, individuals with lower versus higher barriers to resources reported overall

Table 1. Challenges and Barriers to Success

Overall (n = 96)				
Question #	Questions	N (%)	Median (IQR)	Mean (95% CI)
Q1	Technology (computer or other electronic resources at school or home.	62 (64.6%)	4.00 (3.00)	3.95 (0.66, 7.24)
Q2	Laboratory equipment and STEM supplies to learn.	62 (64.6%)	4.00 (2.75)	4.10 (0.83, 7.37)
Q3	Research, books, and academic resources to complete my work.	62 (64.6%)	4.00 (3.00)	4.06 (0.75, 7.37)
Q4	Equipment and computers that were up to date.	62 (64.6%)	4.00 (3.00)	4.02 (0.63, 7.41)
Q5	ACT/SAT preparation materials for college entrance.	62 (64.6%)	4.00 (4.00)	3.92 (0.24, 7.60)
Q6	STEM focused tutoring for my academics.	62 (64.6%)	4.00 (3.00)	3.93 (0.38, 7.48)

Table 2. Cultural Competence/Humility (While in high school . . .)

Overall (n = 96)				
Question #	Questions	N (%)	Median (IQR)	Mean (95% CI)
Q1	My family could communicate with my school free of language barriers.	61 (63.5%)	5.00 (2.00)	4.52 (0.99, 8.05)
Q2	I often had to interpret English for my family.	61 (63.5%)	3.00 (5.00)	3.28 (−0.88, 7.44)
Q3	I felt prepared to work with members outside of my ethnic/racial community.	61 (63.5%)	6.00 (2.00)	5.15 (2.78, 7.52)
Q4	I was taught by teachers representing my ethnic/ racial community.	61 (63.5%)	4.00 (3.00)	4.18 (0.65, 7.71)
Q5	My academic curriculum included content and role models that were representative of my ethnic/ racial community.	61 (63.5%)	4.00 (4.00)	4.03 (0.31, 7.75)
Q6	I did not have concerns regarding my ability to relate to my fellow peers of different cultural and ethnic backgrounds.	61 (63.5%)	5.00 (2.00)	4.62 (1.60, 7.64)
Q7	I had experience in dealing with those of different socioeconomic status.	61 (63.5%)	5.00 (2.00)	4.67 (1.71, 7.63)

Table 3. Personal Concerns (While in high school . . .)

Question #	Questions	Overall (n = 96)		
		N (%)	Median (IQR)	Mean (95% CI)
Q1	I had transportation to STEM after-school programming.	61 (63.5%)	5.00 (2.00)	4.52 (0.99, 8.05)
Q2	My parents and family did not understand the importance of STEM after-school programming.	64 (66.6%)	3.00 (5.00)	3.28 (−0.875, 7.44)
Q3	I had concerns regarding violence in my neighborhood.	64 (66.6%)	6.00 (2.00)	5.15 (2.78, 7.52)
Q4	I had access to food/nutrition.	64 (66.6%)	4.00 (3.00)	4.18 (0.65, 7.71)
Q5	I supported/assisted my parents financially and/or personally (i.e.: work around the house, caretaker to younger siblings/cousins/other, caregiver to parents/guardians).	64 (66.6%)	4.00 (4.00)	4.03 (0.31, 7.75)

Table 4. Personal Support (During high school . . .)

Question #	Questions	Overall (n = 96)		
		N (%)	Median (IQR)	Mean (95% CI)
Q1	My parents related or understood my educational journey and needs.	61 (63.5%)	5.00 (2.00)	4.48 (1.15, 7.81)
Q2	My parents/family supported me seeking opportunities outside of the classroom.	64 (66.6%)	6.00 (2.00)	4.84 (1.92, 7.76)

improvements in personal development of 8.9 points (95% CI: 5.3, 12.6) and 9.2 points (95% CI: 5.9, 12.5), respectively (Appendix, Figure A5). Similar trends were observed for career literacy, with individuals with lower versus higher barriers to resources reporting overall improvements of 10.5 points (95% CI: 3.1, 17.8) and 16.8 points (95% CI: 10, 23.5), respectively (Appendix Figure A6).

