



Advancing Equity in STEM Education Through Collective Action: A Biogen Case Study

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NPEA
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Meeting
the Moment

Reimagining
Equity and Access
for a New
Educational Era

Speakers



Sonja Okun

 **rootCAUSE**

Principal



Jamie Hennick

 **rootCAUSE**

**Senior Manager of
Strategic Initiatives**



Alekhya Chaparala

 **rootCAUSE**

Manager

About Root Cause

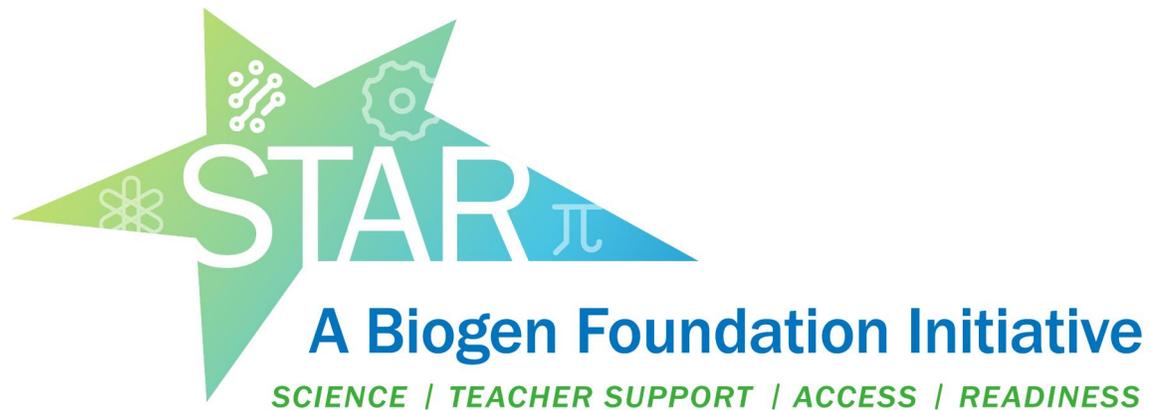
Root Cause is a nonprofit consulting team that helps drive effective and enduring social change.

Our mission is to be a transformative partner in building, improving, and sustaining social change initiatives that enable all people to thrive. We help nonprofits, public agencies, and philanthropies achieve their goals while advancing racial and economic equity and justice.



The Origins of STAR

In 2017, the Biogen Foundation engaged Root Cause to help design and implement a new, multi-year, collective-action philanthropic initiative in STEM education. In 2018, the Biogen Foundation launched **STAR (Science, Teacher support, Access & Readiness)**, a \$10M, four-year investment designed to drive STEM education equity in Cambridge and Somerville, Massachusetts. In 2021, given the continued impact of the pandemic and the vital roles STAR grantees play in supporting some of the region's most vulnerable children and families, the Biogen Foundation committed to funding STAR through year 5 (2023).



Through STAR, Biogen is:

- **Investing in six high-performing nonprofits** that serve students in grades 6-14 and
- **Coordinating a multi-stakeholder network** that serves students historically underrepresented in STEM college and career pathways, notably, students of color.

