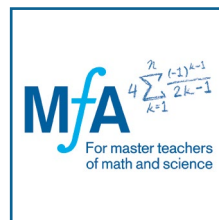
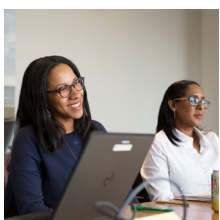
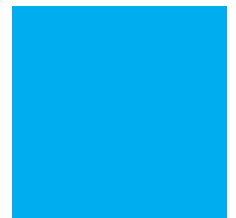
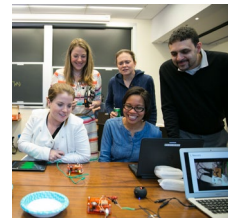
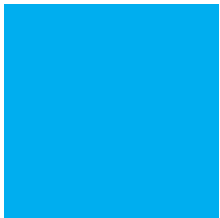
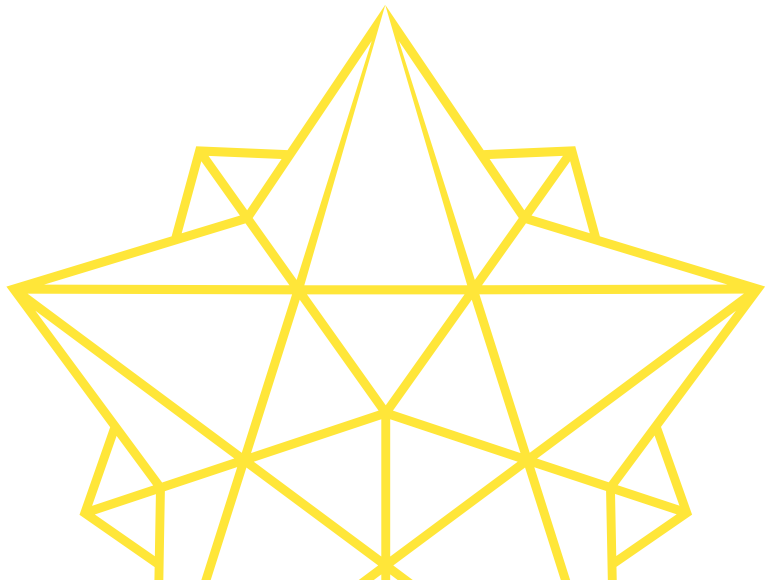
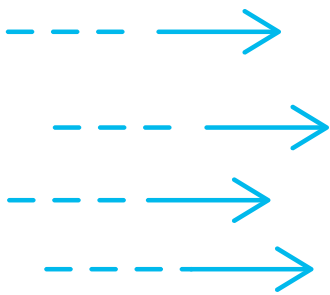


MfA Reflections

2016-2017





Foreword

For the past decade, MfA has gathered a great deal of information about its fellowship programs and analyzed the results. We engaged several large firms to do some of this work—Macro International (student achievement), Abt Associates (evaluation strategies), Horizon Research (principal feedback). We carried out internal projects—MfA saturated schools, teacher profiles, case studies, attitudinal surveys, AP calculus, comparative data on attrition. We engaged outside experts—school types, Regents scores, teacher evaluations. We learned a lot about our fellowship program, and we used what we learned to both validate and improve our work.

Now that we have reached a scale that is likely to remain constant for the next few years, we want to systematize this activity and to disseminate its results more widely. We therefore plan to create and publish an annual report—MfA Reflections—which will look at specific aspects of our fellowship. We want it to be closely tied to our goals:

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

We hope it will help us to gauge and document our success in achieving these goals. For this reason, each annual report will be organized into five sections:

- Teacher Retention
- Teacher Efficacy
- Teacher-to-Teacher Learning & Leading
- School Impact
- Spotlight on Special Activities

While the details may vary slightly from year to year, the categories will remain consistent so that we identify trends over time. Consistency also strengthens the evidence from a single year.

Teachers are the heart of MfA. Over time, these annual reflections will provide a detailed portrait of our teachers, their accomplishments, and the community they have built. This also furthers our mission by highlighting our greatest asset, of which we are justifiably proud.

December 2017



Dennis John, Director of Research
Courtney Allison, Deputy Executive Director
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Designed by Jennifer Cody, Communications Associate

II. Table of Contents

The Annual Report covers several topics that together help to inform our metrics of success. Each of these broad topics include several components which are outlined below.

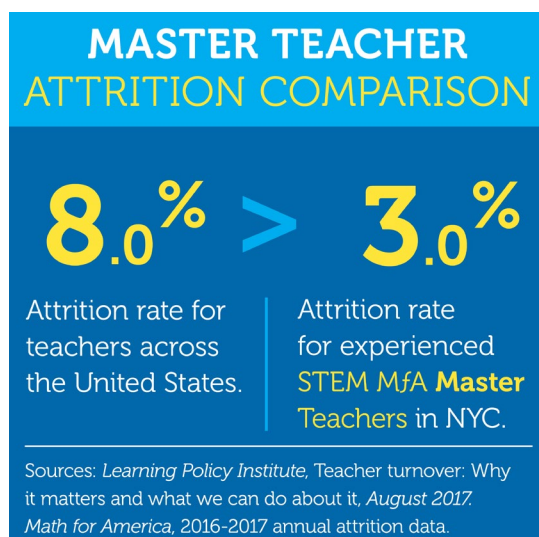
I. Teacher Retention	5
i. Professional Retention	5
ii. Fellowship Retention	6
II. Teacher Efficacy	7
i. Case 1: Steven, MfA Master Teacher	8
ii. Case 2: Brian, MfA Master Teacher	10
III. Teacher-to-Teacher Learning & Leadership	11
i. Co-Facilitation of Professional Development	11
ii. Professional Development Course Analysis	12
iii. Effective Facilitation and Learning	15
IV. School Impact	17
ii. Regents Exam Performance	17
V. Annual Spotlight	19
i. Characteristics of Teacher Led Communities: The Case of The Summer Think Conference	19
Appendix: Additional Reading References	21
The National Dialogue – Teacher Retention and the Role of Community	21
References	24

I. Teacher Retention

The goal of this section is to compare the retention of MfA teachers with NYC DOE teachers, as a whole. We also look at attrition within our own program and reflect upon the effectiveness of MfA fellowships. We have developed a regular cycle of review and analysis to examine both of these facets of retention together.

i. Professional Retention

Students are more likely to succeed when their teachers are true masters of the subject matter and are deeply committed to the craft of teaching. This is, of course, predicated on keeping teachers in the classroom. We collect professional retention data annually from October to October. We track teachers from the beginning of the year to the next so we can identify who continued, who renewed, and who withdrew/completed. Teachers that withdrew/ or completed their fellowship but did not apply for renewal are tracked further to identify who has left the profession since ending their fellowship. The professional retention rate is calculated by dividing the number of teachers who have remained in the classroom by the total tracked population.



We found that Master Teachers remained in their classrooms at significantly higher rates than others. **The attrition rate for experienced MfA Master Teachers in New York City is far below the average national teacher attrition rate reported in the same year.**

In the 2016-17 school year, among schools that reported above 60 percent or greater student poverty levels, over 90 percent of MfA teachers chose to stay the following year.

ii. Fellowship Retention

Over 90 percent of our teachers who participated in our fellowship program last year continued to teach into this year. However, this means that one in twenty teachers decided to leave their positions teaching in a NYC public school and thus, needed to withdraw from their fellowship. To further understand our retention rates, we analyzed the data and found that 4th- and 5th-year teachers made up a disproportionate number of withdrawals.

