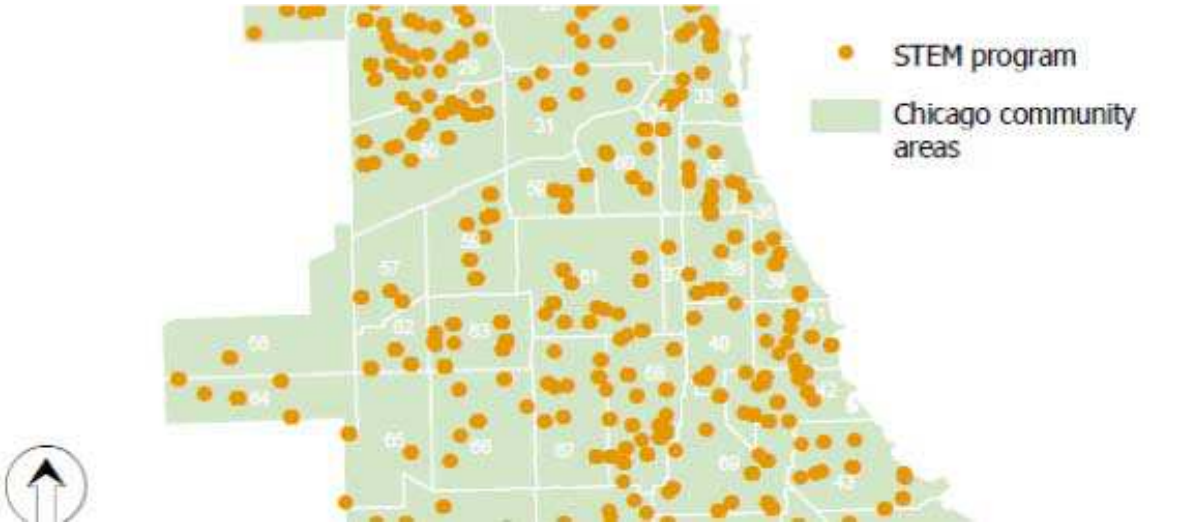
State of STEM in Out-of-School Time in Chicago

FINAL REPORT

Gabrielle Lyon, Project Exploration • stemchicago.wordpress.com • June 2013



Research from the Chicago STEM Pathways Cooperative

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Data referred to in this report is available for review and download online at http://stemchicago.wordpress.com/data.

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Knowledge and skills from science, technology, engineering and mathematics – the STEM fields – are crucial to virtually every endeavor of individual and community life. All young Americans should be educated to be "STEM-capable," no matter where they live, what educational path they pursue, or in which field they choose to work.

Institute for Advanced Study and Carnegie Corporation of New York Commission on Mathematics and Science Education, 2009

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ABOUT THIS PROJECT AND STEM PATHWAYS

The Chicago STEM Pathways Cooperative was formed with support from the Noyce Foundation and the Chicago Foundation for Women as a year-long, community-based effort to survey out-of-school (OST) time programs and consider the ways in which education institutions, businesses and city services could cooperate to build and support equitable and accessible pathways into science, technology, engineering and mathematics (STEM) for Chicago's young people. This project had three goals:

1. Gather and analyze data about Chicago's STEM opportunities in out-of-school time.
2. Bring stakeholders together to discuss what is most important when it comes to creating and supporting youth pathways into STEM.
3. Develop a set of recommendations and an action plan that would enable diverse young people to get, and stay, involved with STEM experiences from kindergarten through college.

In support of these goals, a leadership team representing youth development practitioners, youth program intermediaries, STEM education experts, researchers, policy makers and city agencies assembled in January 2012 to guide project strategy and work with stakeholders across the city to shape the overall project priorities.

The team articulated a "STEM Pathways" framework for thinking about what kinds of information to gather. For the purposes of this project "STEM Pathways" are defined as the progressive collection of STEM experiences a young person has between kindergarten and 12th grade.

The findings from the year-long study were presented at a conference in December 2012 with support from Chicago HIVE Learning Network, After School Matters, Motorola Mobility Foundation, and the Illinois Institute of Technology. The "State of STEM in Chicago in Out-of-School Time" conference brought together nearly 200 national and Chicago-area leaders from across education, science, technology, engineering, corporate, civic and city sectors to raise awareness and build community in support of coordinated pathways of continuous opportunities in K-12 STEM. More than one-third of the attendees were after-school or youth organization leaders, with strong representation from curriculum developers, science center and museum administrators, and after-school program instructors. Representatives from the City of Chicago and the philanthropic community also attended. The survey, report, raw data and conference documents are available at: http://stemchicago.wordpress.com; A LinkedIn group, "Chicago STEM Pathways Cooperative" has been set up at: http://stemchicago.wordpress.com/linked-in-group/.

WHAT DID THE PROJECT SURVEY?

The State of STEM project aimed to answer basic questions about Chicago's out-of-school time STEM landscape. How many opportunities are available? What content is being offered? Where are programs being offered? When are programs available? How do students get to programs? Who are programs targeting? What are the eligibility requirements? Are programs providing progressive and sequential learning opportunities over time?

To be included in the survey, programs needed to meet the following criteria:

- Meet outside of school time (weekends, afternoons and evenings, summer, school holidays).
- Serve youth in grades K-12.
- Serve Chicago Public School students, though not necessarily exclusively.
- Provide STEM programming as the primary purpose.
- Meet at least once for at least two hours or meet for multiple sessions.
- Run between January 1st and December 31st 2011.

The study analyzes patterns across two data sets. The first set consisted of data about programs funded by city-wide agencies and intermediaries including Chicago Public Schools, Department of Family Support Services, Chicago Public Library, Chicago Park District, and After School Matters. The second set of data was generated by a survey that targeted organizations whose programs were likely not included in city-agency data sets. The survey collected data parallel to what was available in city-funded programs as well as additional data having to do with program accessibility, participant eligibility and financial sustainability.

The leadership team reached out to individuals and networks of program providers involved with STEM education, workforce development and youth development to augment the survey data with feedback and recommendations. This study did not explore questions related to program quality, youth outcomes, curriculum, training or staff development.

The resulting data is not comprehensive: specific programs and organizations failed to make it into the final data set either because they did not participate in the survey or because they were not represented in the City of Chicago agency data sets. Due to budget constraints, the study was unable to include a youth "voice" component or to gather qualitative data from program participants.