STAR Partner Information

STAR Grantees



School District Partners



Funder



Network design & facilitation

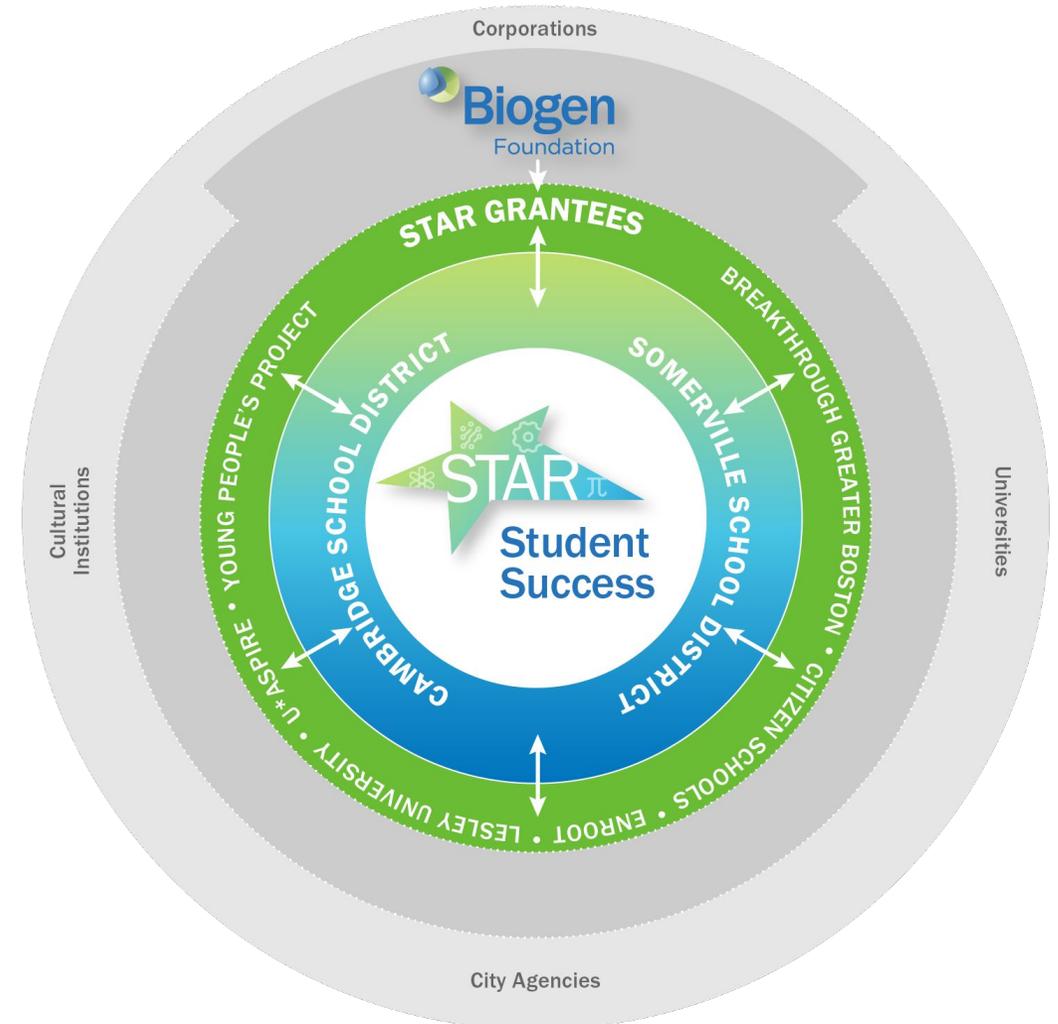


STAR's Collective Action

The STAR Initiative has helped grantee organizations and schools build and deepen relationships as a foundation for a coordinated, sustainable network whose collective impact is greater than the sum of its partners.

STEM ecosystems cultivate relationships that maximize each stakeholder's unique contribution to ensuring all students have equitable access to STEM resources and opportunities.

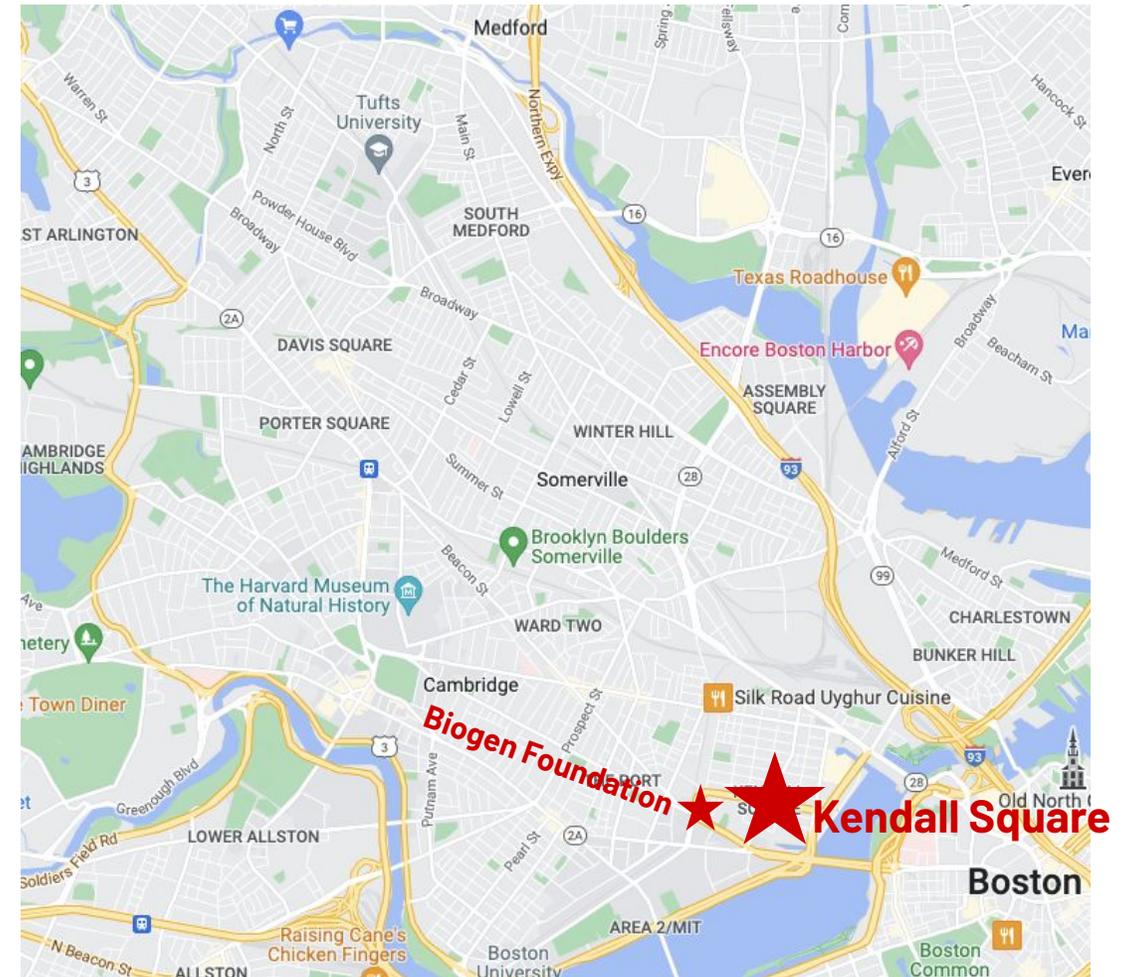
Typically, these networks have one backbone organization, or network manager (Root Cause in the case of STAR), that facilitates collective action amongst stakeholders. These can include: schools and districts, out-of-school-time programs, leading STEM institutions (i.e. higher education, industry leaders, science centers, etc.), the private sector, public agencies and other community-based organizations, young people, and their families. There is no better place poised to lead the way in building a strong local STEM education ecosystem than the Greater Boston area, home to Kendall Square - one of the world's most powerful life sciences and technology hubs.