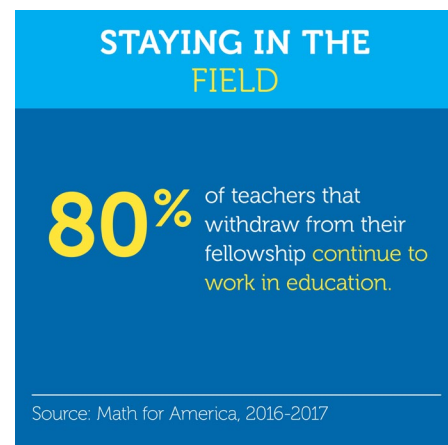
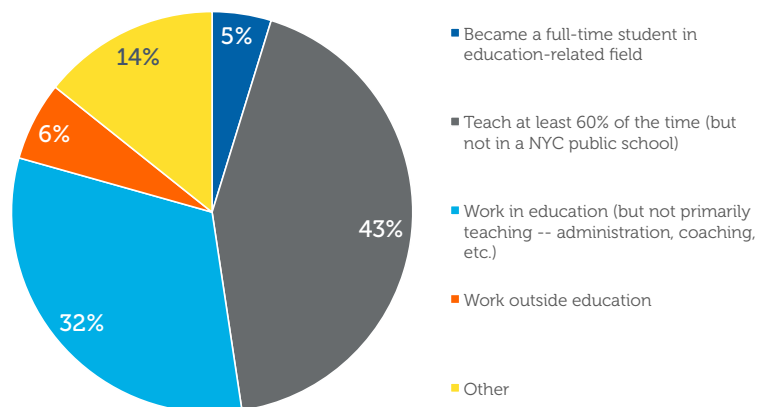
Fellowship retention data is collected annually from September to June of the following year to align with the academic school year. At the end of the academic year, the number of withdrawals is divided by the total number of teachers from the beginning of the year to calculate the fellowship retention rate.

In such cases where teachers do withdraw from MfA fellowships, 80 percent of individuals continue to work in education.

It is worth noting that withdrawal from MfA can be attributed to reasons that would otherwise disqualify individuals from fellowships (i.e. teaching below 60 percent of the time, work outside of education field, etc.).

100% of all withdrawals have left full-time teaching in NYC

Reasons for Withdrawal



II. Teacher Efficacy

We believe teacher efficacy is at the heart of what makes our professional learning community unique and successful. We've designed the MfA model to be one in which the teachers enjoy a great deal of ownership and autonomy. In addition, they are offered myriad opportunities to increase their confidence through exposure to new opportunities and different ways to engage and learn.

Efficacy refers to a person's perceptions of his or her ability to perform a task; it is the belief that he or she has the skills to perform certain behaviors that allow for specific outcomes.

Self-efficacy is an assessment of one's abilities to take action, produce results, and have control over a given situation. In educational contexts, high levels of teaching self-efficacy have been linked with increased student achievement, higher expectations of students, and a greater commitment to teaching (Roberts, 2010). Moreover, teachers who believe student learning

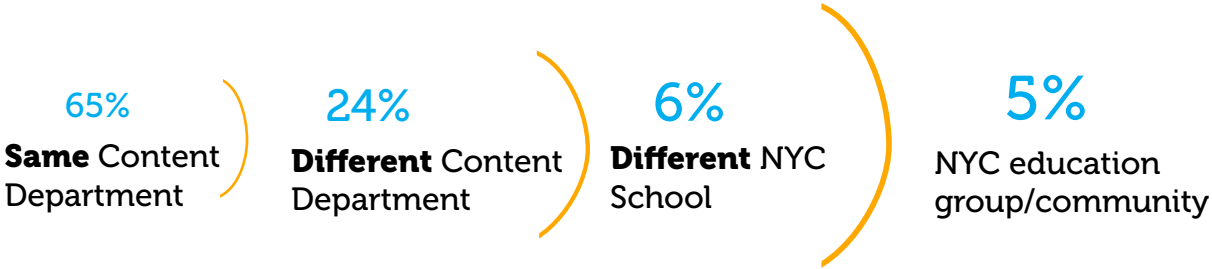
is directly related to the practice of the teacher have more confidence in their ability, take greater responsibility for teaching, and are more effective practitioners.

To better understand the nature of this sharing and learning community, we reviewed interviews, annual surveys, and written testimonials to discover the extent to which participation in an MfA fellowship facilitates teacher-to-teacher influence over content and pedagogical practice.

Annual survey results show that in nearly 90 percent of instances where teachers had opportunities to share with peers at their school the new knowledge gained via their fellowship experiences, they did. This confidence and willingness to share new ideas is central to our teacher efficacy beliefs.

Through interviews with long-time Master Teachers, we sought to better understand the extent to which our community increases professional confidence and creates a feeling of ownership of learning opportunities. The two cases presented here highlight Steven and Brian, who speak about the growth that comes from teacher-to-teacher professional relationships supported by relevant, focused professional development opportunities.

MfA Teachers Share with Educators in



i. Case 1: Steven, MfA Master Teacher

Steven has taught organic chemistry for twelve years at Stuyvesant High School, in Manhattan. Beginning his fifth year at MfA (renewed Master Teacher), Steven has co-facilitated four courses on Organic Chemistry for other MfA teachers. Currently, he also mentors an MfA Early Career Chemistry teacher at another Manhattan high-school and continues to take a wide variety of courses.

A self-described career changer, Steven was drawn to teaching on the recommendation of a friend after completing his postdoctoral work. He found an opportunity to teach his passion: organic chemistry. For Steven, efficacy in teaching requires a peer-led space for growth and mastery of very specific content and pedagogy. As he transitioned from academia to high school teaching, he didn't have that community. His feelings echoed what many other MfA teachers express prior to being awarded an MfA fellowship. Steven recalled:

"It wasn't until I joined MfA that I even met other teachers who taught rigorous high school organic chemistry classes . . . that was an outlet I never had prior to being an MfA fellow."

Steven recounted his initial interactions that helped him shed his feelings of isolation:

"It doesn't sound like that impactful of an event but for the class that I teach, I thought I was only one of a handful of teachers in the country that taught this course. I really felt alone in that respect . . . When I met [MfA peer] and she talked about what she taught at her school I realized, "I am so not alone!" That was really memorable. That was four years ago, and we still collaborate."



As Steven's fellowship and teaching career progressed, opportunities arose for him to connect with other teachers at MfA. In recalling a recent course he co-facilitated with another Master Teacher, Steven described the MfA structures that created a format for his peers to exchange ideas and learn from each other.

"The group constantly brought questions to the table that were very much about getting to the nitty gritty of hard-core chemistry questions. All the teachers [in the course] talked about the ways they explain not only concepts to students, but also the specific ways in which they teach these concepts."

