YEAR 02 REPORT

07.22.2021

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Executive Summary

The New Jersey STEM Innovation Fellowship (NJ STEM) continues to make a positive impact on elementary mathematics instruction across the state. After helping fellows transition to remote instruction during the spring of 2020, the fellowship provided them with the support needed to strengthen their mathematics teaching, increase their confidence in this new learning environment, and spread the innovation and best teaching practices throughout their school communities.

Over the past year, fellows continued to connect and provide critical feedback to push each other to be their best during this challenging time. We are excited to share the story of the first cohort of NJ STEM Fellows and provide exciting updates for the program's future.

In this report, you will find:

- Brief History of NJ STEM
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Brief History of NJ STEM

The New Jersey STEM Innovation Fellowship is based on MƒA's proven teacher fellowship program in NYC. I n the MƒA model, outstanding teachers are selected for fellowships through a rigorous application process. During the fellowship these teachers meet, outside of school hours, to explore innovative teaching practices that enhance student learning. They implement new practices in their classrooms, build capacity to improve student learning outcomes, and ultimately encourage their peers to do the same.

NJ Governor Phil Murphy addresses NJ STEM Fellows at Montclair State University.

NJ STEM was tailored to fit New Jersey's specific needs and advance Governor Phil Murphy's education agenda. After consulting with the New Jersey Department of Education (NJDOE), the decision was made to focus on improving elementary math education through the use of a teaching practice called "number strings." Number strings have been shown to significantly improve learning outcomes in elementary math. Several corporate and family foundations joined together to fund the program, including the Overdeck Family Foundation, PSEG Foundation, Celgene (now Bristol Myers Squibb), Becton, Dickenson and Company, the Maher Charitable Foundation, and ADP. The program is administered by a university partnership led by Montclair State University, along with Princeton University and Rowan University.

After Governor Murphy announced the program in January 2019, MƒA spread word about the initiative with the help of key stakeholders such as NJDOE, the New Jersey Education Association, the New Jersey School Boards Association, and the New Jersey Principals and Supervisors Association.

The first cohort received five applications for each available space. 30 elementary educators were ultimately selected, representing 20 districts and 29 schools. 50% of these educators work in schools where more than 60% of students receive free and reduced lunch. Cohort 1 graduated from the fellowship this year after two years in the program, and a third of these educators will continue in a new emeritus fellowship. The second cohort, who were accepted in June 2021, consists of 30 elementary educators representing 27 districts and 30 schools. Over a third of these educators work in schools where more than 60% of students receive free and reduced lunch.

Story of Cohort 1:

Attending to Student and Teacher Needs During a Pandemic

"Thank you so much for making this possible, I will miss this supportive and crazy place where other people get excited about how to count drain holes or buttons!" - Northeast Region Fellow, final program reflection

Goals

At the start of the fellowship in 2019, the goal was to create a supportive learning community where elementary teachers could open their classrooms to one another in ways that built capacity to implement the innovation of number strings effectively. Initially, the objective was to double the program size in year two and welcome in new fellows for 2020. However, as a result of the impacts of COVID-19, we quickly shifted our goals for the remainder of the spring by inviting all fellows to return for a second year of the fellowship and by modifying the goals for the learning community to help them prepare for the harsh realities of education during the pandemic.

Over the summer, the leadership team met to discuss modifications to the original vision of the fellowship to adapt to the realities of online learning. We wanted to meet the teachers where they were and continue to help them build capacity to support their students' mathematical development.

Our goals for teachers during year 2 included:

- Planning for and implementing numbers strings and related tasks/routines during remote instruction.
- Becoming more confident and skillful in reflecting on their teaching.
- Teaching colleagues about planning for and implementing number strings and related tasks/routines.
- Developing collegial relationships that support risk-taking and reflecting on artifacts of teaching.

By widening the fellowship goals to include remote instruction and teaching tasks/routines, the fellows were able to adapt to the challenges and uncertainties of 2020. In particular, these goals provided opportunities for the fellows to consider how to use technology to (1) provide meaningful learning experiences for themselves and (2) help students learn math at a distance.