Overall, findings indicate that participation was associated with improvements across career literacy, personal development, and socioemotional domains, with the greatest gains among participants who began with the lowest baseline levels.

Discussion

Structural barriers beyond academics can deeply undermine students’ success and are often overlooked by enrichment programs. Students in underserved communities are often first-generation students and must navigate their academic paths alone. Most

STEM and health pathway programs focus on structured academic support in the form of enrichment curricula; however, there is a growing need for programs to provide comprehensive services to reduce sociocultural and economic barriers, particularly for students growing up and attending school in an intensive urban context.

The alumni survey provides a unique window from the other side, that is, from the perspective of those who succeeded. It reveals important lessons into how to support students in the urban core and best practices to achieve success. In what follows, we offer key recommendations for building effective pathway programs in the urban core:

- Develop meaningful and sustainable partnerships between professional schools (e.g., medical schools), community colleges, and urban school districts to provide a foundation to meet the needs of students at the academic, cultural, and so-

Table 5. Career Literacy and Awareness

Question #	Questions		N (%)	Overall (n = 96)	
				Median (IQR)	Mean (95% CI)
Q1	I was motivated to pursue a career in health care and/or STEM.	Pre	71 (74.0%)	5.00 (2.00)	4.6 (1.8, 5)
		Post	66 (68.8%)	6.00 (2.00)	5.03 (2.7, 7.4)
		Difference	66 (68.8%)	0 (1.00)	0.39 (-2.2, 3.1)
Q2	I was aware of the different types of careers related to health care (i.e., clinical or nonclinical) and/or STEM (i.e., science, technology, engineering, or math).	Pre	71 (74.0%)	4.00 (3.00)	4.04 (0.75, 7.33)
		Post	66 (68.8%)	5.50 (2.00)	4.94 (2.67, 7.21)
		Difference	66 (68.8%)	0 (2.75)	0.96 (-2.81, 4.72)
Q3	I could identify the steps needed to enter a career in health care and/or STEM.	Pre	71 (74.0%)	4.00 (2.00)	3.89 (0.68, 7.10)
		Post	66 (68.8%)	5.00 (2.00)	4.83 (2.67, 6.99)
		Difference	66 (68.8%)	0 (2.00)	0.96 (-2.64, 4.61)
Q4	I could make educated career choices.	Pre	71 (74.0%)	4.00 (2.00)	4.10 (1.20, 7.00)
		Post	66 (68.8%)	5.00 (2.00)	5.02 (2.88, 7.16)
		Difference	66 (68.8%)	0.50 (2.00)	0.96 (-2.16, 4.07)
Q5	I could explain how different skills relate to different careers in health.	Pre	71 (74.0%)	4.00 (2.00)	3.93 (0.99, 6.87)
		Post	66 (68.8%)	4.00 (2.00)	4.76 (2.41, 7.11)
		Difference	66 (68.8%)	0 (2.00)	0.92 (-2.72, 4.57)
Q6	I was able to clearly communicate my personal career interests.	Pre	71 (74.0%)	4.00 (2.50)	4.13 (1.17, 7.09)
		Post	66 (68.8%)	6.00 (2.00)	5.03 (2.60, 7.46)
		Difference	66 (68.8%)	0 (2.00)	0.94 (-2.47, 4.35)
Q7	I knew how to advocate for myself with respect to my career goals (e.g., calling to schedule an interview, contacting references, identifying mentors).	Pre	71 (74.0%)	4.00 (2.00)	3.86 (0.59, 7.13)
		Post	66 (68.8%)	5.00 (2.00)	4.95 (2.64, 7.26)
		Difference	66 (68.8%)	0.50 (2.75)	1.17 (-2.16, 4.50)
Q8	I had connections to professionals in the health care and/or STEM fields.	Pre	71 (74.0%)	4.00 (4.00)	3.76 (0.04, 7.48)
		Post	66 (68.8%)	5.50 (2.00)	4.97 (2.50, 7.44)
		Difference	66 (68.8%)	1.00 (3.00)	1.30 (-3.03, 5.63)
Q9	I could see the connection between a career in health care and/or STEM and improving my community.	Pre	71 (74.0%)	5.00 (3.00)	4.34 (1.18, 7.50)
		Post	66 (68.8%)	6.00 (2.00)	5.21 (2.94, 7.48)
		Difference	66 (68.8%)	0 (2.00)	0.91 (-2.60, 4.42)
Q10	I had opportunities to talk with several professionals about their career path.	Pre	71 (74.0%)	4.00 (3.00)	3.83 (0.30, 7.36)
		Post	66 (68.8%)	6.00 (2.00)	5.11 (2.72, 7.50)
		Difference	66 (68.8%)	1.00 (3.00)	1.38 (-2.83, 5.59)
Q11	I had a good idea of the career path I wanted to pursue.	Pre	71 (74.0%)	5.00 (4.00)	4.08 (0.65, 7.51)
		Post	66 (68.8%)	5.00 (2.00)	4.94 (2.29, 7.59)
		Difference	66 (68.8%)	0 (2.00)	0.94 (-2.73, 4.60)