He explained how facilitation not only provides him the platform to share his expertise, but it also gives him the opportunity to learn from other teachers outside of his department. This level of autonomy and trust clearly illustrates the reach and influence of our teacher driven community. About bringing together chemistry teachers from across the city, Steven says,

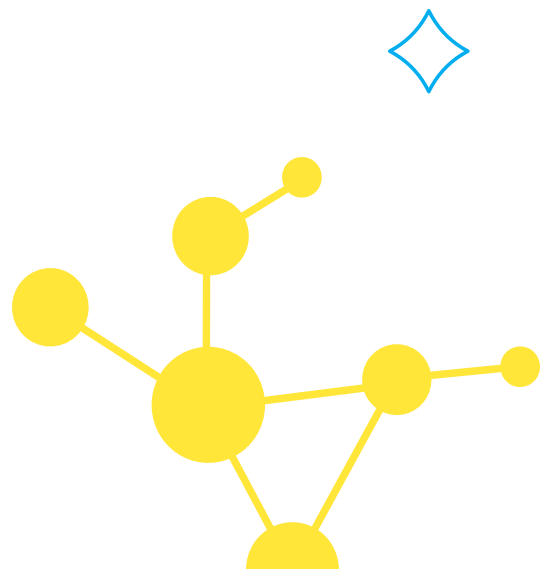
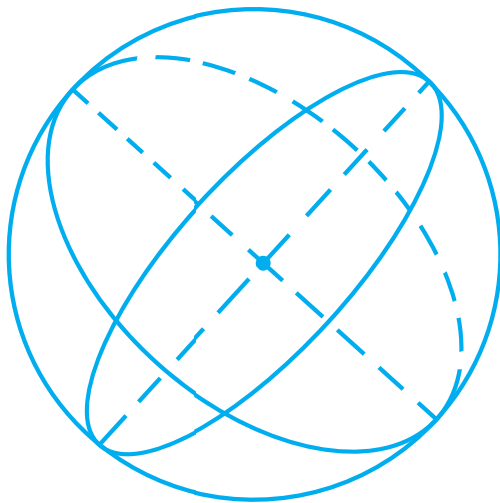
IV. Teacher Efficacy

"That's how I learned, from my colleague at Midwood in the Chemistry PLT, and now I share [those ideas] here at my school too. (It) really reaches a wider community of teachers than just my classroom. I definitely benefit from the [MfA] community as much as I hope to contribute."

Summary

Steven attributes his increased teaching efficacy to the opportunities he has had within the MfA community

and at his school, including engaging with colleagues and sharing what he has learned in his roles as participant and MfA course facilitator. He has learned that there does not need to be a clear distinction between the collaboration with teachers in his school and his larger professional community. Steven argues that this can be traced back to the teacher-to-teacher influences that exist both at Stuyvesant and to his role within the MfA community.



ii. Case 2: Brian, MfA Master Teacher

Like Steven, Brian is in his fifth year at MfA. He has taught math for 11 years and is currently in his second year at the Bronx Center for Science and Mathematics. He teaches Algebra II/Trigonometry and the school's first ever math elective. Brian has been a stalwart figure in the MfA community. After co-planning the MfA Summer Think Conference (see section V-i), he was featured in the June, 2017 edition of the MfA blog, Teacher Voices. Brian has also co-facilitated six MfA courses.

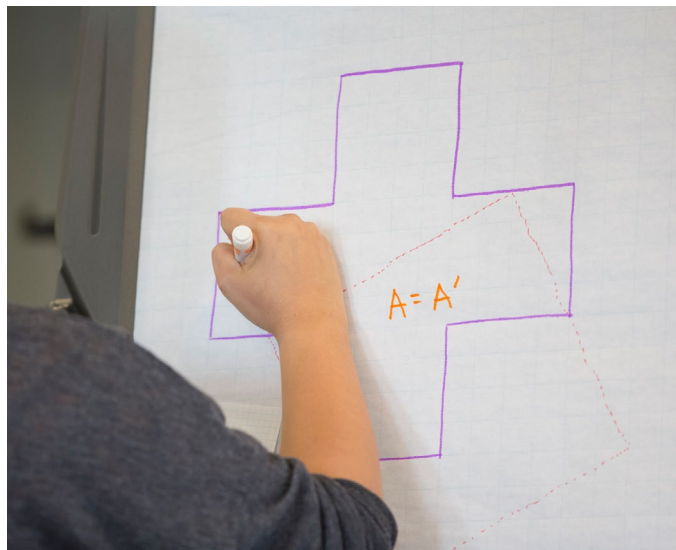
As he begins his twelfth year as a math teacher, Brian's dedication to teaching drives his constant search for opportunities to improve his pedagogy and content knowledge. This commitment is not just a professional pursuit but also a personal mission:

"I teach my students and I teach my classes as if my son was on the roster. I feel like all of my students are somebody's niece, grandson, or granddaughter and they want the absolute best for them. They just want the teachers to pour into the classroom everything they have and I want that for [students as well] . . . You've got to be all in."

To understand Brian's drive to affect his school community and his students, we need to first understand Brian's experiences at MfA that brought forth what he calls his "inner leader." It began with an opportunity to implement MfA's PLT course model with his math department:

"We created and ran a PLT at my school using the MfA protocols. It was shared facilitation. It was incredible . . . People loved it. This was PD that was for us, by us. The teachers at my school all bought into it. It was so valuable in terms of the content we pulled out and the teaching strategies. For me, as a teacher, it was empowering because I was leading this really awesome PD that no one had ever experienced before . . . It allowed me to tap into my own inner leader."

Ownership over PD that was teacher-led and driven boosted Brian's confidence to take on more prominent leadership roles that had lasting effects.



"Now there are real PLTs happening at our school once a month . . . Again, I got that from my MfA experience . . . Now it's basically a school-wide structure."

The crux of Brian's transformation to feel ready and equipped to tangibly affect change is the teacher-to-teacher learning and support that is a fundamental component of all PD at MfA. Before pitching the idea of an MfA PLT to his administrators, Brian first approached the MfA community with the idea to brainstorm some ideas for content (via the Small-World Network). Their response was overwhelmingly positive:

"The MfA community is so creative and sees math and science in a different way than most math and science teachers . . . they triggered so many thoughts and ideas. I didn't know what to expect when I threw it out there but like I said, there are so many thoughtful math teachers, specifically at MfA, who responded and gave me so much confidence."

Summary

Brian continues the "good struggle," as he puts it, at the Bronx Center for Science and Mathematics, and he has developed his own capability to lead amongst his peers. As with Steven's account earlier, learning among the MfA community permeates the community itself and carries over to the teachers' schools.

III. Teacher-to-Teacher Learning & Leadership

Central to MfA fellowships are the learning opportunities that allow teachers to benefit from and contribute to course offerings, formats, and protocols. These bring into focus the value, meaning, and power of teacher-to-teacher learning and leading across the MfA community. We examine these opportunities by reflecting on the course offerings at MfA, and the applicability and influence of professional development on teachers' practice.

During the 2016-17 school year, MfA made available to its teachers more than 300 "courses" comprising over 750 sessions.