The Origins of STAR

The Biogen Foundation has made a visionary commitment through STAR. There is no better place poised to lead the way in building a strong local STEM education ecosystem than the Greater Boston area, home to **Kendall Square**—one of the world's most powerful life sciences and technology hubs.

Biogen Foundation began by investing in the communities it is in closest proximity to - Cambridge and Somerville - with the vision that STAR could potentially scale to additional Greater Boston communities at some point.



Key Components of STAR

One of the most important and unique aspects of the STAR collective action initiative is the **engagement of both school districts in the network**. STAR liaisons from each grantee organization, and each school district, have met monthly and worked collaboratively for over three years with the shared goal of advancing STEM education equity.

The myriad challenges the pandemic has posed for students and families has highlighted the critical role that out-of-school time organizations play in leveling the playing field for students who typically do not have equal access to STEM exposure and enrichment opportunities.



Grantee Organizations

Key Components of STAR

Biogen Foundation's investment in **supporting STAR Data Specialist positions** in each school district is helping to optimize the work of grantee organizations and schools by analyzing STAR's impact.

The alignment of data collection and analysis between STAR and the school districts STAR serves helps organizations better understand:

- **Who they serve,**
- **How students experience STEM education** in middle and high school, and
- **How STAR as a network can strengthen individual and collective practices to help more students** - specifically students of color, low-income students, and English language learners - become better prepared to pursue STEM education and career pathways.

Assessing STAR's Impact

Assessing STAR's Impact

STAR stakeholders collaborated to develop a common purpose and shared outcomes

Research shows that measuring student outcomes in STEM education ecosystems is incredibly challenging. Most STEM ecosystems limit measurement to the size, diversity, and functioning of the network partners. In Year 1, STAR stakeholders developed some broad network-wide shared outcomes to work towards:

Student & Educator Outcomes	Network Outcomes
Increase in number of Cambridge & Somerville students, historically underrepresented in STEM careers, participating in and gaining deeper STEM exposure and learning opportunities/activities	STAR grantee organizations have more effective communication and coordination as a means of meaningfully working to strengthen student and educator outcomes
Increased number of Cambridge & Somerville students, historically underrepresented in STEM careers, expressing an interest in and persisting in, and prepared for pursuing STEM education and/or career pathways	STAR grantee programs are more effectively aligning with and complementing school districts' goals as part of a unified effort to build STEM education ecosystems that effectively serve all students
Increase in educator confidence in teaching STEM-related subjects	
Increase in educators' use of hands-on/experiential activities to help connect STEM subjects to real world applications	

Assessing STAR's Impact

Measuring the impact of a collective action network with diverse stakeholders is challenging

- For STAR, 5 of the 6 grantees provide direct services to students, and 1 grantee is a university focusing on teacher professional development.
- The 5 student-facing organizations:
 - Range significantly in size and scale (i.e. local vs. national, budget size, etc.)
 - Serve different students (e.g. middle and/or high school, and post high school)
 - Measure different things, and
 - Use different methods for measuring outcomes and impact.