		Overall (n = 96)			
Question #	Question #		N (%)	Median (IQR)	Mean (95% CI)
Q12	I was well connected to other students with similar career interests.	Pre	71 (74.0%)	4.00 (3.00)	3.68 (0.17, 7.19)
		Post	66 (68.8%)	6.00 (2.00)	5.11 (2.80, 7.42)
		Difference	66 (68.8%)	1.00 (3.00)	1.53 (−2.31, 5.37)
Q13	I felt confident about my professional future.	Pre	71 (74.0%)	4.00 (3.00)	4.14 (0.95, 7.33)
		Post	66 (68.8%)	6.00 (2.00)	5.03 (2.56, 7.50)
		Difference	66 (68.8%)	0 (2.00)	0.96 (−2.48, 4.39)
Q14	I felt confident about my personal future.	Pre	71 (74.0%)	4.00 (3.00)	4.17 (0.99, 7.35)
		Post	66 (68.8%)	6.00 (2.00)	5.02 (2.45, 7.59)
		Difference	66 (68.8%)	0 (2.00)	0.92 (−2.51, 4.35)

cioeconomic levels. This unique approach provides comprehensive and continuous assistance to students, as each partner creates opportunities to meet their unique needs.

- Integrate programs in existing community structures such as local school districts and bring known community leaders such as teachers, administrators, alumni, and community stakeholders (i.e., local poets, community development groups, mental health professionals, and others) into leadership positions. This inclusiveness creates a sense of belonging among students and provides a smoother transition as students navigate education from the middle/high school level to undergraduate studies (either at a two- or four-year school) and finally to professional/graduate schooling. Students feel connected to institutions, and the curriculum is connected to their realities. More importantly, partnerships help ensure that programs are designed to meet the community's true needs.
- Plan and budget for the unique realities of students growing up in intensive urban contexts. The students who needed the most support were those for whom the Saturday Academy had the greatest impact. This impact was especially notable for students who had the least access to and availability of STEM resources, who were concerned

about violence in their communities, and who did not have a supportive group (i.e., parents, family members, fellow peers, etc.) in their lives. By having a culturally inclusive and emotionally safe social environment for students, the Saturday Academy created the foundation for students to be their authentic selves, not be afraid to ask questions or seek assistance, and form positive relationships.

- Focus on professional identity development and network expansion. A student's self-perception can create barriers to their academic success. For alumni, having a professional community with shared values and backgrounds was important to their success; it provided them with a sense of belonging and allowed them to see themselves as leaders and changemakers in their chosen fields. Moreover, the SA mentorship model allows participants to interact with mentors who are members of their community and current professionals in STEM fields. Mentors, many of whom are from underrepresented groups and/or alumni, not only bring technical knowledge to the table but also play a role as cultural brokers between the students' realities and the paths to a career in STEM. Their presence creates a real possibility for participants to start developing networks and professional connections that can assist with educational and job applications.