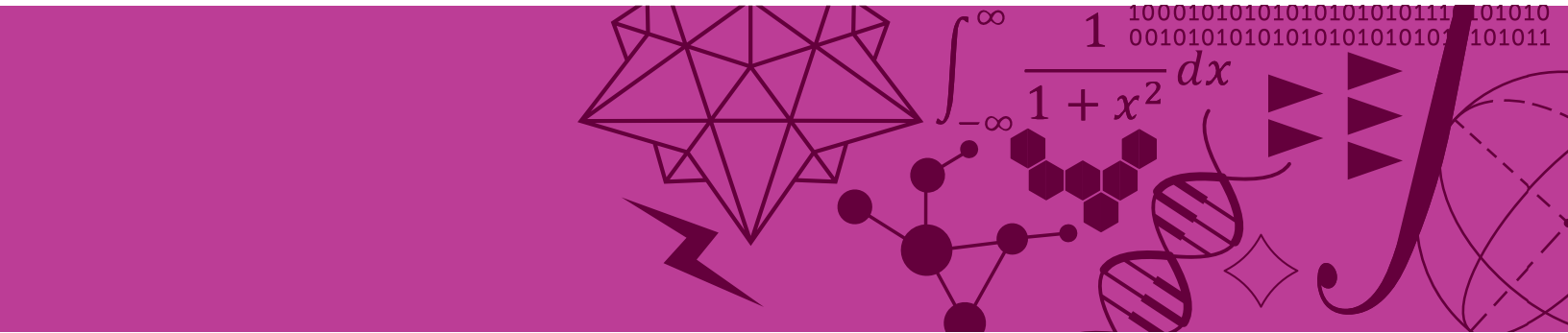
i. Co-Facilitation of Professional Development

Teacher-to-Teacher Learning and Leadership depends on opportunities for teachers to build professional relationships among like-minded educators. MfA works to hone facilitation skills and develop a sense of community through our co-facilitation approach. Many of our courses are co-facilitated either by two

MfA teachers or by an MfA Master Teacher and an field expert in mathematics or science education. A breakdown of such course offerings is provided below.

Facilitation	Fall 2016	Winter/ Spring 2017
MfA Teacher/Staff	99	128
Field Expert	45	33
Co-Facilitated (MfA Teacher/ Staff & Field Expert)	8	14
Total	152	175





ii. Professional Development Course Analysis

This process of teacher-to-teacher learning is further supported by the diversity and sheer number of opportunities for professional development at MfA. Year over year, MfA has worked alongside teachers to increase and diversify its PD courses, connecting its equally diverse and growing population of teachers, with topics spanning numerous content and

pedagogical areas.

Varying course structures allow flexibility in format for teachers to choose what is best for them.

Key PD structures include:

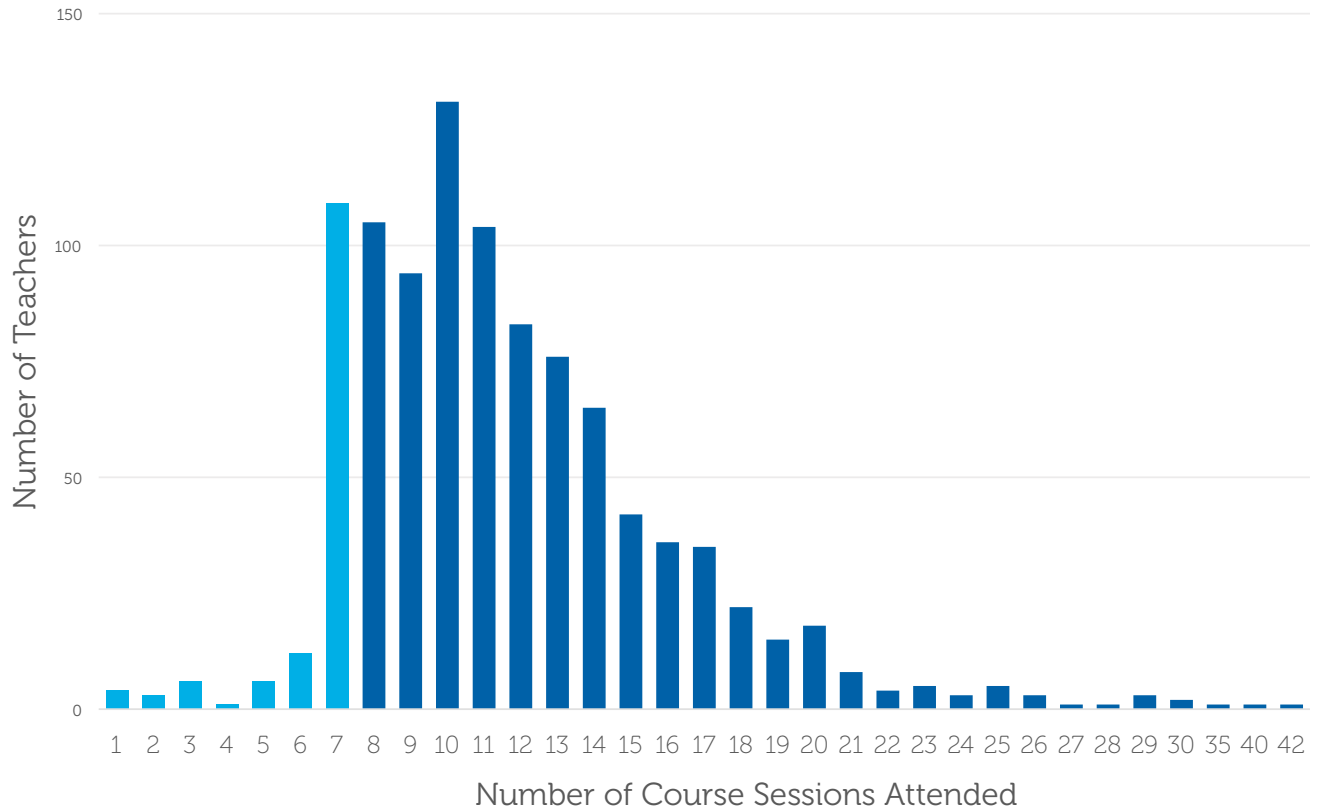
<p>Professional Learning Teams (PLTs)</p>	<p>PLTs meet four times over the course of the semester and consist of small teams of teachers who come together over this sustained period of time to deeply explore problems of practice. Participants bring attention, focus, and a willingness to move beyond sharing lessons and ideas to critically examine student work, research, and classroom practice. Please watch our PLT video here.</p>
<p>Single Sessions, Mini-Courses, and Extended Length Courses</p>	<p>These courses are a series of between one and eight connected workshops where experts from outside academic institutions and from the MfA Master Teacher community engage MfA teachers at the cutting edge of their content area and/or pedagogical practice.</p>
<p>Cohort Meetings</p>	<p>Cohort meetings are regular workshops designed to provide opportunities for teachers to lead, collaborate, learn, share, and reflect with their peers. Cohort meetings are specifically designed for certain cohorts.</p>
<p>Interest Groups</p>	<p>Interest Groups are designed for small groups of teachers to meet informally around a common interest. They provide opportunities to make connections and begin conversations with MfA colleagues.</p>

III. Teacher-to-Teacher Learning & Leadership

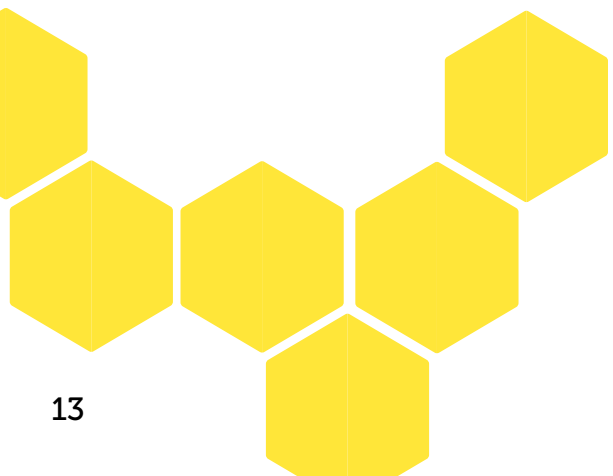
We strive to make sure our PD course offerings are responsive to teacher interests and needs. The majority of teachers in our community exceeded

the minimum requirements (7 course sessions) and attended between 8 and 12 PD course sessions during 2016-2017 academic year.

MfA Course Session Attendance, 2016-17



761 workshops took place during the 2016-2017 school year.



