

MfA

For master teachers  
of math and science

$$4 \sum_{k=1}^n \frac{(-1)^{k-1}}{2k-1}$$



2019-2020

MfA

REFLECTIONS

# Foreword

For the past five years, MfA has been the same size – about a thousand NYC math and science teachers. We now gauge success not by program size but rather things that are harder to measure, such as efficacy and impact. We want not only to improve our program but also to extend its reach beyond the MfA teachers themselves. This collection of annual reports will document our progress in achieving these goals.

For the past four years, we have published these brief reports – MfA Reflections – that are meant to accomplish this. They are organized into five key areas:

- Teacher-to-Teacher Learning and Leadership
- Teacher Efficacy
- Teacher Retention
- School Impact
- Spotlight on Special Activities

This year's spotlight focuses on equity – a vitally important topic for MfA in the past, which became even more relevant in 2020.

The organization of these annual reports reflects the fundamental goals of MfA:

- To foster professional growth for our teachers
- To provide opportunities for leadership, expanding MfA's reach
- To keep the most accomplished math and science teachers in the classroom
- To change the teaching profession itself, making it more rewarding and exciting

Over time, the collection of these annual reflections will provide a portrait of our teachers, their accomplishments, and their communities.

**John Ewing, 2020**

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# Teacher-to-Teacher Learning & Leadership

Prior to the spring semester of the 2019-20 school year, MfA's fellowship model was centered around in-person collaboration. Typically, MfA hosts over 400 in-person professional development workshops each semester, the majority of which are designed and led by MfA teachers themselves. MfA also invites practicing mathematicians and scientists, as well as outside education experts, to lead workshops for teachers. On any given night during a typical academic year, hundreds of teachers from all over New York City gather in MfA's classroom spaces to participate in professional learning opportunities with their peers.

By March of the 2019-20 school year, when New York City entered lockdown as a result of the COVID-19 pandemic, teachers across the entire public school system switched to remote teaching with only a few days' notice. When schools went virtual, MfA went virtual, too. MfA staff worked with teachers to redesign the remainder of the spring semester. We moved workshops to Zoom and adapted the content of workshops to address new challenges presented by the pandemic, creating space for teachers to share and discuss strategies for remote teaching, utilizing education technology tools, and supporting students' social-emotional health.

To further adapt our fellowship model and better support teachers, MfA hosted workshops throughout the summer months. Previously, with the exception of an annual summer conference, MfA's professional development workshops were only offered during the academic year. MfA hosted 66 virtual workshops in July and August of 2020,