Table 6. Personal Development

Question #	Questions		N (%)	Overall (n = 96)	
				Median (IQR)	Mean (95% CI)
Q1	I was confident in my academic abilities.	Pre	64 (66.6%)	5.00 (1.00)	4.45 (2.00, 6.90)
		Post	62 (64.6%)	5.00 (2.00)	5.03 (2.93, 7.13)
		Difference	62 (64.6%)	0 (2.00)	0.581 (-1.89, 3.05)
Q2	I knew how to monitor my academic efforts.	Pre	64 (66.6%)	4.00 (1.00)	4.27 (1.49, 7.05)
		Post	62 (64.6%)	6.00 (2.00)	5.15 (3.03, 7.27)
		Difference	62 (64.6%)	0 (2.00)	0.903 (-1.94, 3.75)
Q3	I knew my strengths.	Pre	64 (66.6%)	4.00 (2.00)	4.16 (1.26, 7.06)
		Post	62 (64.6%)	6.00 (2.00)	5.15 (2.99, 7.31)
		Difference	62 (64.6%)	1.00 (2.00)	0.984 (-1.56, 3.53)
Q4	I knew how my strengths could impact my success.	Pre	64 (66.6%)	5.00 (2.00)	4.20 (1.22, 7.18)
		Post	62 (64.6%)	6.00 (2.00)	5.19 (3.13, 7.25)
		Difference	62 (64.6%)	0 (2.00)	0.984 (-2.17, 4.14)
Q5	I had a desire for learning.	Pre	64 (66.6%)	5.00 (2.00)	4.64 (1.99, 7.29)
		Post	62 (64.6%)	6.00 (2.00)	5.13 (2.90, 7.36)
		Difference	62 (64.6%)	0 (1.00)	0.50 (-1.44, 2.44)
Q6	I understood how relationships could assist me in school and my career.	Pre	64 (66.6%)	4.00 (2.00)	4.11 (1.17, 7.05)
		Post	62 (64.6%)	6.00 (2.00)	5.29 (3.06, 7.52)
		Difference	62 (64.6%)	1.00 (2.00)	1.24 (-1.94, 4.42)
Q7	I understood the benefits of teamwork to my future career.	Pre	64 (66.6%)	4.00 (3.25)	4.11 (0.97, 7.25)
		Post	62 (64.6%)	6.00 (2.00)	5.24 (3.01, 7.47)
		Difference	62 (64.6%)	1.00 (2.00)	1.19 (-1.73, 4.11)
Q8	I felt comfortable working with people from different cultures.	Pre	64 (66.6%)	5.00 (2.00)	4.78 (2.33, 7.23)
		Post	62 (64.6%)	6.00 (0)	5.52 (3.56, 7.48)
		Difference	62 (64.6%)	0 (2.00)	0.774 (-1.42, 2.97)
Q9	I had the tools to overcome barriers.	Pre	64 (66.6%)	4.00 (2.25)	3.88 (0.92, 6.84)
		Post	62 (64.6%)	5.00 (2.00)	5.00 (2.79, 7.21)
		Difference	62 (64.6%)	1.00 (2.00)	1.15 (-1.83, 4.13)
Q10	I knew how to set goals.	Pre	64 (66.6%)	4.00 (2.00)	4.06 (1.06, 7.06)
		Post	62 (64.6%)	6.00 (2.00)	5.05 (2.72, 7.38)
		Difference	62 (64.6%)	0.500 (2.00)	1.02 (-2.16, 4.20)

Table 7. Socioemotional Learning (During my time in Saturday Academy, the program's faculty and staff...)

Question #	Questions	Overall (n = 96)		
		N (%)	Median (IQR)	Mean (95% CI)
Q1	Helped me feel valued.	62 (64.6%)	6.00 (2.00)	5.24 (3.12, 7.36)
Q2	Noticed some of my strengths.	62 (64.6%)	6.00 (1.75)	5.26 (3.16, 7.36)
Q3	Inspired me to use my strengths in different ways.	62 (64.6%)	6.00 (1.75)	5.27 (3.07, 7.47)
Q4	Connected me with other adults (teachers, professional mentors) who could guide me in pursuing my goals etc.	62 (64.6%)	6.00 (2.00)	5.16 (2.77, 7.55)
Q5	Encouraged me to have an open mind toward my peers and new ideas.	62 (64.6%)	6.00 (2.00)	5.32 (3.22, 7.42)
Q6	Pushed me to take responsibility for my actions.	62 (64.6%)	6.00 (2.00)	5.32 (3.28, 7.36)
Q7	Provided opportunities to take initiative.	62 (64.6%)	6.00 (1.00)	5.44 (3.38, 7.50)
Q8	Created a safe space for me to share my thoughts and experiences.	62 (64.6%)	6.00 (2.00)	5.27 (2.92, 7.62)
Q9	Inspired me to see other possibilities for my future.	62 (64.6%)	6.00 (1.00)	5.32 (3.14, 7.50)
Q10	Encouraged me to finish tasks even if they were hard for me	62 (64.6%)	6.00 (2.00)	5.29 (3.21, 7.37)
Q11	Worked with me to solve problems and reach goals	62 (64.6%)	6.00 (2.00)	5.31 (3.29, 7.33)