From Fall 2016 to Spring 2017, we increased courses for nearly all PD Types¹:

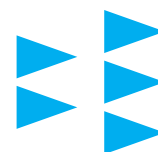
PD Type	Fall 2016	Winter/ Spring 2017
PLTs	34	40
Mini-Courses	33	42
Single Sessions	45	48
Extended Length Courses	5	1
Cohort Meetings	7	7
Engagement Opportunities	13	12
Interest Groups	15	25
Total	152	175

¹ Math for America Professional Development Report - Spring 2017 Semester and Annual Reflection

During Fall 2016 and Spring 2017, our courses according to Subject Area are as follows:

PD Strand	Fall 2016	Winter/ Spring 2017
Math Content	14	13
Science Content	9	10
Math Teaching & Learning	34	44
Science Teaching & Learning	28	37
Computer Science & Technology	15	13
Inquiry & Practice	37	51
Teacher Leadership	15	7
Total	152	175

*Strand = General PD Subject Area



iii. Effective Facilitation and Learning

We also focus on the impact that our PD has on our teachers as learners of content, practitioners of pedagogy, and leaders charged with understanding their students. Drawn from over 4,000 PD surveys,

the graph below indicates that the vast majority our teachers found MfA PD to be impactful to at least one element of their classroom practice.

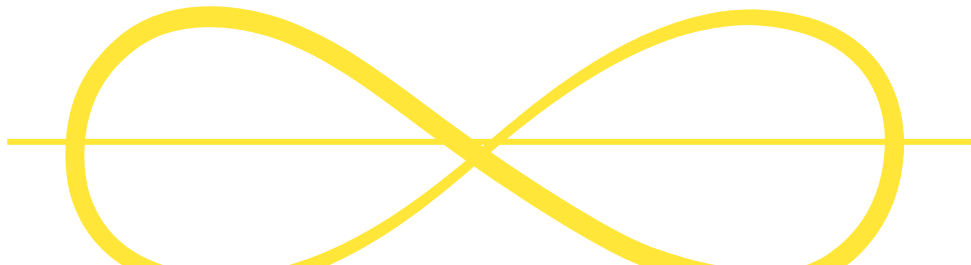
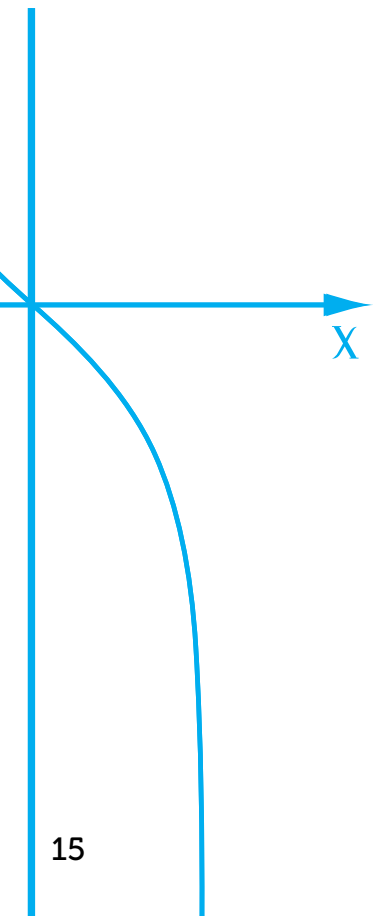
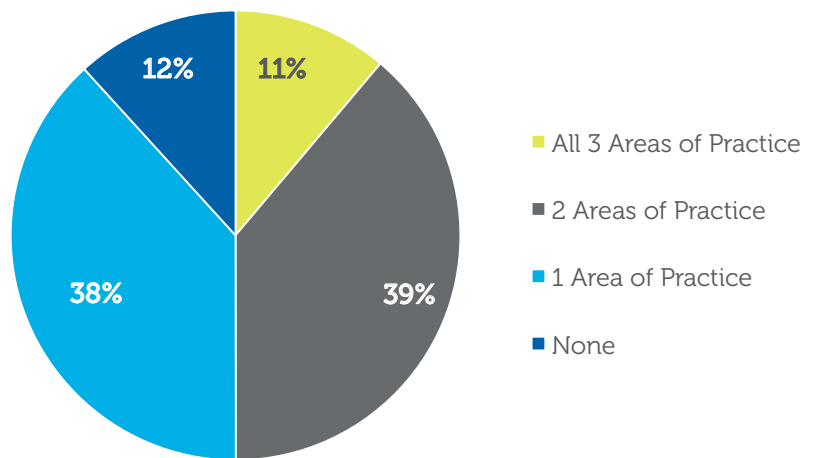
88% of MfA PD courses influence at least 1 area of practice for teachers

Areas of Practice:

Source: 4,628 survey responses

- Content Knowledge
- Pedagogy
- Knowledge of Students

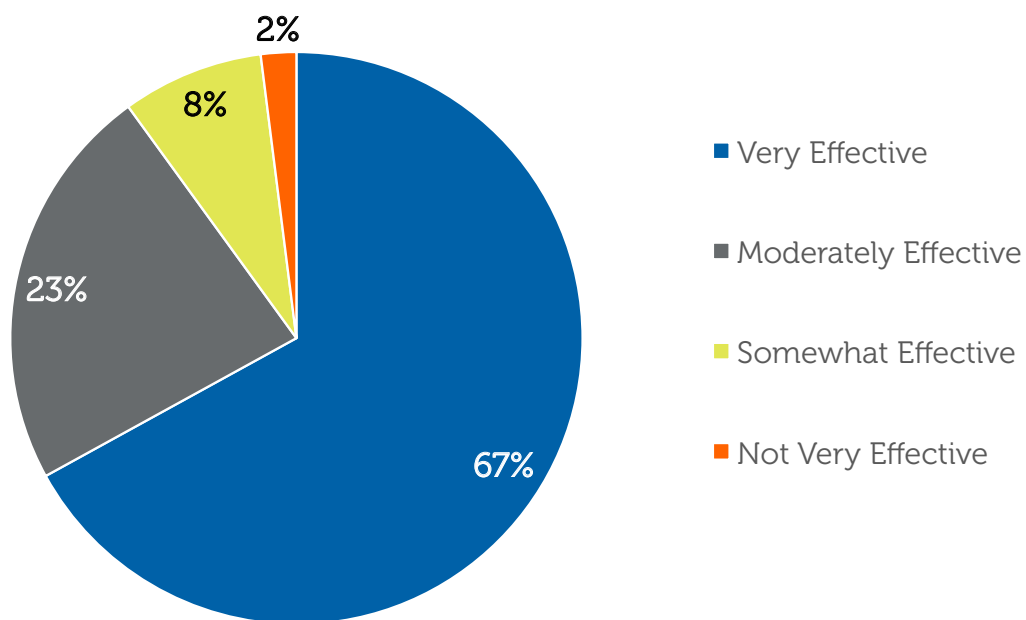
Areas of Practice Influenced by MfA PD, 2016-17



Leading adult learning has proven to be an effective method for sharing and learning new content and ideas. So, it's not surprising to us that teachers continue to request more opportunities to facilitate courses at MfA. While we know that there is more work to be done in this area, the majority of teachers who

have served as facilitators have demonstrated an ability to effectively share and communicate content to a wide MfA audience. The effectiveness of facilitators is also reflected in the survey feedback from teachers as shown below.

How Effective Was Your Facilitator?