WHY STEM IN OUT-OF-SCHOOL TIME MATTERS

Meaningful experiences with science, technology, engineering and math enable young people to become critical and collaborative thinkers. Research shows that high-quality experiences in school are necessary but insufficient for young people to get and stay involved with science, and to be equipped with the skills necessary to pursue science and engineering beyond high school graduation. Without an intentional plan for how young people will get – and stay – involved with STEM, the status quo will remain the same:

- Chicago's diverse young people will fail to experience the wonders of discovery or fully explore the world around them.
- Student achievement in Chicago in STEM in school will remain sub-par.
- African Americans, Latinos and girls will remain underrepresented in STEM in out-of-school time programming, college majors and in careers.
- Investment by funders and policymakers in STEM education efforts will lack systemic impact.
- Area companies will not have the local talent pool they need.

OVERVIEW

Summary:

- More than 2,032 out-of-school STEM programs were run by more than 500 organizations in 2011.
- STEM and out-of-school time programs served an estimated 88,576 students.
- The greatest number of programs targeted 6th-8th grade students.
- Programs served more girls than boys (56.2% and 43.8%, respectively).
- Latinos were underrepresented in programs compared to their representation in Chicago Public Schools.
- Libraries, museums and universities were underutilized as program sites in the summer compared with the school year, while community-based organizations took on a larger role during the summer.

A summary of the combined data sets is available in Appendix A of this report. Figures referred to below can be found in Appendix B: Figures and Charts.

Program Availability [Figures 1, 1a, 1b]

- Opportunities are available throughout most, but not all, Chicago neighborhoods.
- Programs seem to be clustered near cultural and academic institutions.
- More programs ran during the school year than during the summer. Up to 1,039 programs were available at any one time during the school year, compared to only 436 in the summer.
- There was more program diversity during the school year than during the summer; engineering as a subject lagged behind other content areas, particularly in the summer.
- Throughout the year, weekday programs outnumbered weekend programs by a ratio of 4:1 on the low end and 25:1 on the high end.
- The preponderance of programs operating in schools (77%), significantly outnumbered programs operating in other venues, such as parks or museums. [NOTE – this number isn't correlating – look at 1b]

Program Characteristics [Figures 2, 2a]

- Programs fell into four content categories: Science, Technology, Engineering and Math, or Multiple (meaning more than one content area was a "primary focus").
- Program experiences fell into three categories: structured inquiry-based, hands-on programs (69%); academic tutoring, including clubs (26%); and events (5%). Although there were fewer events offered than other types of program experiences, events reached the largest number of elementary and middle school students.
- Content exposure and knowledge development goals and activities were emphasized more frequently than technical skills or career readiness.

Participant Characteristics [Figures 3, 3a, 3b]

- The greatest number of programs targeted middle school (42%) followed by elementary school-age students (34%) and then high school students (24%). (n=1175, 943 and 662, respectively.)
- Programs served more girls than boys (56.2% and 43.8%, respectively).
- An estimated 44% of participants were African American and 28% were Latino. This compares to a CPS population of 42% African American and 44% Latino students.
- The two most frequently cited program eligibility requirements were: participants must be a CPS student (53.8%) and demonstrate a "stated interest in STEM" (62.2%).
- Programs were most likely to target low-income students (91.6%), past participants (63.3%), academically at-risk students (56.4%), students with special education needs (41.1%), and youth at-risk of violence (34.9%).
- Programs were least likely to target students who were undocumented (8.0%) and/or English Language Learners (10.2%).

Funding and Sustainability [Figures 4, 4a]

- Younger programs (5 years old or less) relied on one or two sources of funding; older programs (5-10 years old) had more diverse funding streams.
- Foundations were consistent funders across programs of all ages; older programs tended to have more corporate sponsorship than newer programs.
- A major statewide initiative to support STEM Pathways for college and career readiness for all students – the P-20 State of Illinois-led STEM education initiative – is funded through Race to the Top.

CHALLENGES

During the process of collecting data and soliciting survey responses, the leadership team reached out to many individuals involved with STEM and education in the city of Chicago, as well as networks of program providers to provide additional data, feedback and recommendations. The observations that follow are based on these conversations and stakeholder recommendations, feedback and survey results gathered from "State of STEM" conference participants.

1. STEM Coordination:
   - Chicago does not have an overarching STEM Pathways strategy for young people in grades K-12. There is no coordinating agenda or specific agency cataloguing programs, facilitating STEM program partnerships or city-wide program delivery goals, or promoting STEM opportunities to young people and their families.
   - Program providers are highly engaged, but have not organized around common goals.
   - Program providers do not have a common vocabulary, vision, or set of shared metrics when it comes to program goals or youth outcomes for STEM learning.
   - Many STEM programs run "under the radar." Hundreds of programs exist that are not funded by a city agency, and many run without a specific school partner. These programs are undocumented in city data systems.

2. Chicago Public Schools STEM Strategy:
   - Chicago Public Schools does not have a system-wide STEM education strategy that includes out of school time programming, nor is there a dedicated position for STEM after school programming.
   - There is no infrastructure for coordinated collaboration between STEM in- and out-of-school efforts, and no opportunity for STEM providers to identify students and their families for outreach or to report back to CPS on students' participation in meaningful STEM experiences outside of school.

3. Data Availability and Program Outcomes:
   - Data is hard to access and sometimes does not exist. There is no one single source for data on when and where STEM after school programs are being run, who is running them, who the programs are for, how many students are being served or longitudinal, or multi-program outcomes for participants.
   - Many organizations lack staff members dedicated to data collection or student participation tracking.
   - There is no set of shared or defined metrics that all program providers collect and report.
   - There is no organized channel for students to share insights and key learnings with adults or with their peers.

4. Accessing OST STEM Opportunities:
   - Latinos and undocumented students face the most challenges connecting to STEM programs due to program structure, eligibility requirements and a dearth of intervention strategies.
   - Access to STEM programs is uneven across the city, caused in part by language and transportation barriers.

RECOMMENDATIONS

Now that we have initial baseline data, what do we do with it? Chicago's existing STEM and out-of-school time programming is diverse, energized and widespread. However, it is relatively unorganized in terms of strategic vision, investments, or goals for outcomes. It is not enough to deliver existing programs or create new ones. A data-driven approach suggests we will need different strategies if we are going to involve underrepresented and disenfranchised students and if we are going to increase the numbers of students who not only participate in STEM out-of-school, but who pursue STEM in college and careers after high school. What will these mechanisms be and how will they be sustained?