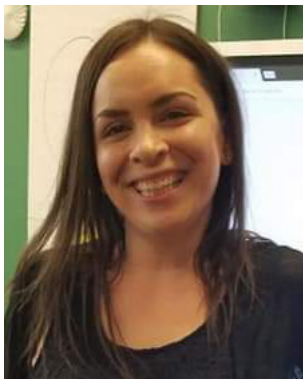
Activities

The activities for the fellows remained relatively consistent across the two years, an aspect of the program that provided the teachers with much needed grounding as they grappled with the challenges presented by the pandemic. These activities included the following:

- Summer institute: Preparing teachers for effectively implementing the innovation (year 1) and for the various challenges of the years, including continuing to build skills in remote and hybrid instruction (year 2).
- Regional meetings: Participating in monthly meetings (in person and online) to share artifacts of teaching and engage in collegial discussions focused on improving instructional practices to support student thinking. In year 2, these meetings also included two "grade band meetings," where teachers from across the regions met in grade bands (K-1, 2-3, and 4-5) as a way to dig deep into content, share problems of practice, and strengthen the NJ STEM community of practice across, and not just within, regions.

Impact

The NJ STEM Fellowship's impact on teachers and their practice is clear both through our data and through teachers' testimonials. Our impact was powerful enough that people outside of our community noticed as well; this year, two NJ STEM Fellows were interviewed for stories locally, providing a window into the power of this community. One of the teachers interviewed, Racheal Safier, also shared her future hopes and goals in the final cohort meeting. She will strive to *"Utilize what I've learned as an administrator someday; Encourage innovation in the classroom and facilitate opportunities for teachers to reflect on their practice."*



Racheal Safier

Beyond these stories, we used three data sources to understand how well our innovation was supporting teachers and students.

1. Teacher surveys: We surveyed fellows at four separate times during their two-year fellowship in order to gain a perspective on how (and how often) number strings and other related tasks and routines were being used in the classroom; the ways in which the fellows were stepping up as leaders in their schools and districts; and to gather feedback on their professional learning opportunities.
2. The National Survey of Science and Mathematics Education: We administered selected questions from this instrument at four separate points in time throughout the fellowship. This instrument provides information about how frequently teachers are using practices that are aligned with improved student outcomes.
3. Classroom videos: In year 1, we collected videos in September 2019 and March 2020. The videos were collected in order to understand how students benefited from instruction using number strings.

Through these data sources, we have worked to understand the success of the fellowship by investigating (1) classroom implementation, (2) teacher leadership, and (3) impact on student learning.

Classroom Implementation

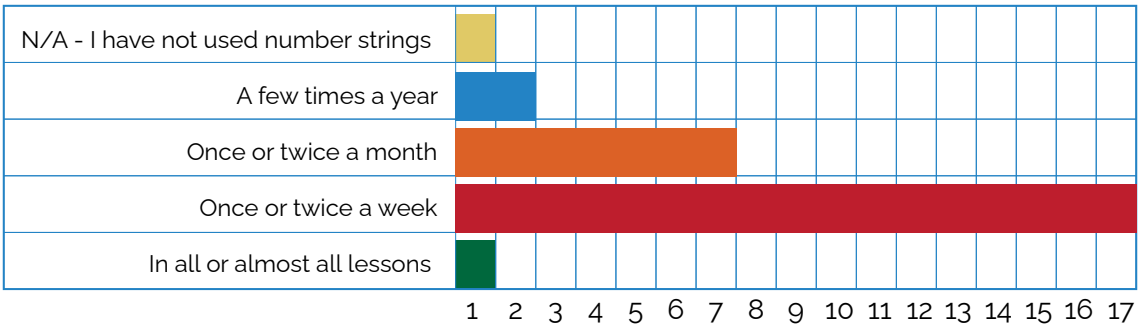
"The most interesting thing for me has been working with students to try to understand how they construct their understanding of numbers and math problems." North Region Fellow - Midyear survey 2020

During the first year of the fellowship, the fellows gained proficiency in using numbers strings, orchestrating productive class discussions, and increasing their confidence as mathematics educators. By June of the first year, all fellows reported using number strings, on average, at least three times per week prior to moving to remote instruction. Moreover, all fellows agreed that the fellowship had strengthened the way they taught mathematics as a whole within their classrooms.