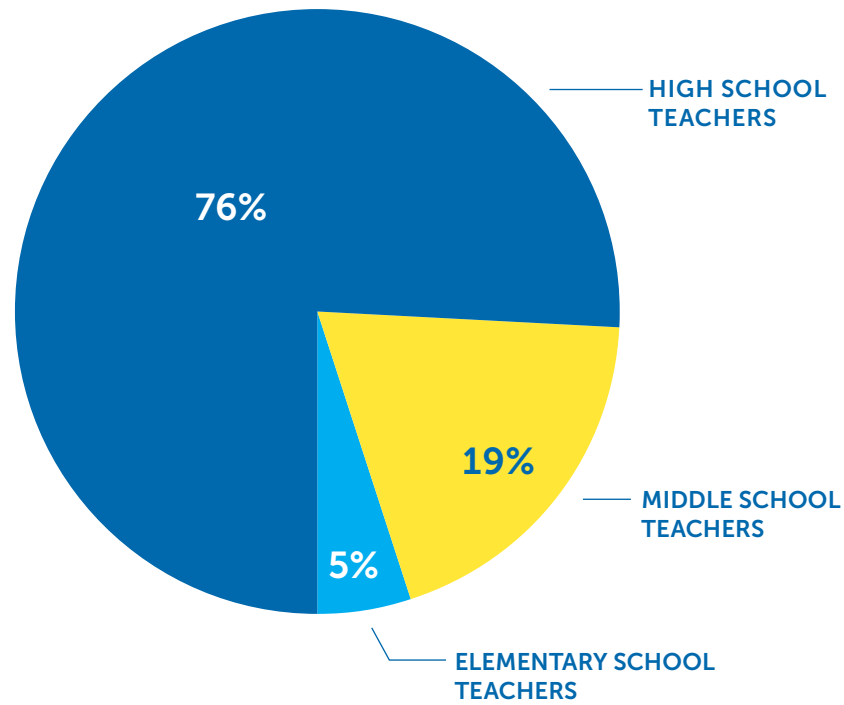


attended by more than 380 teachers. In the fall semester of 2020, despite the ongoing challenges presented by school closures and remote teaching, MfA teachers designed, led, and participated in over 500 virtual workshops, more than in any other semester.

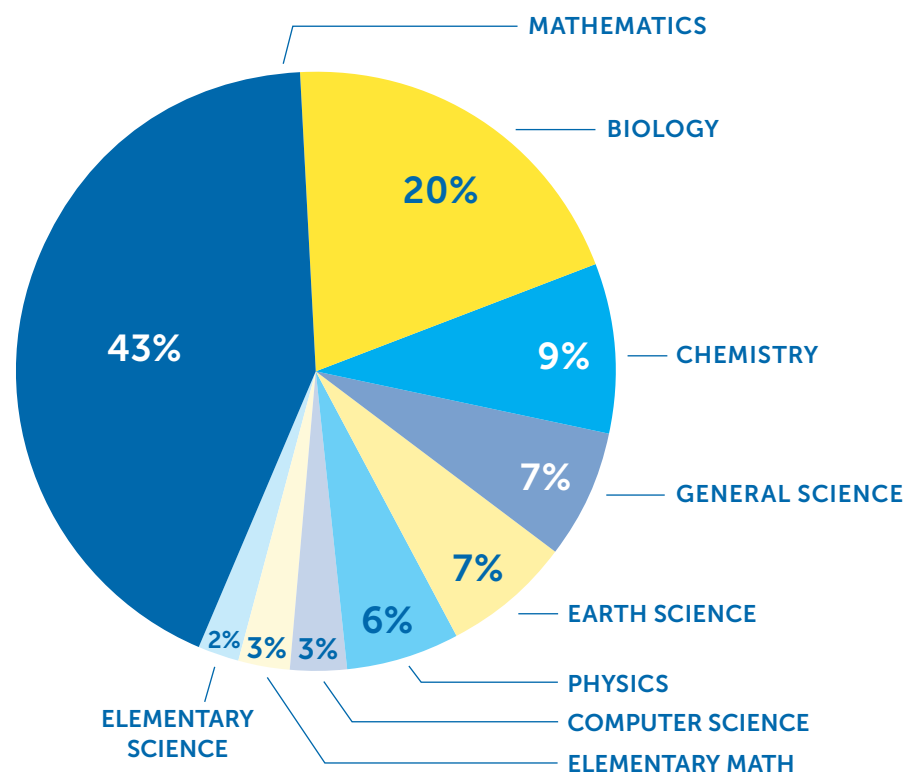
MfA has created a network of outstanding math and science teachers throughout New York City. In the MfA network, teachers form professional learning communities that innovate teaching from the ground up. They explore new ideas, try them in their classrooms, and share them with colleagues, ultimately benefiting students in NYC and beyond.

**MfA's fellowship model counteracts professional isolation and burnout among teachers and allows teacher-led innovation to flourish. This is now more critical than ever.**

### Grade Levels



### Subject Areas



140

EARLY CAREER TEACHERS

874

MASTER TEACHERS

88

MASTER TEACHERS EMERITUS

1,102

TOTAL TEACHERS

Data as of October 2019

### REMOTE TEACHING RESOURCES

In July of 2020, MfA hosted a virtual workshop, "Promising Practices: A Forum on Remote Teaching & Learning," in which teachers were invited to share and reflect on how to best help all students learn remotely. Teachers explored student participation, assessment, ownership, social-emotional support, digital interactions, accountability, collaboration, and more.