As envisioned by the STEM Pathways Cooperative leadership team, a city-wide approach to fostering a robust STEM and out-of-school time system should focus on coordinating efforts that enable young people to get – and stay – involved with STEM throughout their growth and development. Enacting such a vision will require attention in the following areas:

Create a citywide STEM pathways education agenda that leverages an out-of-school time clearinghouse and coordinator who can help connect disparate STEM providers, communities, CPS, funders and policymakers through a public portal for young people, parents, educators and youth-advocates. An online clearinghouse should provide up-to-date information about available programs, share information with teachers and mentors, and provide a calendar of events and workshops. A key aim: provide up-to-date information about available STEM programs that is readily available, easy to use, and broadly promoted.

Prioritize funding that enables organizations to collaborate and coordinate services and learning between and amongst youth organizations. Capacity building investments for organizations, innovative opportunities for underserved populations, and professional development for adults will help increase access, equity, and quality. An active, networked community of program providers who have the capacity to collaborate over multiple years on complementary STEM program opportunities should be developed and supported.

Invest in data collection, data sharing and data analysis that will help support program collaboration, increased quality and longitudinal student outcomes related to persistence I STEM. STEM and out-of-school time programs support positive youth development such as career-readiness, socio-emotional skills, and leadership development. In the absence of a well-defined, shared set of definitions of content, program goals, and outcomes, the assessment of program quality and the strengthening of youth-centered outcomes will remain a challenge. Creation of such a set of shared language and best-practices for data collection would facilitate collection and analysis of longitudinal data, program management, and analysis of meaningful youth participation.

Establish mechanisms that ensure structured, ongoing communication between CPS central office, individual schools, and OST STEM providers. Program providers seeking to send information to youth and families should be able to submit desired/target population requests (kindergarteners, eighth-graders with a 2.0+ GPA, Latinas enrolled in trigonometry or higher, participants in computer science classes, etc.) to CPS. More broadly, there should be greater sharing of information – participation and program distribution data, program availability, eligibility information, and success stories.

Use data about the current landscape to set priorities within organizations and across existing networks. Data should be used to inform program development and delivery of new programs, to increase summer program opportunities and to better capitalize on libraries and parks as programming sites. Increase developmentally-relevant program opportunities that will foster positive identity development and advanced skill development through internships and mentorships.

Reduce barriers to entry for underserved youth, particularly Latino youth and youth who struggle academically. CPS and

STEM providers should create multi-lingual programs, promotional materials and content. Reduced-fare public transportation on weekends and school holidays for high school students will ease access to programs. Increasing free and low cost programs in public venues (such as parks and libraries, in addition to schools) during non-school hours will help ensure broader access in otherwise underserved neighborhoods.

Invest in building and strengthening relationships with parents, teachers, and networks of program providers who can serve as allies. As demonstrated by participation in the community survey and the December conference, a diverse community shares the agenda of ensuring quality out-of-school time opportunities in STEM for all of Chicago's youth. Targeted efforts should be made to reach the most vulnerable students and engage the most economically disadvantaged parents. Information about STEM opportunities can be combined with other technology, literacy and community development efforts. After school programmers can, and should, work in partnership with teachers and schools to ensure structured connections between young people's out-of-school experiences and their academic lives. made to reach the most vulnerable students and engage the most economically disadvantaged parents. Information about STEM opportunities can be combined with other technology literacy and community development efforts.

Provide enhanced professional development. STEM program providers/ instructors should be able to take advantage of courses that help improve inquiry, reflection and program design. Professionals also should learn how to design databases and analyze data.

NEXT STEPS

If this is the work ahead, a new set of questions arise:

- How does the City ensure programs are high quality and accessible for many kinds of students – particularly students who are currently overlooked?
- How should program providers organize their individual efforts for a collective impact for youth?
- How can out-of-school experiences in STEM be connected to young peoples' in-school lives?
- What knowledge and experiences matter for young people to develop across their STEM program experiences?
- How do program providers become more youth-centered?
- What measures matter?
- How can existing networks function as allies/contributors/supporters in service to youth engagement and persistence in STEM in out-of-school time.

Adoption of a city-wide STEM Pathways strategy could have a dramatic influence not only on the workforce development pipeline, but also ensure that the full spectrum of Chicago's young people have the opportunity to make discoveries about the world and themselves.

Appendix A: Overview of Full Data Set

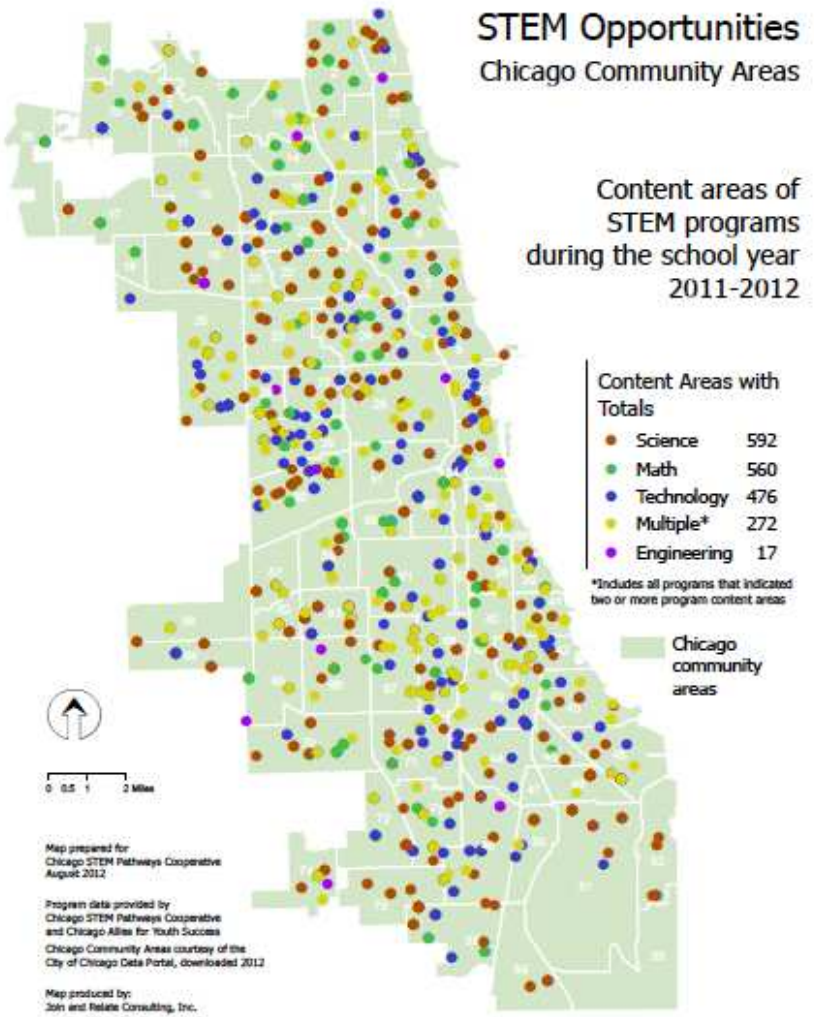
	Administrative Sample	Survey Sample	Full Sample
Programs	1,718	314	2,032
Organizations	443	75	507*
Academic/Tutoring	528	5	533
Events/Outreach	62	35	97
STEM	1,128	272	1,400
Science	650	123	773
Technology	551	29	580
Engineering	5	14	19
Math	607	78	685
Three or more categories	5	151	156
Winter	849	190	1,039
Spring	702	199	901
Summer	336	100	436
Fall	669	199	868
Weekdays	1,690	233	1,923
Weekends	72	59	131
Park-based	126	13	139
School-based	1,400	166	1,566
University-based	11	20	31
Library-based	72	5	77
Museum-based	0	17	17
CBO/Other-based	109	90	199
Elementary	764	180	943
Middle	976	214	1,175
High	530	145	662
Post-secondary	110	14	124
Avg. # sessions	17.0	33.5	19.1
Avg. minutes per session	96.0	126.5	100.4
Avg. weeks in length	9.6	18.1	10.7
Total participants	31,173	57,403	88,576
Total avg. daily attendants	22,938	5,216	28,155
Avg. # participants	18.9	190.1	45.4
Avg. daily attendants	13.9	39.2	15.8