- Localize the curriculum and employ culturally responsive pedagogical approaches. STEM curricula that are elevated to the experiences and contributions of people of color in STEM are crucial for students not only in forming their STEM identity but also in their retention in the field. The SA curriculum is focused on current issues affecting the community, making it possible for students to see the connections between careers in health and improving their communities as well as how their background has the potential to maximize their impact in the field. The curriculum takes a strengths-based approach with

a focus on community assets and existing structures that can help improve outcomes through system change.

- Focus on sociocultural factors beyond academics. By addressing systemic barriers (i.e., access to and availability of STEM resources, community violence, and academically/socially supportive groups), programs tailor a unique and supportive environment for underserved students, who are often first generation, to move forward with the social capital and knowledge of the STEM/health culture in terms of their academic success and personal

vitality. Key recommendations to remove additional barriers faced by students who live in an urban context include the development of key relational partnerships, having community leaders as instructors, incorporating budgetary flexibility to address the unique challenges faced by students, focusing on personal development and network expansion, and providing a localized curriculum.

- Develop a cohesive and strong evaluation plan that includes community feedback. Ongoing collection and analysis of program data and community feedback ensures that programming meets student and community needs, expectations, and preferences. Students, teachers, parents, and families should have a voice in the program's direction and services (i.e., food offered, STEM and health topics, student resources, program time frames, other). This openness is particularly key in working with communities whose voices have traditionally been silenced. Finally, longitudinal tracking of programs' outcomes is essential to ensure that the approach is effective, to develop evidence-based strategies to pathway work, and to persuade funding agencies of the value of investing in the future of underserved talented youth.

Conclusion

Effective pathway programs in under-resourced urban contexts require a comprehensive approach that goes beyond academics. Through alumni engagement; socioemotional support; and localized, strengths-based programming, programs like the Saturday Academy provide a holistic model of support that empowers students to overcome systemic barriers; build professional networks; and thrive academically, socially, and professionally. By combining these elements, such programs not only foster immediate student success but also help address the underrepresentation of students of color in STEM and advance equity in health and community outcomes. Future research should build on these findings using shorter, targeted surveys complemented by qualitative interviews and longitudinal designs to clarify the mechanisms through

which pathway programs influence career development, self-efficacy, and professional identity formation, particularly among students facing the greatest structural barriers.

Limitations of the Study

The results of this study must be interpreted with caution, and several limitations should be considered. Among the 96 individuals who completed the survey, 36 did so only partially; thus, the sample size was smaller than anticipated and might not be representative of the larger population. Missing data were handled using pairwise deletion, which may introduce bias if the data were not missing completely at random. There is also a threat of response bias, both social desirability bias—due to personal connections between participants and program staff—and recall bias, particularly considering the retrospective nature of the study. Social desirability bias is especially important to note in this context, as alumni may have felt pressure to provide favorable responses that reflect positively on the program, either out of loyalty, gratitude, or perceived obligation. Future research could mitigate this limitation by incorporating validated social desirability scales and emphasizing respondent anonymity more explicitly in survey instructions. At the same time, it is worth noting that participation in the program emphasized structured reflection and ongoing feedback, which may have helped to normalize honest self-assessment and reduce the extent of such bias. Additionally, survey length impacted alumni completion, as it created time constraints and decreased survey engagement. Thus, it is likely that the responses of those who completed the survey are systematically different from those who did not participate in the survey, affecting the generalizability of the results. Given the sparsity of studies, there remains an opportunity to continue exploring alumni perceptions of the role of pathway programming in their professional career choices. In addition to our alumni Facebook group, we plan to engage alumni in recruiting additional participants via chain sampling. Furthermore, on the basis of what we learned in the current study, we plan to explore the effects of the Academy on those who needed the most (i.e., lower baseline scores for professional network development and career literacy) but with shorter surveys as well as key informant interviews that can provide further insight into the Saturday Academy's impact.