Throughout the forum, teachers raised concerns about students whose needs are not being met through remote learning due to factors including diverse learning needs, responsibilities outside of school, and access to and proficiency with reliable technology. Teachers also shared examples of remote teaching successes. MfA interviewed several of these teachers and created a set of **remote teaching resources** on the MfA website. Our hope is that the stories provide new ideas for other teachers to tackle these challenges as well as comfort in knowing they are not alone in their experiences.

### MfA FALL FUNCTION KEYNOTE

On November 9, 2019, MfA Master Teacher *Sendy Keenan* was the featured speaker at the 13th Annual MfA Fall function. This event honors the entire MfA community of over 1,000 NYC teachers who are pushing the boundaries of mathematics and science education at MfA and beyond. Below is an excerpt from *Sendy's* speech to the MfA community.

"In these times, we cannot afford for our young people's minds to sit idle, for the promise of their brilliance to be stunted, or for them to be indoctrinated into a society where they are constantly reminded that they are not enough. At MfA, we have an extraordinary opportunity and responsibility to work towards equity and justice and to cultivate curriculum that does not repudiate our students' existence. Every year alongside all of the great content offerings, there are an increasing number of pedagogical courses in the MfA catalog dedicated to figuring out how we can help students feel strong and secure in their own cores about who they are in the world, how teachers can better recognize and build upon our students' innate genius, and how we can responsibly prepare students to challenge the inequities that surround them. This is a great start, but too often these courses are predominantly filled with teachers of color. We are more than 1,000 teachers representing [hundreds] of schools, and MfA has the power to effect real change in our education system. However, we cannot challenge inequitable systems and level the playing field for our students unless we are all committed and involved. We must see all children as our own children. We must leave our comfort zones. Part of being true Master Teachers is our willingness to push ourselves to gain new knowledge in all areas of teaching, not simply those in which we feel strongest. We can, and should, do better."



# Teacher Efficacy

In the fall semester of the 2019-20 school year, over 100 teachers new to the MfA community answered a set of questions borrowed from Horizon's National Survey of Science and Mathematics Education (NSSME+). Among them:

How well prepared do you feel to do each of the following in your instruction?

- Develop students' awareness of STEM careers
- Differentiate instruction to meet the needs of diverse learners
- Incorporate students' cultural backgrounds into instruction
- Encourage students' interest in math or science

The same teachers were asked these questions again in the fall semester of the 2020-21 school year, with regard to both in-person and remote instruction.

## How well prepared do you feel to do each of the following in your in-person instruction?

(1 = not adequately prepared, 2 = somewhat prepared, 3 = fairly well prepared, 4 = very well prepared)

	Year 1 in MfA FALL 2019	Year 2 in MfA FALL 2020
Develop students' awareness of STEM careers	2.6	2.9*
Differentiate instruction to meet the needs of diverse learners	3.2	3.4*
Incorporate students' cultural backgrounds into instruction	2.8	3.1*
Encourage students' interest in math or science	3.3	3.5*

n=113, \*statistically significant

After completing the first year of their fellowships, MfA teachers felt better prepared to differentiate instruction to meet the needs of diverse learners, incorporate students' cultural backgrounds into instruction, encourage students' interest in math or science, and develop students' awareness of STEM careers during in-person instruction. However, teachers also reported feeling much less prepared to do each of these during remote instruction. MfA's 2020-21 professional development catalog, designed in collaboration with teachers, places a heavy emphasis on translating and adapting best practices to the remote teaching environment.