* Some organizations overlapped between survey and administrative samples so organizations do not sum to 507. Individual schools and parks were treated as independent organizations.

i Team members were: Jennifer Axelrod, Chicago Public Schools; Jim Cheshire, Chicago Allies for Youth Success; Mike Davis, City Colleges of Chicago; Jerry Doyle, Illinois Institute of Technology; David Sinski, After School Matters; John Tolva, City of Chicago; John Loehr, STEM consultant; Stephanie Levi, Northeastern Illinois University; Gabrielle Lyon, Project Exploration; Rabiah Mayas, Museum of Science and Industry; and Jeff McCarter, Free Spirit Media.

ii Networks which participated during data collection included: Chicago HIVE Learning Network, Chicago Wilderness, Chicago Youth Voices Network, Ingenuity, Museums in the Parks, World Business Chicago, Smart Chicago.

School Year vs. Summer STEM Programs



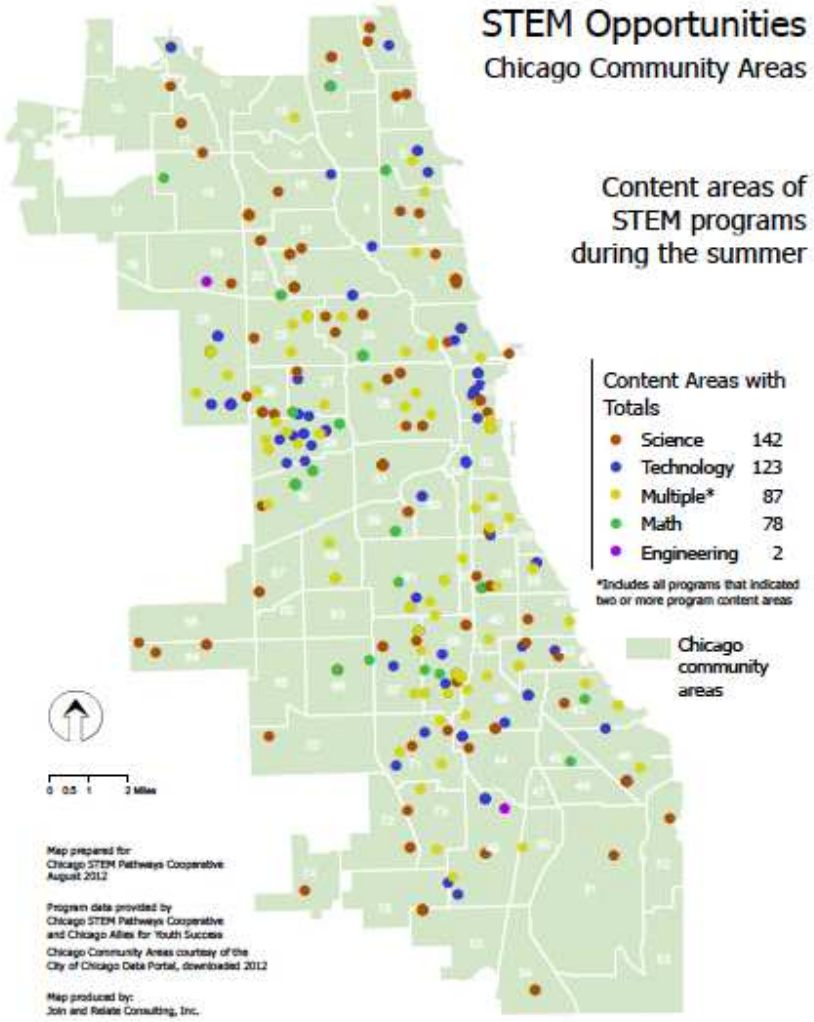
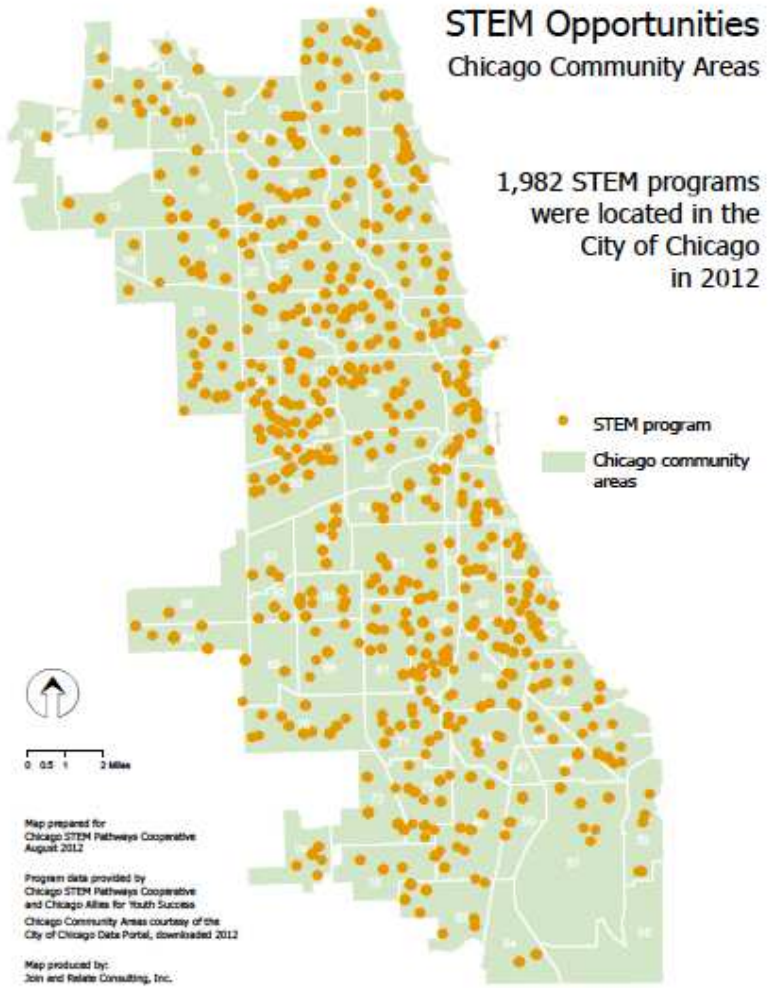