The inherent value of our community comes from teachers connecting with other teachers who align with their philosophical approach to teaching, their specific subject matter, and/or their teaching priorities. That is, teachers learning from other teachers.

However, we recognize that facilitating professional learning conversations is a new skill for many teachers, and we are working to support facilitation as a learning area unto itself across our professional development approach.

IV. School Impact

Master Teacher accounts make it clear to us that the MfA PD extends beyond our walls. Teachers seek to build similar communities of learning among their school peers in ways that are inspired by their MfA experiences. This year, we will investigate more closely how teachers, inspired by MfA, work in their schools to introduce new content or pedagogical approaches, to accept leadership roles, or simply to initiate collaborative work with other teachers. There is a delicate balance, however, given that we don't work directly with schools but rather with teachers. We understand that school culture is complex and widely variant across the city. So we approach our goal with humility, hoping to have a positive impact on schools where our teachers work, while understanding that the fellowship itself does not improve any one school. Instead, we hope that MfA's fellowship model influences the professional learning culture of the schools where MfA teachers work.

i. Regents Exam Performance

Our goal is to help teachers grow as teachers. At the center of the teacher experience, of course, are his/her students. As teachers learn and grow, high student test scores may naturally follow. While student test scores are not included in our fellowship admissions criteria nor do we consider test scores as a measure of the success of our fellowship or of our teachers, they are an important factor in

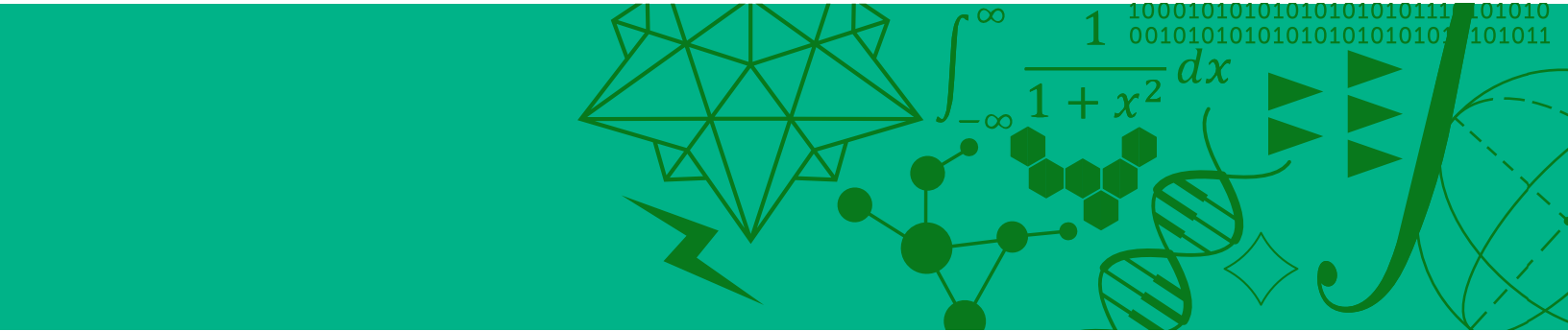
understanding teachers' professional efficacy, and they often serve as a differentiating factor among schools. (See [Achievement & Rats](#), by John Ewing, MfA President, October 2016). To that end, we believe that it's important for us at least to examine correlations. We analyzed the previous years' Regents Exam performance of students of MfA teachers versus students of non-MfA teachers in New York City.

We compared MfA Master Teachers and Non-MfA teachers from the NYC Department of Education. The comparison groups only included those who taught a course ending in a math or science Regents exam.

6,694 Non-MfA Teachers
313 MfA Teachers

Findings indicate that the students of teachers with an MfA fellowship scored significantly higher on Regents exams in all math and nearly all science subjects. (The study took into account other major predictors

of student scores, including poverty status and demographic composition of the school and teachers' experience in the classroom.)



MfA teachers' students consistently scored higher on all of the math and science regents exams.

* Average Regents scores were calculated for each teacher based on the average of their students' scores on the exam. Then, teachers' scores were averaged for the MfA group and the non-MfA group.

For comparison purposes, both MfA and non-MfA teacher groups differ slightly in demographic characteristics as well as their schools' poverty level and student population. For instance:

- The MfA group is made up of a slightly greater proportion of male teachers.
- The MfA group is less ethnically diverse than the non-MfA group.
- MfA teachers also work in schools with a slightly lower poverty rate than non-MfA teachers, less ethnically diverse student populations, and schools with fewer students with disabilities and English Language Learners.

Previous studies have shown that all of these factors play a role in student achievement and were included in the analysis of this

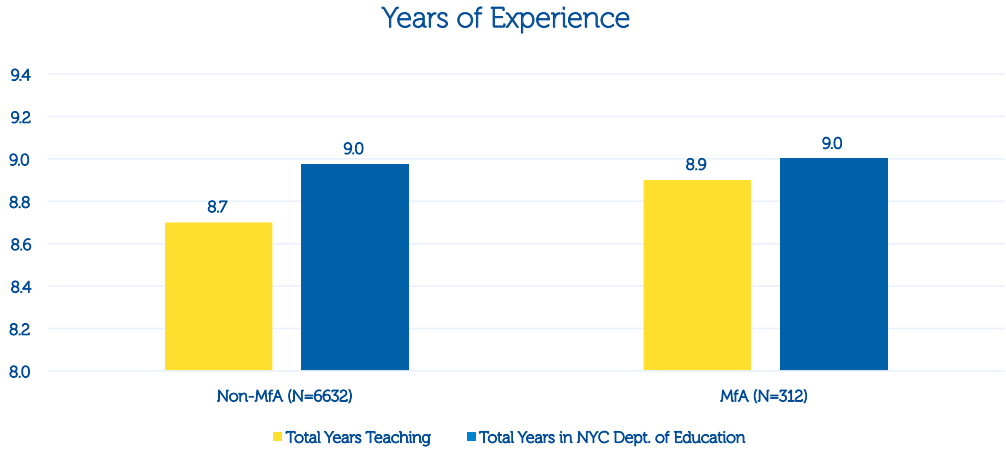
Average Regents Scores for MfA vs. Non-MfA Teachers

	MfA Teachers		Non-MfA Teachers	
	Average Regents Score (by teacher)*	# of Teachers	Average Regents Score (by teacher)*	# of Teachers
Algebra	70.4	100	66.4	2698
Geometry	64.8	65	56.2	1455
Trigonometry	59.2	68	54.2	901
Chemistry	72.4	42	64.3	639
Earth Science	66.7	31	61.9	1150
Living Environment	74.4	70	68.6	2044
Physics	75.2	23	67.1	284

recent examination in order to isolate the impact of MfA teachers on Regents scores.

The number of years teaching experience was nearly equal between the two groups, indicating that experience levels among MfA teachers did not unfairly skew results.

Data drawn from NYC DOE shows MfA teachers have nearly equal years of teaching experience to non-MfA teachers.



Yet, scores on nearly all Regents exams were significantly predicted by participation in MfA

V. Annual Spotlight

The Annual Report “Annual Spotlight” highlights MfA experiences that resonate with our teachers and speak to the fundamental characteristics of the teacher-to-teacher influence of teacher-led communities. This year, we place a spotlight on the 2017 MfA Summer Think 3-Day Conference.

i. Characteristics of Teacher Led Communities: *The Case of The Summer Think Conference*

In the summer of 2017, more than one hundred MfA teachers came together for a teacher-led conference—the first teacher developed summer programming MfA has ever offered. We called it the Summer Think.