MfA connects teachers to the math and science world beyond K-12 education by building partnerships with external facilitators who teach courses at MfA. Teachers collaborate with these experts both to enrich STEM curriculum at their schools and to keep themselves challenged and engaged in the core content of their disciplines. For example, in the 2019-20 school year, Bianca Jones Marlin, a neuroscientist and postdoctoral researcher at Columbia University, led two courses attended by over 260 MfA teachers in which she presented and discussed her current research in epigenetics. Po-Shen Loh, a mathematics professor at Carnegie Mellon University, led a course on matrices attended by 85 teachers. Aaron Watters, a senior software engineer at the Flatiron Institute of the Simons Foundation, led a course for computer science teachers exploring the Jupyter Notebook interface as a tool for teaching computer programming to middle and high school students.



In the spring semester of 2020, we surveyed 994 MfA teachers to ask about their fellowship experiences. 94% of MfA teachers agreed with the following statements:

**At MfA, I have sufficient opportunities to explore advanced content related to my field and interact with practicing mathematicians and scientists.**

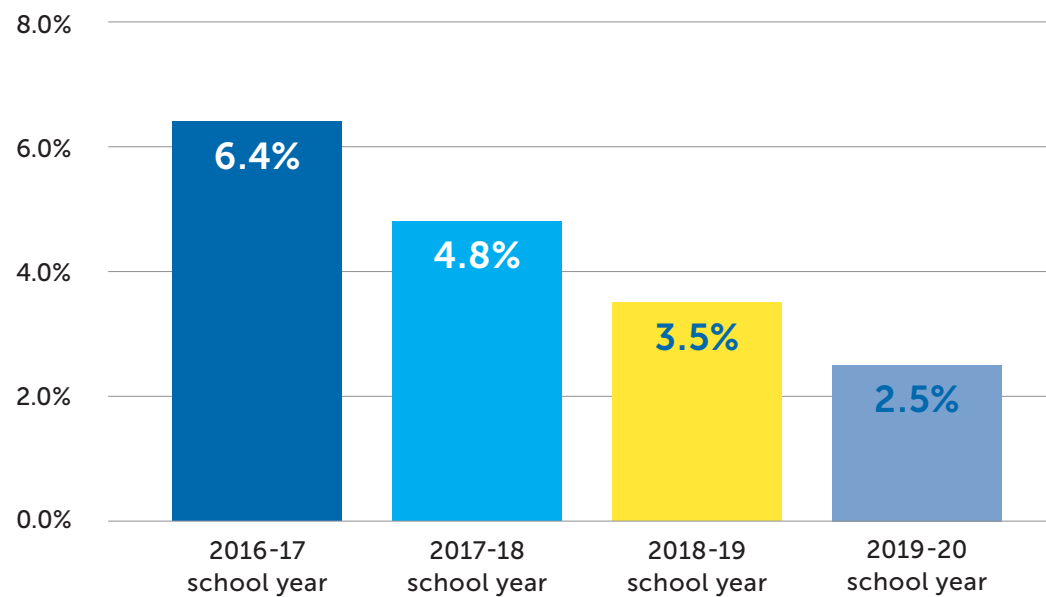
**As a result of my MfA fellowship, I see myself as an authentic member of the professional mathematical and scientific community.**

# Teacher Retention

By awarding four-year fellowships to experienced teachers, which include annual stipends and the opportunity to participate in professional learning experiences within a community of peers, MfA aims to increase the retention of outstanding K-12 math and science teachers in NYC public schools.

Each year, we track and report attrition from our fellowship program in order to monitor trends and determine whether we are, in fact, keeping the best teachers in the classroom. During the 2019-20 school year, 2.5 percent of MfA teachers withdrew prior to completing their fellowships, which is the lowest attrition rate over the past four years.

## Fellowship Attrition



We surveyed first-time fellowship recipients to learn more about which aspects of the fellowship influenced their decision to stay in the classroom during the 2019-20 school year. Among options which included receiving a stipend and supplemental funding, receiving recognition as a respected teacher, and collaborating with a community of peers, teachers new to the MfA community most frequently chose expanding my professional network and enriching my professional life as the aspect of the fellowship that factored most into their decision to continue teaching in the 2019-20 school year.

MfA teachers also remain dedicated to their school communities. Among the cohort of teachers who completed a fellowship in the 2019-20 school year, 82 percent taught at the same school during all four years of their fellowship.