Figure 1a

Out-of School Time STEM Programs in Chicago in 2011



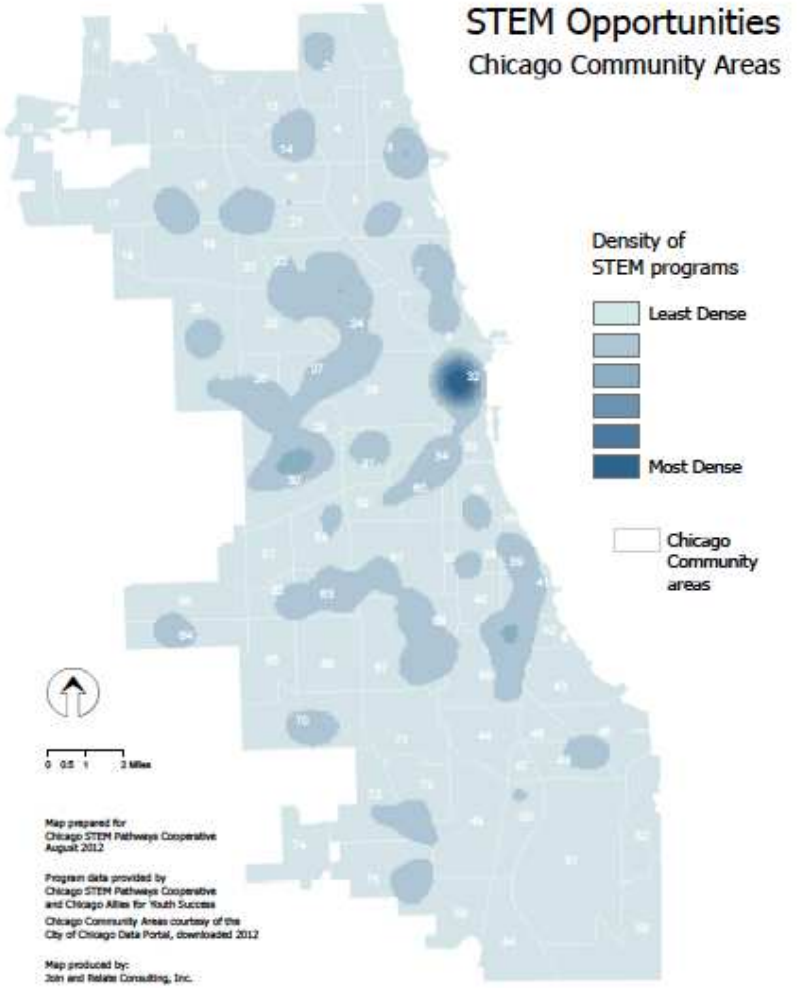
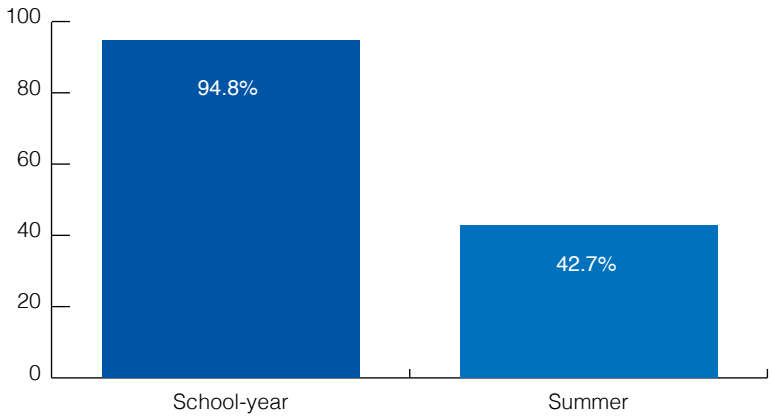


Figure 1

Program Availability

Percent of STEM Programs Available by Time of Year



Percent of STEM Progams by Site Type

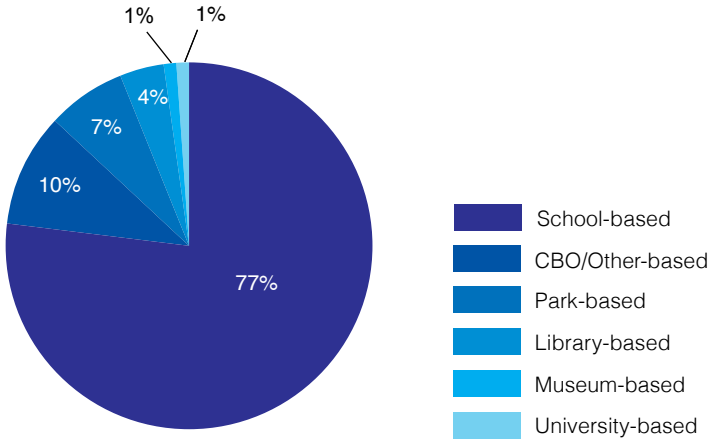
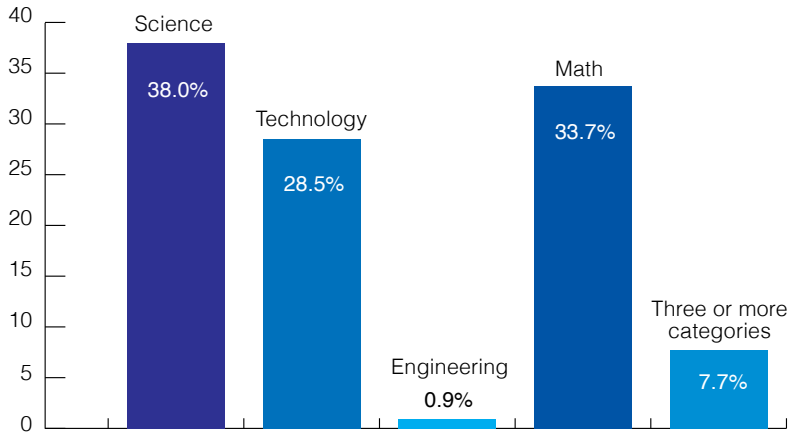