Assessing STAR's Impact

The collaboration of school districts and grantees led to a proposal from the Superintendent of Somerville public schools for embedding staff in districts to help analyze the impact of this collective action initiative.

- In Year 3, to support and optimize the connection between the work of schools and STAR grantee organizations, Biogen Foundation funded two new part-time STAR Data Specialist positions who work for the Cambridge and Somerville public school districts. Having positions embedded in the districts can maximize data sharing amongst all the stakeholders and enable analysis of multiple angles of STAR's impact.
- STAR Data Specialists were hired in both Cambridge and Somerville at the end of 2020. The Data Specialists worked with the STAR data and evaluation committee, and Root Cause, to develop an initial evaluation plan.

Assessing STAR's Impact

The STAR Data Specialists developed an initial evaluation plan

Table 1. STAR Outcomes & Research Questions	
Outcomes	Research Questions
General: Understanding who is being served	How have the profiles of students served in STAR programs changed since the STAR initiative began?
	<i>What is the profile of students served by STAR initiative programs?</i>
Short Term: Students develop interest in STEM	How has participation in STAR programs impacted the interest students have in STEM?
	<i>How do students' interests in STEM compare between those enrolled in STAR programs and peers who are not?</i>
Mid-Term: Students develop capacities to be successful in STEM	Have students improved habits of mind for 21st century learners? (Ex. persisting, problem solving, communication)
	<i>Are STAR students more likely to enroll and persist in high level math and science courses or take additional STEM courses?</i>
Data capturing changes in STAR students over time (Bold)	
<i>Data comparing STAR students with non STAR students (Italicized)</i>	

Table from STAR Evaluation Plan Spring 2021

STAR Grantees & Impact Years 1-3



Number of Youth Served in STAR Years 1-3 (2018-2021)

	BTGB # of students served	Enroot # of students served	YPP # of students served	uAspire # of students served	Citizen Schools # of students served	Lesley University # of students served	Total unique* students served in years 1-3
Cambridge	283	140	231	689	N/A	30	1,225
Somerville	138	130	N/A	315	833	525	1,825
Organization Total students served in both districts	421	270	231	1,004	833	555	3,050

Initial Analysis: Who is STAR Serving?

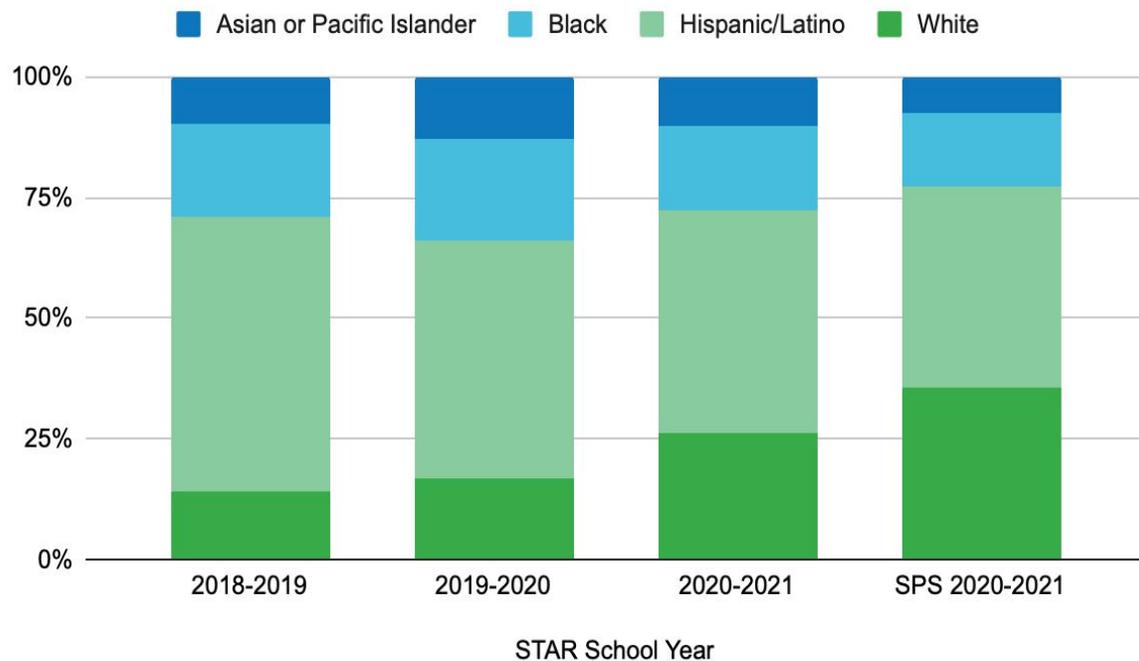
This first level of research showed that the proportion of underrepresented students participating in STAR is higher, and in some cases much higher, than the proportion of these students in each school district.