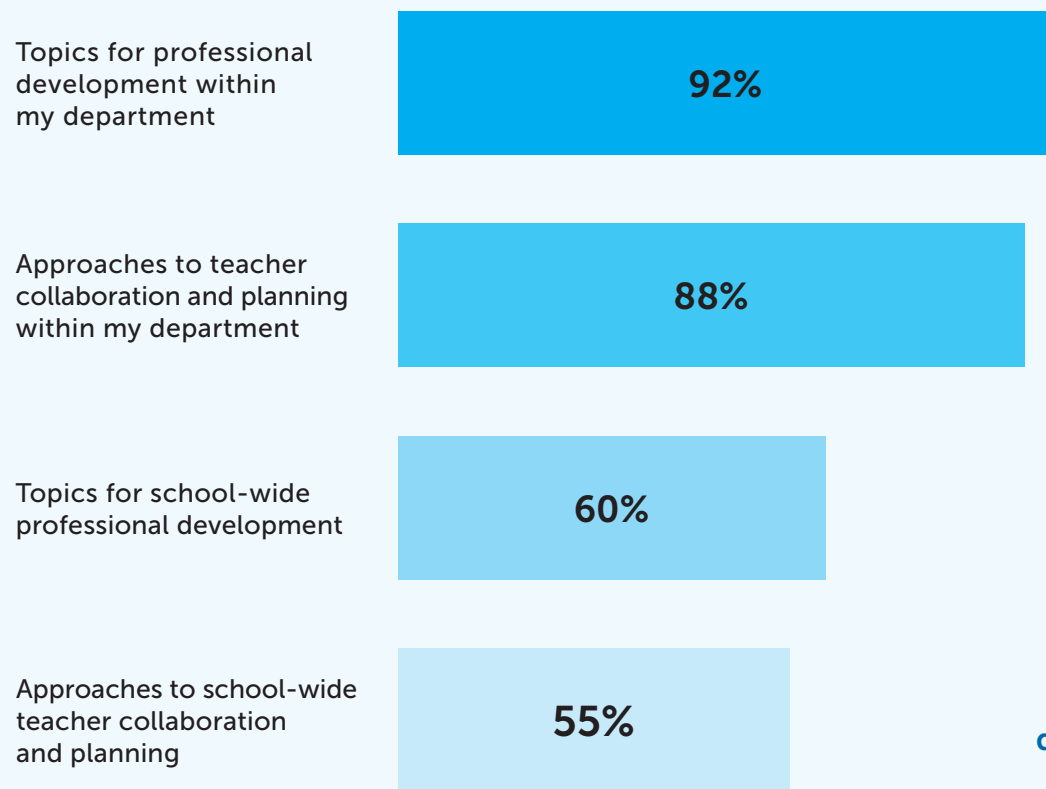
Master Teachers who complete a four-year fellowship are eligible to apply for additional fellowships. 85 percent of the Master Teachers who completed their first fellowships in the spring of 2020 applied for a second fellowship, and 80 percent of these applicants were awarded another fellowship starting in the fall of 2020. Master Teachers who do not receive an additional fellowship can continue to participate in the professional learning community at MfA through the MfA Emeritus Corps.

# School Impact

At MfA, teachers join a professional community where they can explore cutting-edge content, innovative teaching practices, and research-based professional development models. MfA teachers bring what they learn back to their school communities, resulting in increased student learning and better teaching and professional development in schools.

In the spring semester of 2020, we surveyed 994 MfA teachers to learn more about their leadership in their school communities.