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Appendix

Figure A1. Career Literacy and Awareness Domain Effect Sizes Represented by Means (Black Marker) and 95% Confidence Intervals

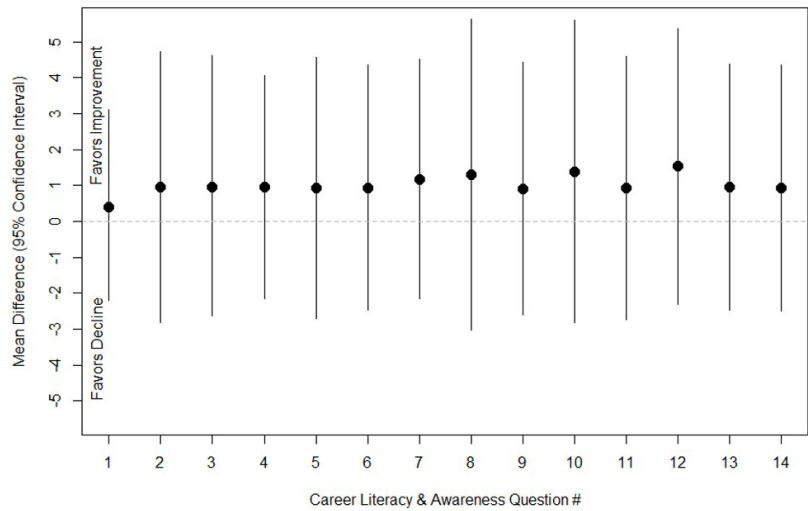


Figure A2. Personal Development Domain Effect Sizes Represented by Means (Black Marker) and 95% Confidence Intervals

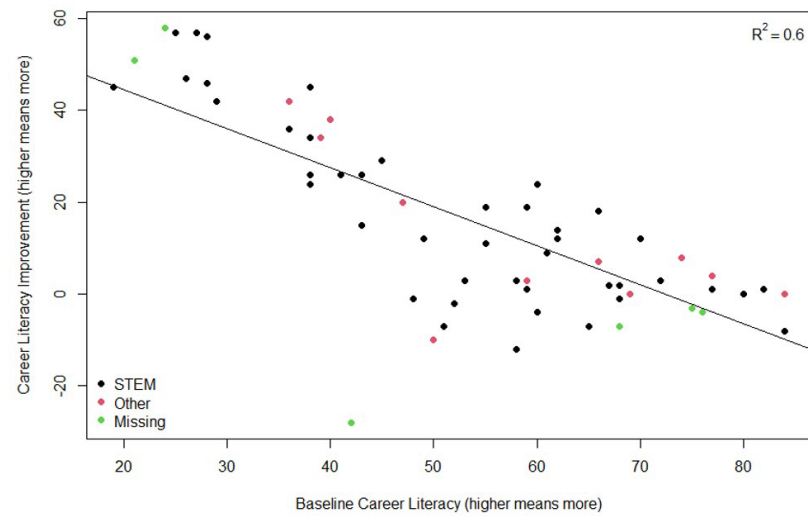


Figure A3. Scatterplot Showing Changes in Career Literacy (y axis) as a Function of Baseline Career Literacy (x axis), With Participant Responses Labeled According to Their Self-Reported Career Field