- In both Somerville and Cambridge, **the percentages of students of color and students from low-income families in STAR programs are much higher** than the percentages of students of color and students from low-income families in each respective school district. This trend, to a less degree, held true with non-native English speakers and female students.
- **The percentage of Hispanic students served by STAR programs in Somerville was higher** than the percentage of Hispanic students in the Somerville Public Schools district.
- **The percentage of Hispanic students served by STAR programs in Cambridge was comparable** to the percentage of Hispanic students in the Cambridge Public Schools district.

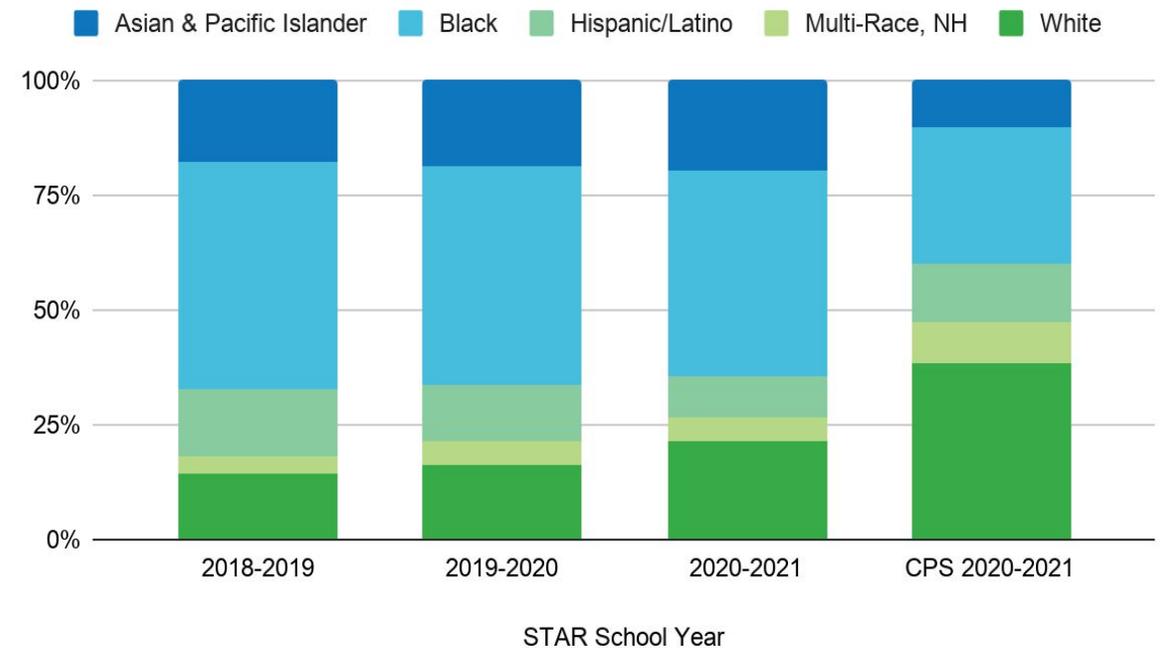
Initial Analysis: Who is STAR Serving

An example of data from Phase 1 of the Spring 2021 Evaluation Plan: How does the race/ethnicity of students served by STAR grantees each year compare to that of students across the school districts?

Somerville STAR Race/Ethnicity



Cambridge STAR Race/Ethnicity



Initial Analysis: Who is STAR Serving?

Cambridge Public Schools have had the resources to invest in building a data platform that tracks what out-of-school-time (OST) programs students are enrolled in. While data in the system is incomplete (not all OST programs are registered in the portal yet), the Cambridge STAR Data Specialist is able to compare students in STAR programs to students in all other OST programs, and to students not enrolled in any OST programs.

The data analyses the STAR Data Specialist has begun in his first year have tremendous potential for helping the district analyze all OST programs.



Underrepresented students in STAR vs. Cambridge Public Schools and other OST Programs (pt 1)

School Year	*of Color				Hispanic				English Language Learners (ELL)			
	STAR	CPS	CPS OST	CPS No OST	STAR	CPS	CPS OST	CPS No OST	STAR	CPS	CPS OST	CPS No OST
2018-2019	86.3%	62.0%	57.2%	63.5%	16.1%	14.8%	11.9%	15.7%	11.6%	6.1%	2.9%	7.2%
2019-2020	85.8%	61.4%	78.8%	60.5%	15.3%	15.3%	21.2%	15.0%	10.5%	5.3%	5.3%	5.3%
2020-2021	80.3%	61.5%	82.7%	55.6%	11.8%	15.4%	12.7%	16.1%	6.4%	4.2%	5.1%	3.9%

[Continued >](#)