## Ideas that I and/or other MfA teachers at my school have shared from MfA have been incorporated into:



**81%**  
of MfA teachers have facilitated professional development for colleagues within their department

# IN THE CLASSROOM

## EMPOWERING STUDENTS WITH DATA CAITY, HIGH SCHOOL EARTH SCIENCE

I took two MfA courses that were really transformational in the way I structure my curriculum and the way I get students to engage with large data sets: "Hudson River: NYC's Wettest Earth Science Teaching Tool," facilitated by a living environment teacher from WHEELS, and "New York City's Water Story," led by Department of Environment Protection (DEP) educators. I teach at a transfer school, so my students are anywhere between 14-21 and they are all in mixed grades with varied levels of science experience. These courses equipped me with the resources and knowledge to construct a semester-long course focused on the significance of water in NYC. They helped me engage students who previously thought of themselves as unsuccessful in school – and specifically, unsuccessful in science.

I learned how to access and utilize a large publicly available data set from the DEP website, which I originally had no idea even existed! With that, in addition to other water resources from DEP, I created a curriculum that I was able to scaffold to the mixed reading levels, the mixed computer skill levels, and the mixed levels in mathematical thinking in my classes. I analyzed the data on my own and then gave the data set to students so they could use it to generate a hypothesis for their performance-based assessment (PBAT) in science. I also used supplemental funding from MfA to purchase the materials that students used to collect water samples and generate data on the physical and chemical properties of water from the Hudson River.

As a result of this water project, I had 18 students present and pass a science NYC PBAT. My students were really motivated. I had one student who wanted to measure the water in the East River for her project because that's where her apartment building is. I initially told her we didn't have time for that (our school is by the Hudson River), but she was really insistent.

For two weeks straight, I met her every day at 7 a.m. with all the materials, and we collected water samples. This is a student who had previously never made it to her 9 a.m. class, and the fact that she met me every day at 7 a.m. for two weeks straight showed me that there was some buy-in to the content we were learning. Not only was she showing up, but during this project she also mentioned she wanted to further her science education, so we went to the guidance counselor's office together and looked at college science programs. That was really exciting for me to see because this was a student who previously was not thinking about attending college at all.

In addition, several students who had low attendance across many of their classes started coming for after school help with very specific questions that were focused on the data. We also

had students stay after school to present for a STEAM night and model how to collect data on water. I think the biggest point is that this project helped us to get students who were overaged and under-credited feel successful and proud of their work analyzing a big and complex data set. There was more buy-in, the learning was place-based, and it opened up room for student voice, so I'm really happy I took those courses at MfA.

## SPIRALING TO THE TOP TEN VALUES OF THE SCHOOL

### DANIEL, HIGH SCHOOL MATH

I teach at the only full-service night high school in the five boroughs. Many of our students are recent immigrants, and many of our students are 18 to 20-year-olds who have not previously had success in school, let alone math.

Before I got into MfA, I researched the best way to frame the Algebra curriculum for my students. I discovered this "spiraling" method, where you hit on the same topic multiple times over the course of the semester. Given the challenges with student attendance we have at our school, I think this is a fair and more equitable approach based on students' realities. If students happen to miss a lesson on slope one day in September, they have two more chances to get it when we spiral back around to the topic. This approach can be very beneficial for English Language Learners, as with each spiral, we can add layers of complexity as students' content-specific language acquisition develops. I had already seen these results in my classroom. One of my motivations for applying to MfA was to strengthen this curricular approach.

In the spring of 2019, I took a workshop at MfA centered around a book called *Make It Stick* by Brown, Roediger, and McDaniel, which discusses instructional practices that are aligned with current neuroscience research. What I keep referring to as "spiraling" was referred to as "interleaving" in this book. This workshop gave me more ideas to tweak my approach and made me feel much more confident and empowered to be more vocal in sharing my spiraled curriculum at my school. I started to share the approach with other teachers in my school, and it has caught on, not only in the math department, but it has trickled into the history department as well.

And the science department has had preliminary conversations to say, "What can we do to have this 'spiral' approach in our science classes?" I was very excited to be part of the conversation. Now, "spiraling" has made it on a list of the top ten core beliefs held by teachers in our school about how our students learn best.