Figure 1b

Program Characteristics

Percent of STEM Programs by Content Category



Percent of STEM Programs by Program Type

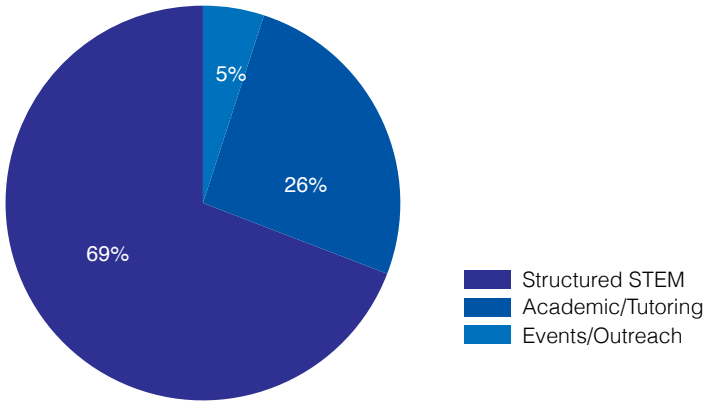


Figure 2

"Structured" STEM Program Content: Goals & Activities

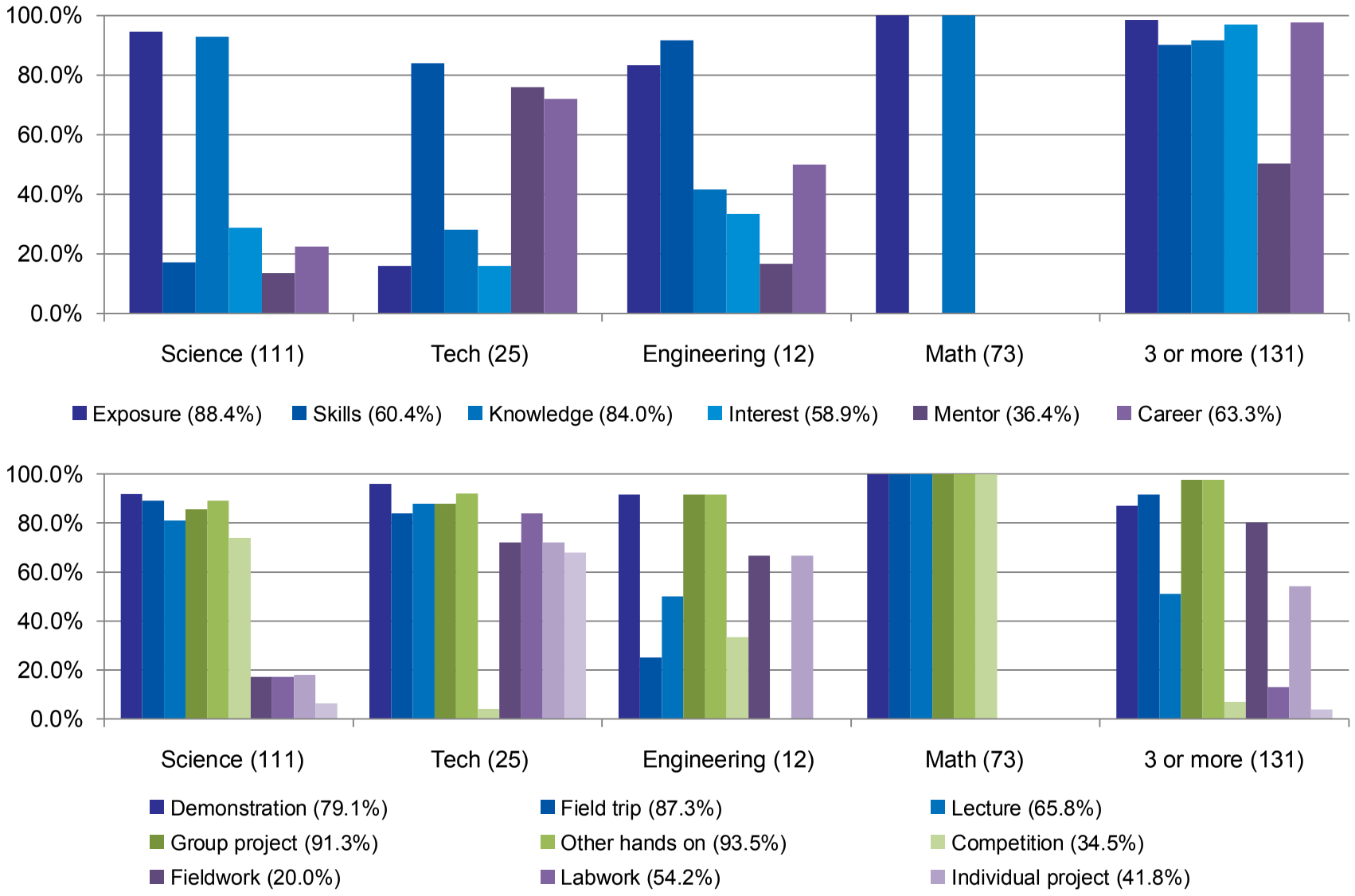
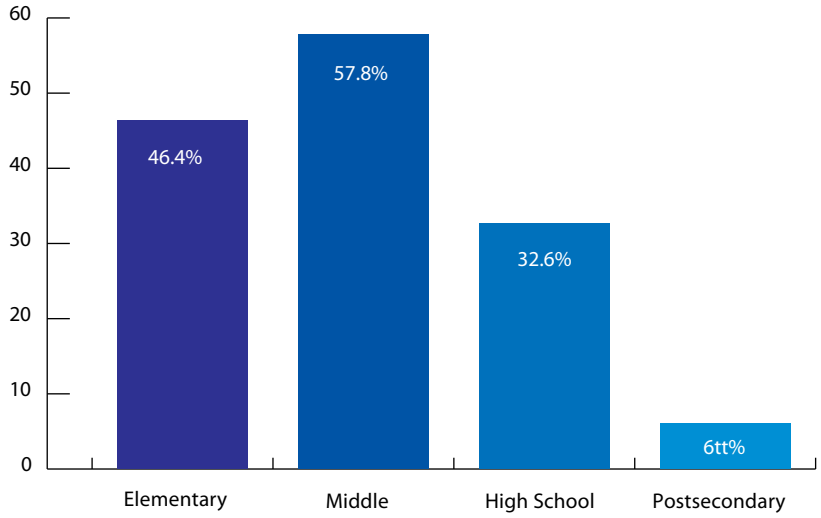