STAR: All Cambridge students participating in programs with any of the five student-facing STAR grantees in the given school year

CPS: Students enrolled in Cambridge Public Schools in grades 6-12 in the given school year

CPS OST: CPS students grades 6-12 who have participated in at least one out-of-school time program during the given school year

CPS No OST: CPS students grades 6-12 who have not participated in any out-of-school time program during the given school year

Though extensive data has been collected on OST participation, it is not comprehensive. Data on OST participation outside of STAR has only been collected in Cambridge, not Somerville



*Note: "of Color" refers to any student who is NOT a white person of non-Hispanic ethnicity

Underrepresented students in STAR vs. Cambridge Public Schools and other OST Programs (pt 2)

School Year	Female				Low-Income				SPED			
	STAR	CPS	CPS OST	CPS No OST	STAR	CPS	CPS OST	CPS No OST	STAR	CPS	CPS OST	CPS No OST
2018-2019	53.7%	49.5%	42.2%	51.9%	70.4%	45.1%	34.3%	48.7%	15.6%	23.1%	13.7%	26.2%
2019-2020	60.1%	49.7%	37.1%	50.3%	73.2%	45.4%	68.8%	44.3%	15.9%	23.1%	25.3%	23.0%
2020-2021	56.6%	48.5%	55.4%	46.6%	59.8%	44.0%	60.2%	39.5%	13.9%	23.9%	20.7%	24.7%

STAR: All Cambridge students participating in programs with any of the five student facing STAR grantees in the given school year

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Aligning STAR and School District Research

Opportunities have arisen for the STAR Data Specialists to to **align STAR research with Cambridge and Somerville school districts' evaluation priorities**, by helping to measure goals using accurate and current data. This work has involved:

- Meeting with the STAR Data Committee, which includes district data personnel, to narrow lines of inquiry
- Extending the reach of STAR data analysis to school district stakeholders, including Math and Science teachers
- Identifying indicators of impact - from STAR as well as each school district's strategic initiatives - on student STEM course enrollment and performance in STEM subjects

Aligning STAR and Somerville Public Schools Work

In Somerville, the Data Specialist's analysis of math and science course-taking data has **created the opportunity for directors of STEM subject departments and guidance counselors to view the evolution of course pathways at the high school in one centralized dashboard.**

This dashboard allows users to view trends over several schools years and includes demographic filters that can be used in tandem. It will aid in guiding conversations around

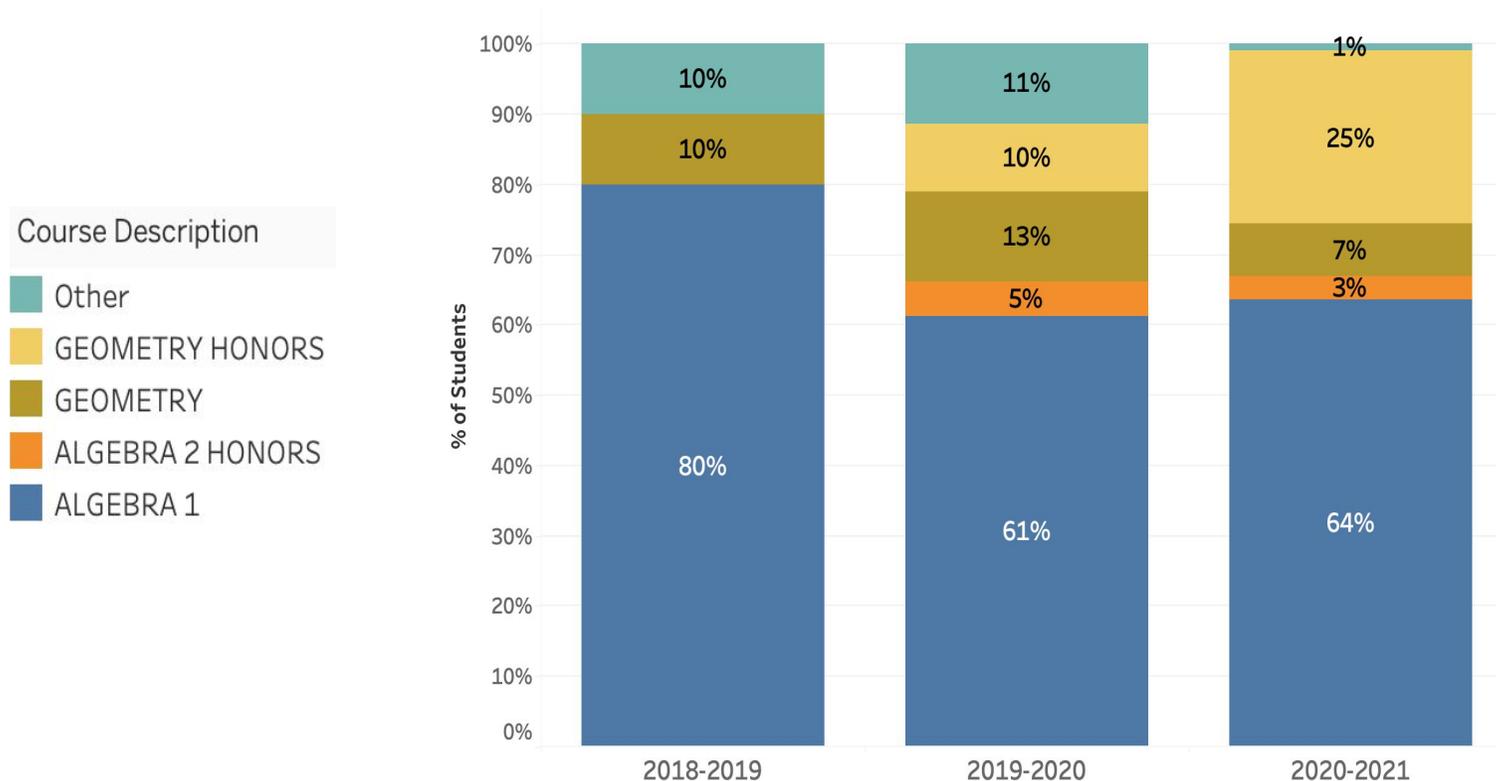
- The impact of out-of-school time enrichment for students and the need to expand out-of-school time programming (a high-priority goal as specified by students on the Somerville Public Schools' Student ESSER III Survey)
- The impact of removing teacher recommendation requirements and implementing open honors programs
- Addressing inequities in course taking among underrepresented student populations (i.e. Black, LatinX, low-income, multilingual learners, etc.)