72%

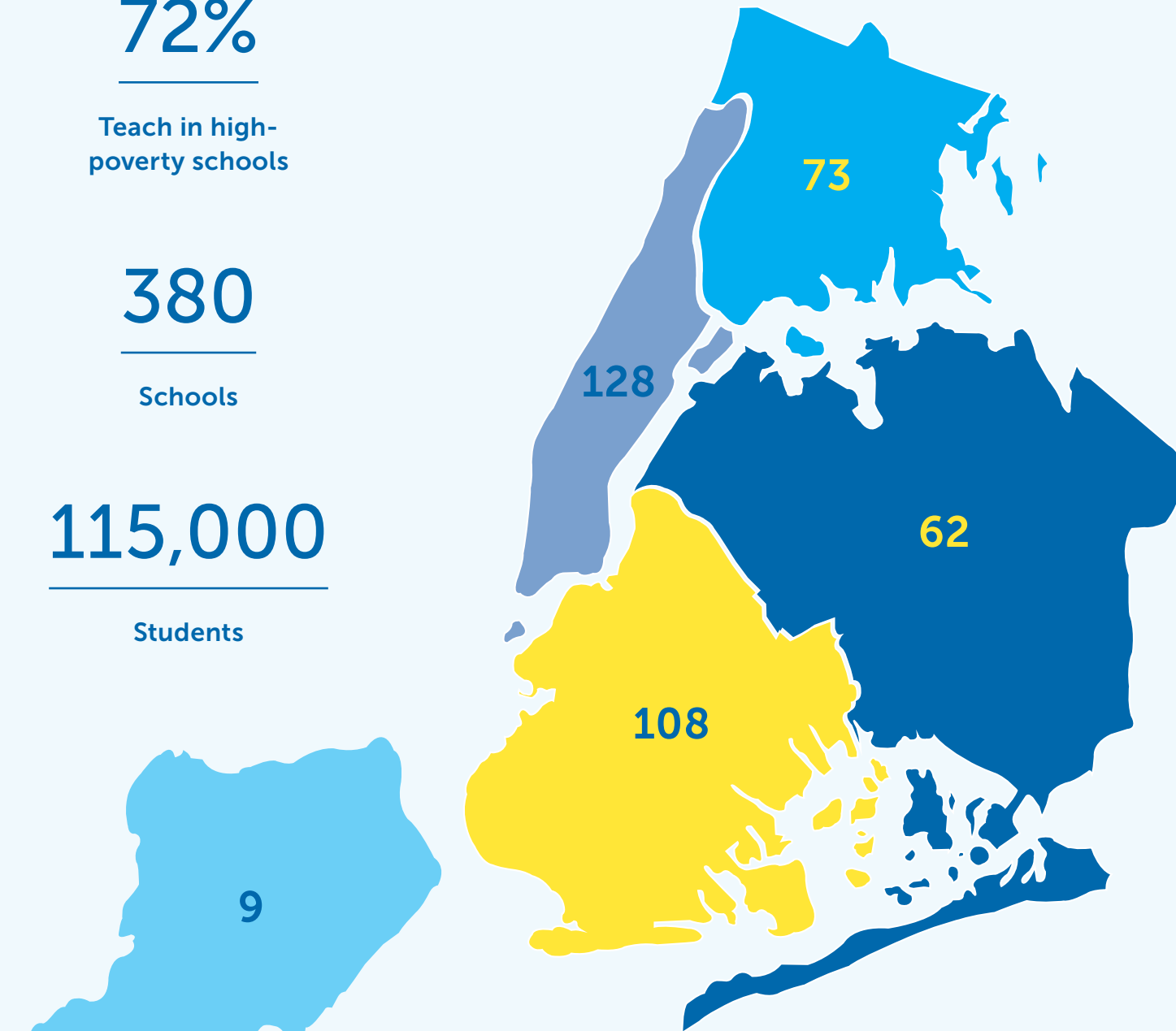
Teach in high-poverty schools

380

Schools

115,000

Students



SCHOOLS

- Bronx
- Queens
- Staten Island
- Manhattan
- Brooklyn

Data as of October 2019



MORE THAN  
**75%**

of MfA teachers said that they regularly incorporate resources and pedagogical strategies from MfA workshops in their instruction on a weekly or daily basis

OVER  
**450**

MfA teachers have started new extracurricular STEM activities, programs, or clubs for students in their schools



## Regents Scores

Using data made publicly available by the New York City Department of Education for the 2018-19 school year, we compared students' performance on math and science Regents exams in high schools with MfA teachers and high schools without MfA teachers.