Figure 2a

Participant Characteristics

Percent of STEM Programs
by Grade Level Served



Percent of STEM Participants
by Gender

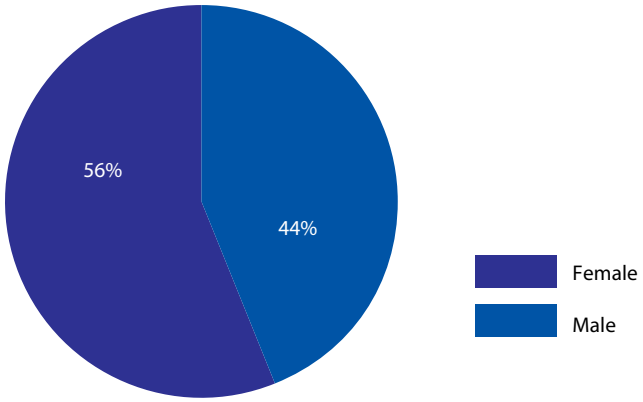
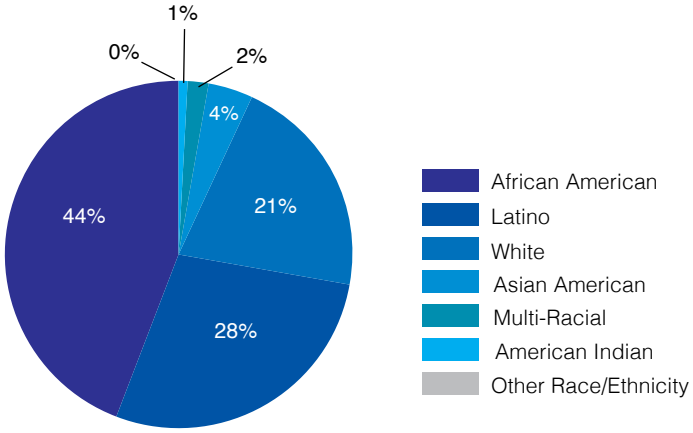


Figure 3

Participant Race/Ethnicity

Percent of STEM Participants by Race/Ethnicity



Percent of 2011-2012 CPS Students by Race/Ethnicity

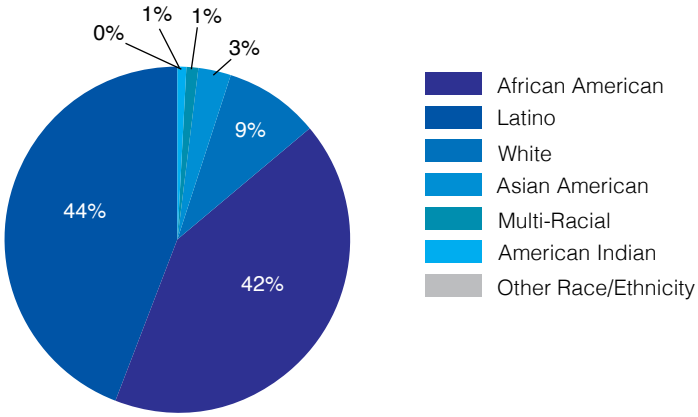


Figure 3a

Eligibility by Program Goal

Structured STEM N=275	Exposure	Build Skills	Increase Knowledge	Lifelong Interest	Career Paths	Provide Mentors
None						
Grades						
Stated Interest						
Neighborhood Residence						
Socio-Economic Status						
Age						
CPS Students						
Female-only						
Male-only						
Teacher Recommendation						

	0 – 9.9%
	10.0 – 19.9%
	20.0 – 29.9%
	30.0 – 39.9%
	40.0 – 49.9%
	50.0 – 74.9%
	75.0 – 100%

Figure 3b

Target Audience by Program Goal

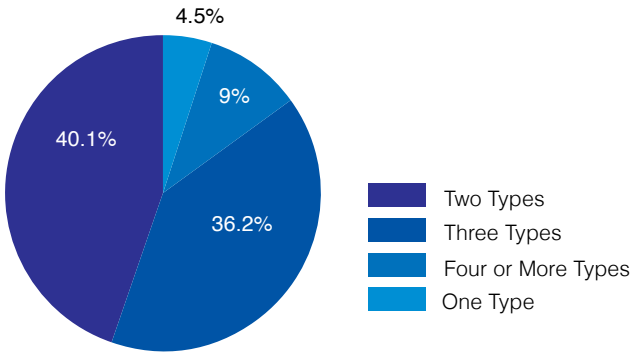
Structured STEM N=275	Exposure	Build Skills	Increase Knowledge	Lifelong Interest	Career Paths	Provide Mentors
CPS Students						
Low Income Youth						
Students with Special Education Needs						
English Language Learners						
Undocumented Youth						
Past Participants						
At-Risk of Violence						
Academically At-Risk						

	0 – 9.9%
	10.0 – 19.9%
	20.0 – 29.9%
	30.0 – 39.9%
	40.0 – 49.9%
	50.0 – 74.9%
	75.0 – 100%

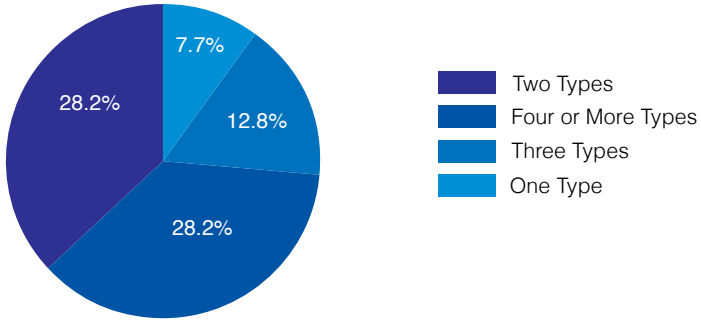
Figure 3c

Program Age by Funder Diversity

One - Five Years (162)