The three-day conference was structured to facilitate deep collaboration in a supportive space. Each teacher attended two types of sessions: *Deep Dives* and *Single Session Workshops*. Each Deep Dive group met for six to eight hours over the course of the three days to explore a pedagogical issue, a problem of practice, or a content related topic. Groups were tasked to build an innovative tool, solution, or curriculum to address their topic. On the third day, groups shared out to all conference participants. Examples of Deep Dive topics included: *Inject Equity/Social Justice into your STEM Classroom* and *Hack Your CS Curriculum and Re-think it from the Ground Up*.

Running parallel with Deep Dive sessions throughout the conference were the Single Session Workshops. These were designed to support and complement the work that was taking place in the Deep Dive Sessions. They provided quick explorations of innovative strategies and tools. Examples of Single Session workshops included: *Formative Assessment and Tips & Tricks for Establishing and Maintaining Group Norms*.

Given that this teacher-organized and teacher-led conference was the first of its kind at MfA, we wanted to learn how the participants characterized their teacher-to-teacher communities. So, at the end of the three-day conference, teachers participated in a survey.



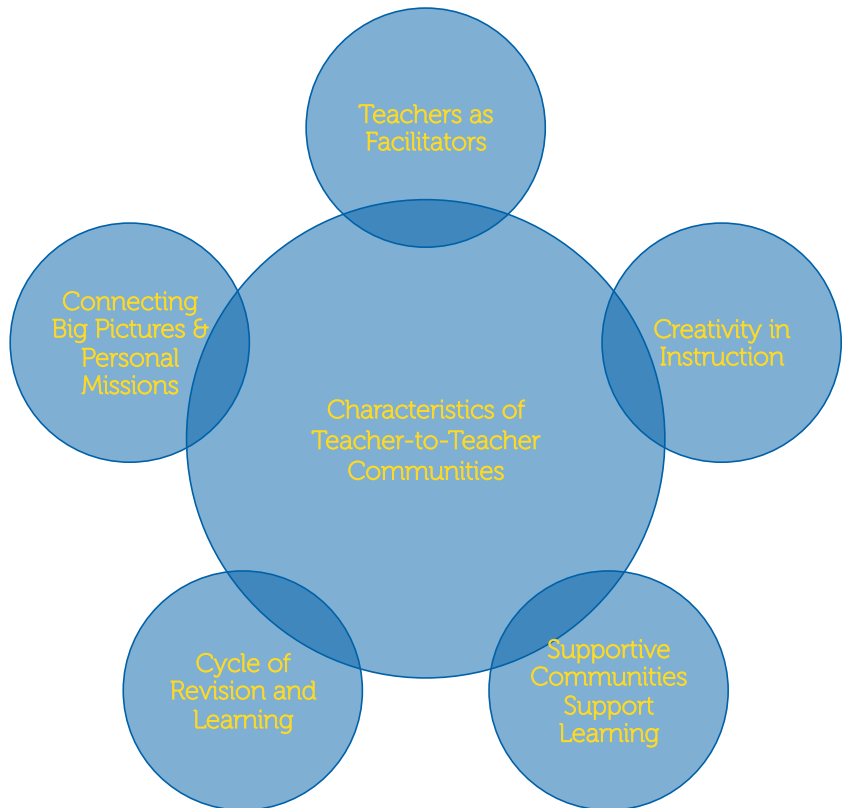
The themes that teachers pointed to as being important characteristics of the conference can be grouped into several broad themes. Five of these themes are displayed in the figure to the right.

A detailed examination of all of the themes would be repetitive, since two of them are the subjects of other sections of this report. ('Connecting to Personal Mission' and 'Creativity in Instruction' are reflected in the cases in section II.) However, three of the themes require some explanation, as they also directly support our approach and understanding of Teacher Efficacy at MfA.

Teachers As Facilitators: Teachers attending the Summer Think Conference held a strong belief that what made the conference so successful was that each teacher had a level of professional responsibility to other teachers that manifested itself as a culture of sharing (i.e. facilitation) and learning.

Cycle of Revision and Learning: Conference teachers also indicated that the conference workshops were flexible enough to allow for constant review and adjustment, supporting an iterative approach to learning and practical application in the classroom.

Supportive Communities Support Learning: Conference teachers also indicated a desire to continue their maintain their relationships from the conference as well as their willingness to take greater facilitation risks again. First time workshop facilitators cited an increase in confidence and a willingness to take additional leadership risks and to try to new strategies in the classroom.



We know that teacher learning is not a solitary endeavor. The above themes highlight that teacher learning occurs as a communal set of activities and interactions among peers, and highlight MfA's commitment to support what is most important to teachers. In many schools and professional development settings teachers are the recipients of, rather than the creators of, learning. Of course, it is easy to understand that true peer-to-peer learning elicits feelings of engagement, efficacy, and ownership. What is significant about the Summer Think, is the rarity in which teachers are given the trust and autonomy to own their own learning in this way.

Summer Think will occur again next summer and we hope to continue to expand its reach as well as the impact it on the teachers who choose to be involved.

Appendix: Additional Readings | References

The National Dialogue – Teacher Retention and the Role of Community

The Social and Economic Impacts of Teacher Attrition

At the center of the national dialogue on the state of the teaching profession is teacher turnover. Teacher turnover has been a topic of research inquiry and debate for years. In 2009, MfA conducted an extensive review of literature regarding teacher retention. The review found the body of research related to the issue of teacher turnover was large and comprehensive, although those studies that may be considered conclusive in their findings formed a much smaller group. At the time, the literature on teacher attrition and retention developed through a relatively uncoordinated array of data collection and analytical efforts that focused on many elements of the problem, but did not produce a very compelling body of cumulative evidence. The information on national attrition rates was sporadic and were subject to inconsistencies because of differences in data collection and sampling methods.

Since then, the study of teacher retention, particularly in K-12 STEM education, has witnessed a renaissance of sorts both in the organization and clarity of research. Recent studies support claims that factors such as administrative support, improved salaries, and dissatisfactions with the teaching career influence teachers' decisions to stay or leave the profession (Carver-Thomas and Darling-Hammond, 2017). Further, when teachers leave the profession, the financial implications of teacher movement out of schools and out of teaching also creates considerable burdens for the schools they leave behind. Estimates exceed \$20,000 to each teacher who leaves an urban school district (Carver-Thomas and Darling-Hammond, 2017).

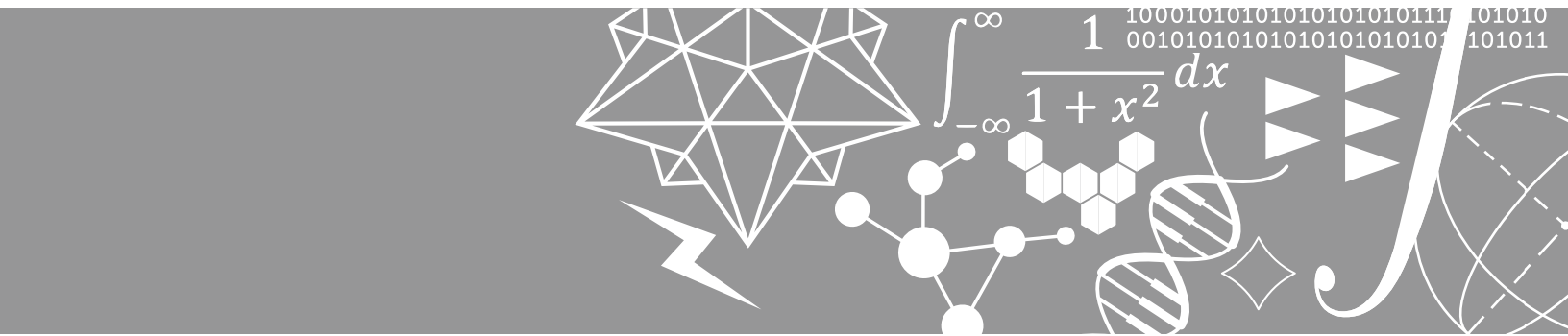
It is also well documented that teachers of