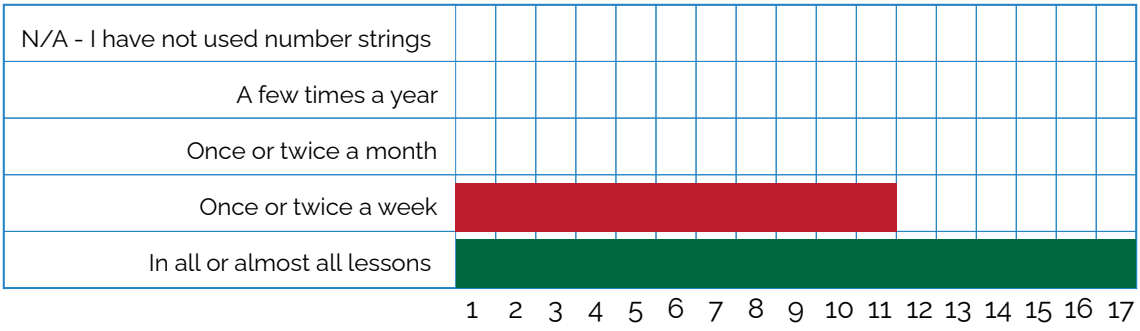
This trend in proficiencies and confidence continued over the course of the 2020-2021 school year.

According to the survey administered in May 2021, despite the challenges presented by hybrid and remote teaching, most of the teachers continued to use number strings in their instruction on a regular basis. Moreover, all fellows incorporated new practices, tasks, and/or routines learned in year 2 into their instruction on a weekly or daily basis.

During the current school year, I have used **number strings** in my instruction...



During the current school year, I have used **new practices, tasks, and/or routines (e.g. Intentional Talk)** I learned in my fellowship in my instruction...



Impact on Student Learning

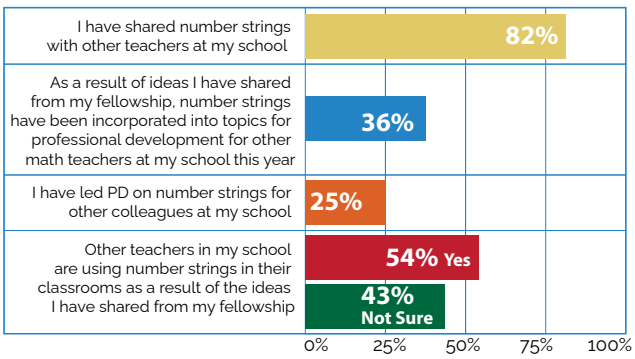
"I have used discussion techniques [from the fellowship] in every single one of my lessons, not just math. Asking students to repeat other students ... it creates amazing discussions." Central Region Fellow - Midyear survey 2020

"For my bilingual students, it opens the opportunity to develop their academic vocabulary and to realize that there's more than one way to solve a problem." North Region Fellow - Final reflection May 2021