Six - Ten Years (30)



Ten or More Years (76)

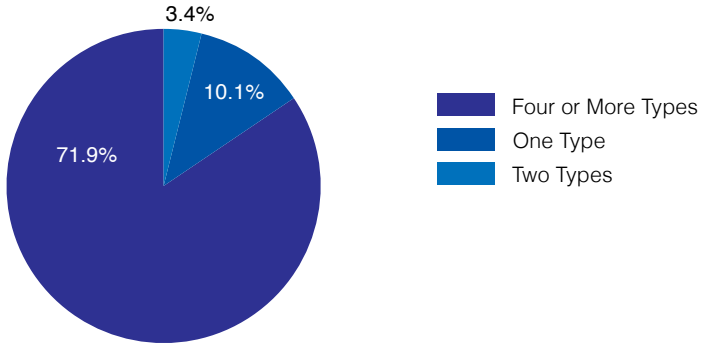


Figure 4

Program Age & Types of Funding

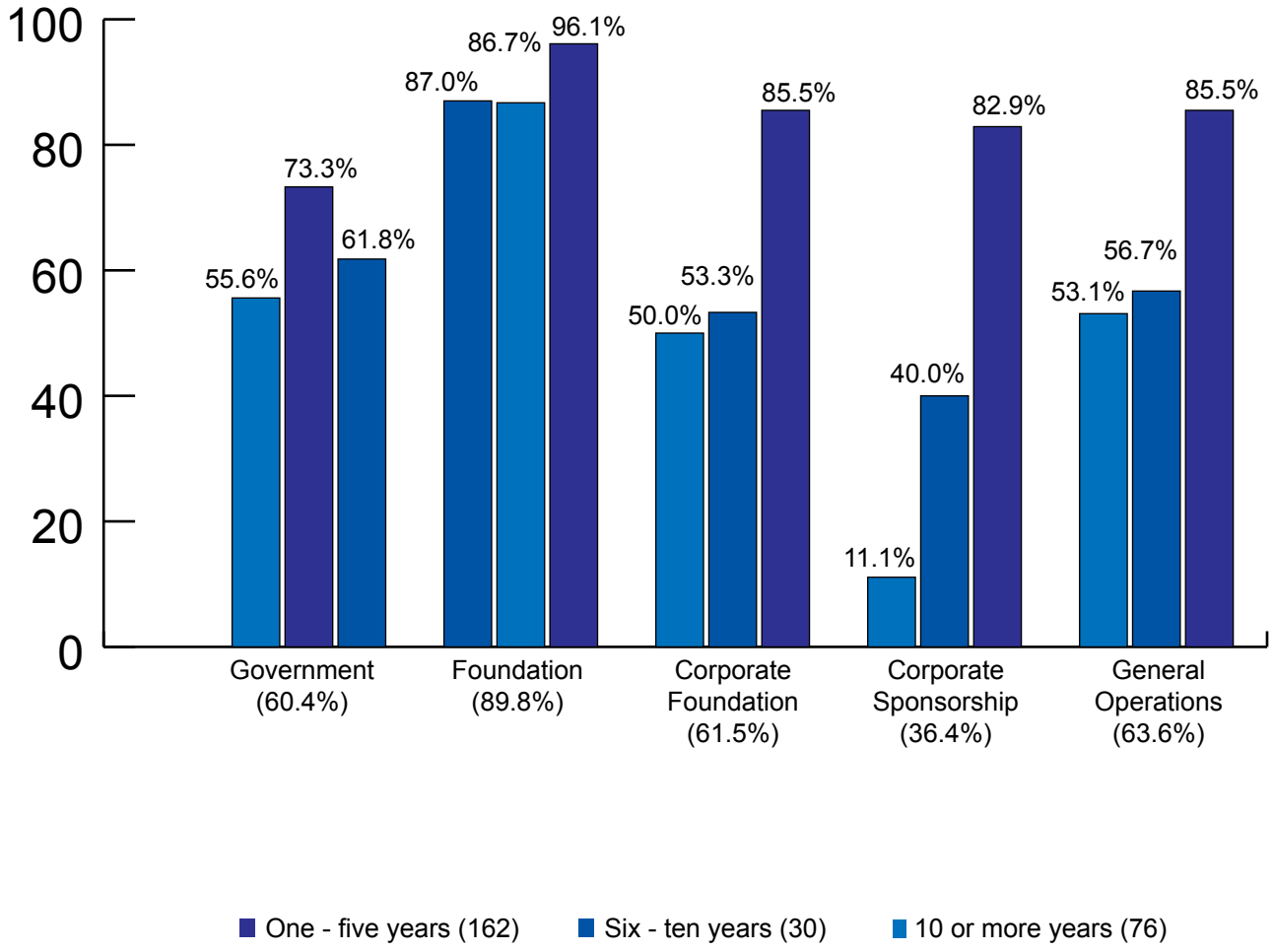


Figure 4a

Appendix C: Conference Presenters and Facilitators

We would like to thank all of our participants, including speakers and breakout session facilitators. Without their dedication, passion and hard work, the conference would not have been possible.

Speakers

Alan Cramb, Provost and Senior Vice President for Academic Affairs, Illinois Institute of Technology
Akeshia Craven-Howell, Officer, Pathways to College and Careers, Chicago Public Schools
Jessica Donner, Director, Collaborative for Building After School Systems
Jerry Doyle, Vice Provost for Student Access, Success, & Diversity Initiatives, Illinois Institute of Technology
Damian Ewens, Director, Providence After School Alliance High School Initiatives
Gabrielle Lyon, Cofounder and Executive Director, Project Exploration
Dan O'Neil, Executive Director, Smart Chicago Collaborative
Michael Ramirez, University of Illinois Chicago, Third Year Communications Major
Andrew Rice, Senior Policy and Research Analyst, Chicago Allies for Youth Success
John Tolva, Chief Technology Officer, Office of the Mayor, City of Chicago

Facilitators

Michael Davis, City Colleges of Chicago
Peggy Espada, National Summer Learning Association
Christian Greer, Chicago HIVE Learning Network
Rabiah Mayas, Museum of Science and Industry
Jeff McCarter, Free Spirit Media
Michael Ramirez, University of Illinois Chicago, Third Year Communications Major
Rafael Rosa, Vice President of Education, Peggy Notebaert Nature Museum
Hillary Stroud, Director, Strategic Initiatives and Evaluation, National Summer Learning Association
Tony Streit, Education Development Center, Inc.
Heather Thiry, University of Colorado
Christy Uchida, Brinson Foundation