mathematics and science are more likely to leave their school or the profession than those in other fields (Sutcher, Darling-Hammond, and Carver-Thomas, 2016). States across the country are experiencing subject area teacher shortages. In 2015-16, forty-two states experienced shortages in their number of subject area teachers. Forty states reported teacher shortages in science. Students in high-poverty and high-minority settings bear the brunt of teacher shortages. When there are not enough teachers to go around, the schools with the fewest resources and least desirable working conditions are the ones left with vacancies (Ingersoll and May, 2012; Sutcher, Darling-Hammond, and Carver-Thomas, 2016).

Past Approaches to Teacher Turnover

Teacher turnover is and has been a concern for some time. Since turnover has both education and social implications, it makes sense that the discussion has resulted in a wide diversity of proposed solutions. As mentioned earlier, research studies have perpetuated certain long-held beliefs that increased salaries, clear pathways for promotion, and/or adjusted hiring practices should be considered in order to make the profession more desirable, particularly for early career individuals. However, while differential pay and incentive programs for math and science teachers remain a major source of debate and reform, Ingersoll and May (2012) found that salary is relatively less important for retaining math and science teachers.

Increasing monetary rewards may result in enhanced recruitment of math teachers, but the data also show that it is actually a lack of classroom autonomy that causes schools to lose math and science teachers and at a far higher rate than other teachers. For math teachers, by far the strongest predictor to leave or



stay in the profession was the degree of individual classroom autonomy held by teachers in schools with regard to content, texts, materials, techniques, and grading in their courses (Ingersoll and May, 2012). For science teachers, the decision to stay or leave the profession was significantly affected by the extent to which individuals received useful content-focused PD. (Ingersoll, Merrill, & May, 2012a).

Acknowledging Teacher-to-Teacher Influence

Ironically, while teachers in secondary education mainly feel responsibility for their own classroom practice, resulting in largely autonomous and isolated work and private learning activities, most teachers learn best when learning from one another (Admiraal, W., Lockhorst, D., & van, P. J., 2012). Most teachers teach separate classes behind closed doors and learn about teaching by teaching, often described as trial and error (Hodkinson and Hodkinson, 2003). Teachers need to share their teaching practice and learning experiences in order to stimulate their own learning. In their work on communities of practice and school teachers' workplace learning, Hodkinson and Hodkinson (2003) conclude that a highly collaborative working culture is accompanied by a learning culture. Teachers learned from one another intuitively, as an ongoing part of their practice.

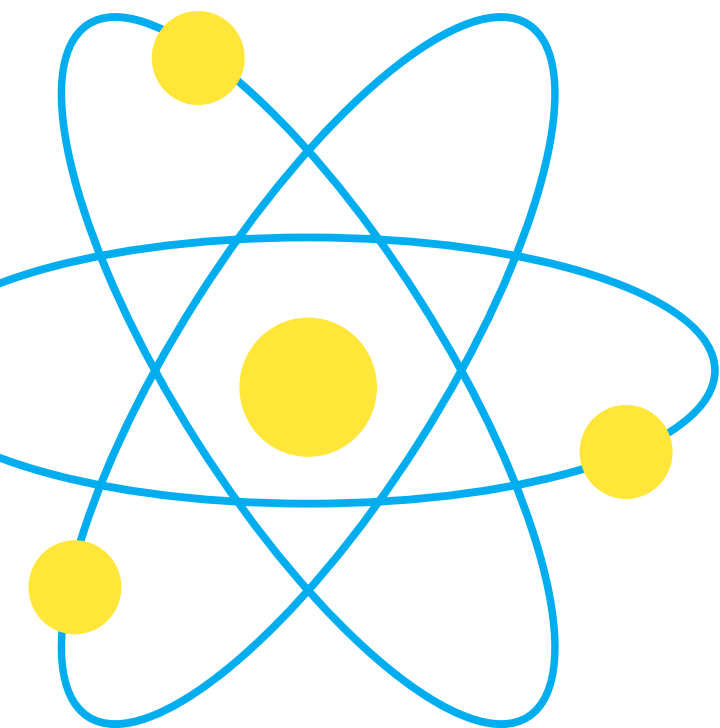
Teacher-to-teacher learning through forms of high quality professional development has also been known to promote teacher efficacy. Essential to both growth and satisfaction is a teacher's idea of efficacy. Generally speaking, self-efficacy is at the root of how we perceive our abilities to execute tasks and how we frame the outcomes of those tasks, and how we attribute blame or credit (Bandura, 1981). Those

attributions then influence how we approach future tasks. It is no surprise then that researchers have found a strong relationship between high levels of teacher efficacy and increased student achievement along with professional commitment (Ashton & Webb, 1986; Gibson & Dembo, 1984). Specific forms of professional development, such as lesson study, are especially effective at increasing self-efficacy by creating feelings of professionalism, increasing confidence, and heightening a sense of the teachers' role in the classroom (Roberts, 2010).

Collaborative Teacher Communities

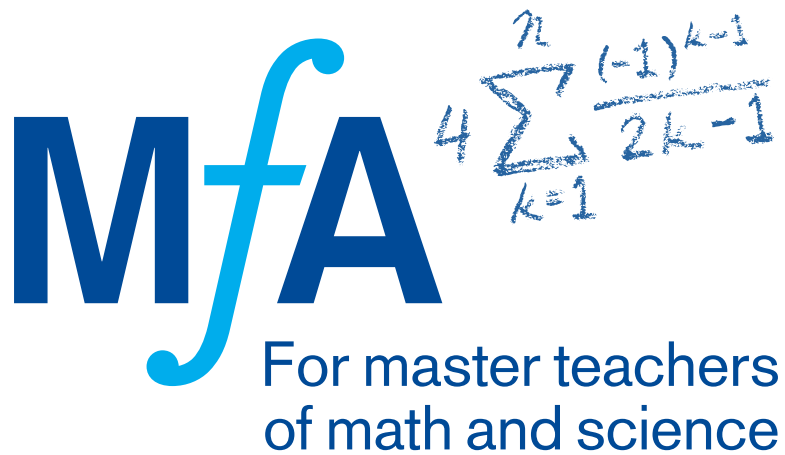
A brief review of recent literature reveals that the historical solutions to teacher turnover do not holistically address the problem of teacher attrition. The importance of professional collaboration and shared decision making does not receive enough attention in the discussion of teacher retention. Plenty of studies cite salaries and professional management as critical focus areas for keeping teachers in the classroom. However, even these studies find that fostering collaborative teacher communities is a necessary part of making teaching a sustainable and rewarding profession.

To summarize, we know that teachers' career decisions are shaped in part by their connectedness to peers working toward a common shared purpose. This cannot be overlooked by any proposed solution to teacher turnover. In fact, a solution that emphasizes such communities in conjunction with other mechanisms such as salaries may stand the best chance of success. (Podolsky, A., Kini, A., Bishop, J. and Darling-Hammond, L, 2016).



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