Somerville Public Schools: Course Enrollment Preliminary Findings

The Somerville Data Specialist found that **there has been an increase in the percent of STAR students taking Geometry Honors (a more rigorous math course) and a decrease in the percent of STAR students taking Algebra 1 (a less rigorous math course).**

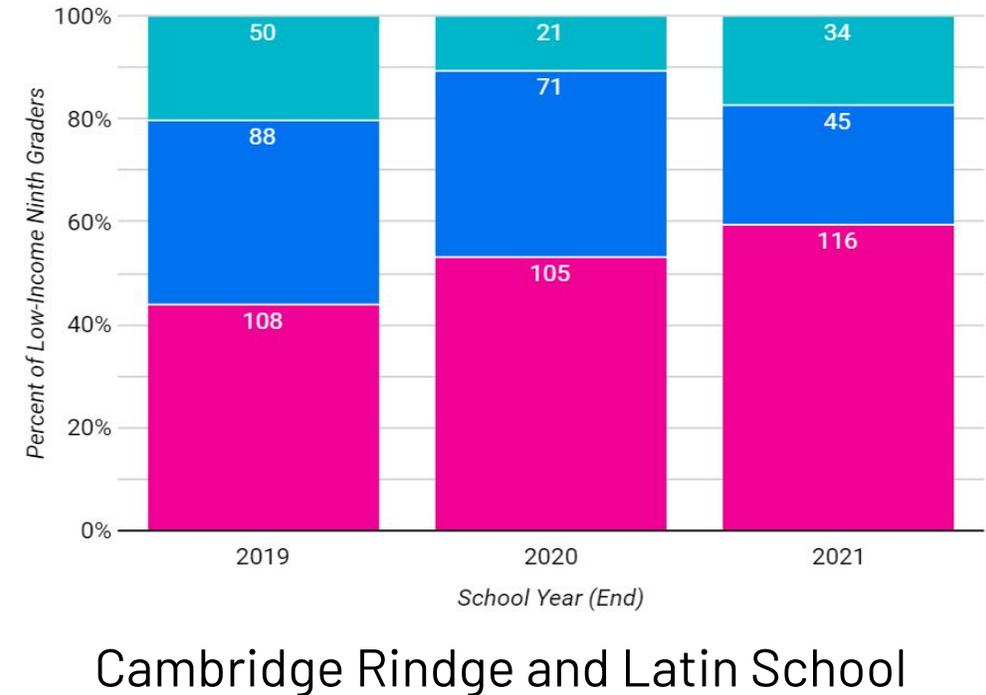
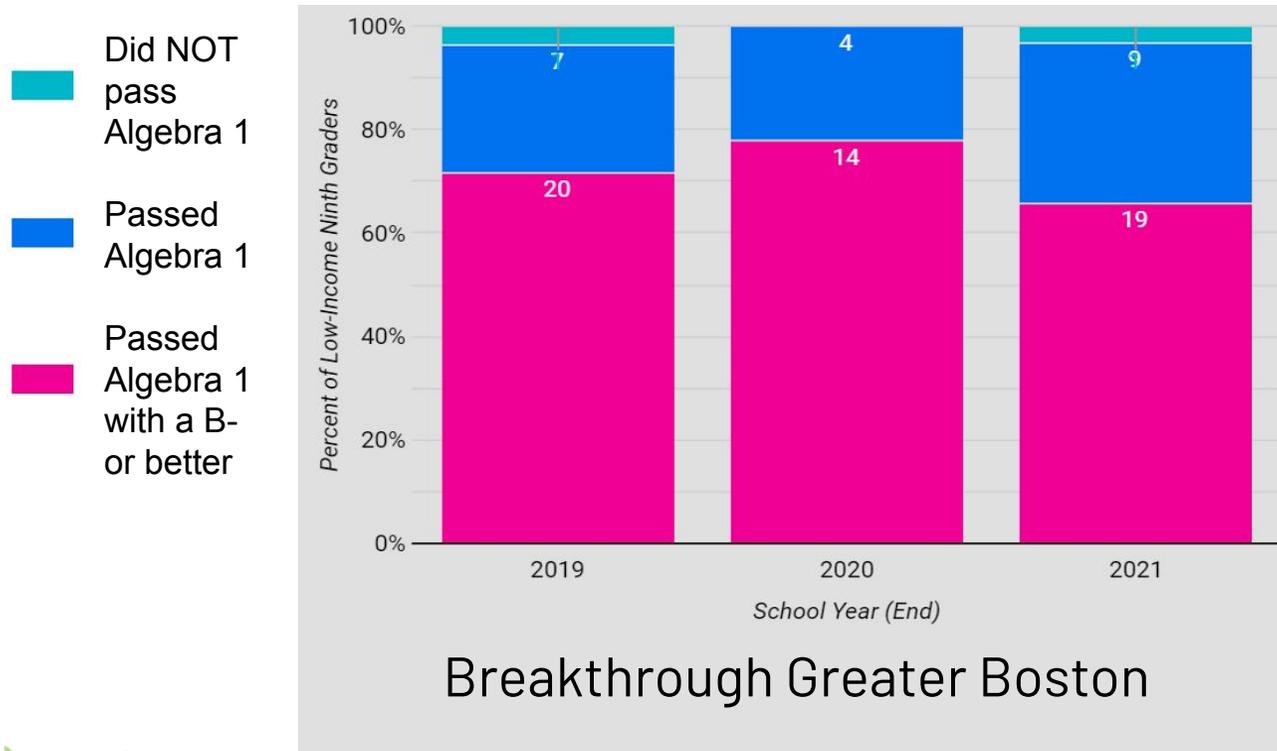
9th Grade Math Course Taking among STAR Students



***Note:** To fulfill the 9th grade math requirement, students must take and pass one of the following courses (in order of difficulty): Algebra 1, Geometry, Geometry Honors, Algebra 2 Honors

Cambridge Public Schools: Course Enrollment Preliminary Findings

The Cambridge Data Specialist found that a **higher percentage of ninth graders from low-income families in the STAR program Breakthrough Greater Boston (BTGB)** have passed Algebra 1 and performed well compared to ninth graders from low-income families in the general Cambridge population



***Note:** Many CRLS 9th graders do not take Algebra 1 and advance to higher level math courses. For these students, passing a higher level core math course (Geometry, Algebra 2, PreCalculus, or Calculus) during 9th grade was counted as passing Algebra 1. The same holds for those who earned a B- or better.

Ongoing STAR Research

The STAR Data Specialists are conducting the following analysis activities in the second semester of the 2021-2022 school year:

- Building dashboards to include Advanced Placement (AP) course enrollment data
- Meeting with each STAR partner to closely investigate dashboards and explore more specific questions or inquiries
- Connecting with district Math and Science leaders to further align data inquiries to those of the Somerville and Cambridge school districts
- Building dashboards to investigate student survey and MCAS data to establish narratives of students' performance over time

Conclusion

It is clear that the research the STAR Data Specialists have done in their first year is just the tip of the iceberg in terms of what we can learn about the impact of the STAR programs, and OST programs generally.

Additionally, as the STAR Data Specialists have shared, the research they've begun to assess STAR's impact is providing valuable insights for school districts, helping inform practice and policy changes that strengthen STEM education equity.

Ultimately, the data sharing and analysis happening in STAR can help determine what kinds of supports are needed, and work best for students typically underrepresented in STEM college and career paths.

As STAR heads towards the end of Biogen's initial 4 year investment and enters its next phase, we're excited to see how lessons learned through data sharing and analysis can draw additional partners to the table to sustain, deepen and grow STAR's work.