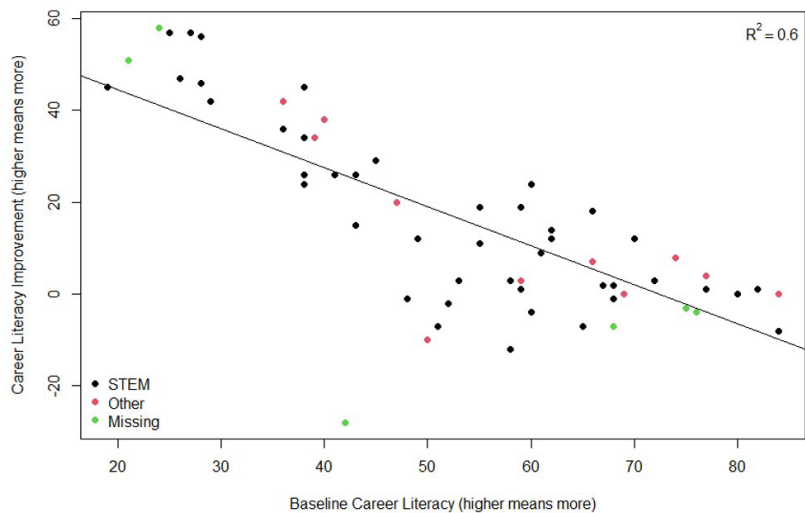


Figure A4. Scatterplot Showing Changes in Personal Development (y axis) as a Function of Baseline Personal Development (x axis), With Participant Responses Labeled According to Their Self-Reported Career Field

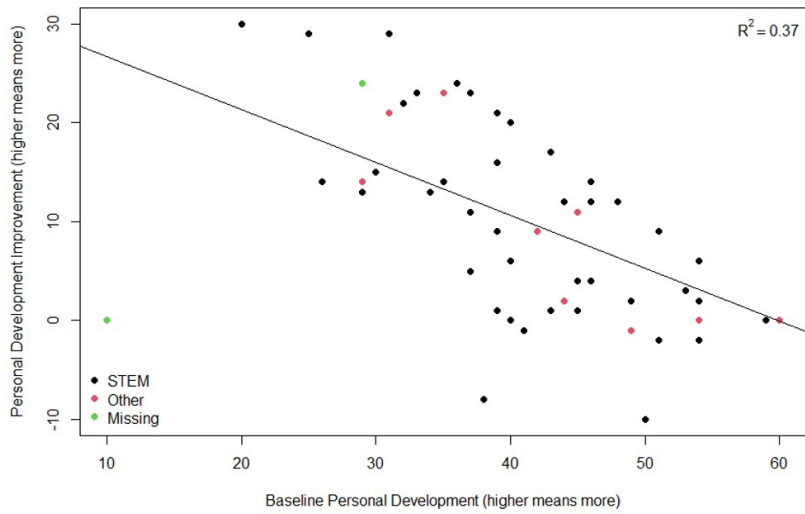


Figure A5. Boxplots Showing Changes in Personal Development (y axis) for Those With Low Versus High Self-Reported Barriers to Resources (x axis)

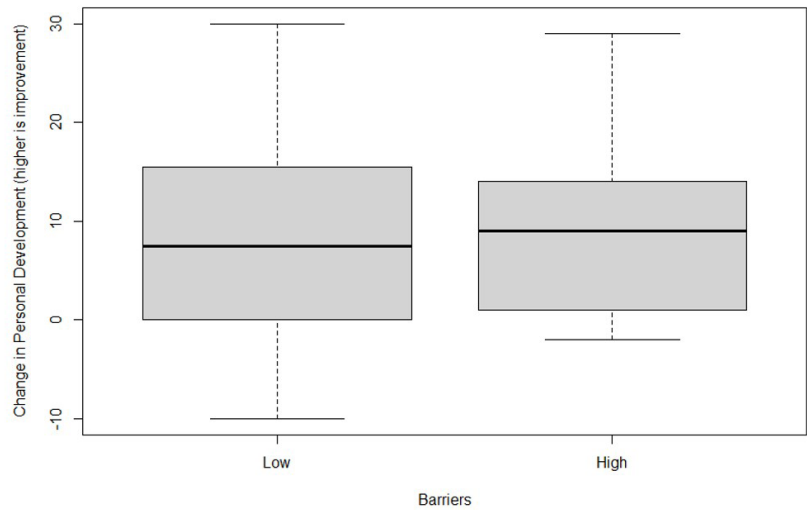


Figure A6. Boxplots Showing Changes in Career Literacy (y axis) for Those With Low Versus High Self-Reported Barriers to Resources (x axis)