In an analysis that controlled for differences among schools and the demographics of test takers, we found that, on average, students in schools with at least one MfA math teacher scored higher on the **Common Core Algebra**, **Common Core Algebra 2**, and **Geometry** Regents exams in the 2018-19 school year. We also found that in schools with at least one MfA teacher in the relevant science subject area, students scored higher on the **Chemistry** and **Earth Science** Regents exams in the 2018-19 school year.

**Schools with at least one MfA teacher in the relevant subject area scored higher, on average, by:**

Regents Exam	Difference in average scores (POINTS)
Common Core Algebra	+3
Common Core Algebra 2	+7
Common Core Geometry	+6
Chemistry	+5
Earth Science	+4



# Annual Spotlight: Equity at MfA

In the 2019-20 school year, MfA established its first Equity Advisory Committee made up of experienced MfA teachers. These teachers worked with MfA staff to set goals for equity and inclusion, reviewed internal data related to those goals, and advised MfA on improving current practices and developing new initiatives.

Nine teachers across four boroughs joined the committee, representing math and science subjects in middle and high school grades. Eight of the nine teachers work in schools serving more than 60 percent of students eligible for free or reduced price lunch. Four MfA staff members, including MfA's COO, joined the committee, representing several departments: Admissions and Recruitment, Professional Development, and Program Evaluation.

The committee met four times throughout the school year. The first meeting was dedicated to establishing norms, ensuring a safe space for discussion, and drafting equity goals in collaboration with teachers. The committee coalesced around the following working definition of MfA's equity goals, inspired by the [New York State Culturally Responsive-Sustaining Education Framework](#):

At MfA, we aim to foster a teacher-centered learning environment by:

- Attracting and affirming multiple expressions and types of diversity, including but not limited to: race, gender, family structure, age, ability, religion, sexual orientation, class, school type, culture, geography, years of teaching experience, and political beliefs
- Developing teachers' abilities to connect across differences
- Empowering teachers as agents of positive systemic change to serve all NYC students
- Supporting teachers' engagement, learning, growth, and empowerment

The committee reviewed data showing demographics of teachers currently in the fellowship program, demographics of the most recent applicants, and demographics of teachers proposing and leading professional development for other teachers in MfA. While the data shared with the advisory committee included comparisons by gender, grade levels, subject areas, school type, and more, racial equity became the focal point for the committee's discussions and recommendations in the 2019-20 school year.

Throughout the 2019-20 school year, MfA implemented several changes to the fellowship aimed at creating a more equitable and inclusive environment for teachers. To provide one example, based on a review of data from prior admissions cycles and survey feedback from previous applicants, MfA staff worked with teachers on the Equity Advisory Committee to design and implement a phone outreach initiative. Through this initiative, current MfA teachers are connected with

new applicants in order to provide support, encouragement, and guidance, with the goal of increasing the number of completed applications from teachers of color as well as teachers from underrepresented community school districts.

As the 2019-20 school year came to a close, George Floyd's murder and the subsequent national protests created additional urgency for MfA teachers to explore racial equity in their classrooms and schools. MfA created new spaces for teachers to do this work with one another and reiterated a commitment to ensuring the fellowship community is inclusive and equitable.

In the 2020-21 school year, MfA will create and begin to implement a comprehensive, long-term strategic plan for equity and inclusion at MfA. The design and implementation of the plan will be informed and supported by MfA teachers and staff. MfA will continue to share information related to equity and inclusion goals, and progress toward those goals, with teachers in the MfA community as well as other stakeholders.

## Teacher Demographics