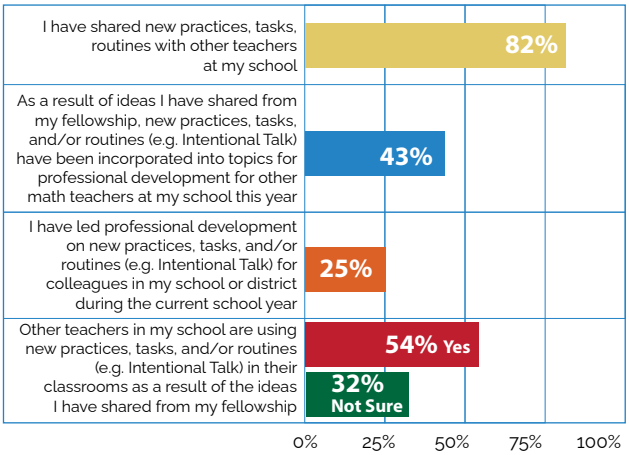
Throughout the first year of the fellowship, we explored the possibility of using standardized test scores in order to draw a connection between teachers' participation in the fellowship and student achievement; however, we ran into various obstacles. First, New Jersey does not make test data available disaggregated by test question, making it difficult to link student test scores to the specific teaching innovations explored in this fellowship. Additionally, due to the pandemic, New Jersey canceled standardized testing in the spring of 2020 and spring of 2021, so no data was available for these years. As a consequence of these challenges, we used the best available proxy measures of student achievement: (1) pre- and post-surveys gauging teacher's implementation of high quality instructional practices; (2) videos of teachers implementing number strings in their classrooms; and (3) self-reported teacher observations of student growth in curiosity, excitement, engagement, and mastery of the mathematics explored in their classrooms.

At four points throughout the fellowship, we surveyed teachers about their instructional practices using a set of questions adopted from the National Survey of Science and Mathematics Education. These questions measure how frequently teachers use instructional practices that are related to number strings and the other innovative tasks/routines explored during the fellowship which, through previous research, have been shown to be highly correlated with student achievement. Examples are shown below.

Number strings - year 1 focus



New practices, tasks, and/or routines (e.g. Intentional Talk) - year 2 focus



Student outcomes

As shown above, through participation in NJ STEM, teachers adopted new teaching practices at a statistically significantly higher rate at the end of year 1 as compared to the beginning of year 1. At the start of year 2, most fellows reported struggling to implement these practices as a result of their move to remote and hybrid teaching environments. However, because of the pivot in goals made before the start of year 2, the fellowship successfully supported teachers in translating innovative practices to their new teaching environments, sustaining the gains made in year 1.

We also asked teachers to assess how their students were responding to the new practices, tasks, and routines they were incorporating in their teaching throughout the fellowship. Teacher observations are shown below across five student outcomes. Most teachers agreed that the innovative practices learned in their fellowship had a direct impact on students' curiosity and excitement about math, mastery of math concepts, and engagement in problem-solving discussions with other students.

As a direct result of the new practices I have incorporated in my teaching, I have observed an increase in my students'...

	Strongly Disagree	Disagree	Agree	Strongly Agree
Ability to identify math ideas that are helpful in problem-solving by talking with their classmates	0	1	18	9
Ability to provide mathematical reasoning to explain, justify, or prove their own thinking	0	0	15	13
Ability to ask questions to clarify, challenge, or build on the mathematical reasoning of other students	0	2	18	8
Curiosity and excitement about math	0	1	9	18
Mastery of the math concepts covered in my class	0	2	19	7

Since our year 1 Report was written, we analyzed new data from year 1 that has further strengthened measures of impact. Using videos of teachers' instruction from November 2019 and March 2020 (prior to the move to remote instruction), we applied the Mathematical Quality of Instruction (MQI) observational rubric developed by Dr. Heather Hill from the Harvard Graduate School of Education and colleagues from Michigan StateUniversity.

An independent coder who was trained in the rubric found that there was, overall, a statistically significant increase in teacher and student practices that are aligned with student achievement in mathematics. In particular, videos demonstrated that, as teachers became more adept at implementing number strings in their classrooms, students had more opportunities to communicate around the mathematics being explored, and that teachers were more likely to use those contributions to build mathematical knowledge in the classroom.

	mean	
Students communicate about the mathematics of the segment	3.2	3.5*
Teacher uses student mathematical contributions	3.1	3.4*
	November 2019	March 2020

Rubric scale: 1 = Not present; 2 = Low; 3 = Medium; 4 = High
*Statistically significant

Next Steps

After completing the NJ STEM Innovation Fellowship program, cohort 1 fellows were able to apply for a new emeritus fellowship, which was set up to further expand the potential for teacher leadership among our fellows as they shared innovation within their schools and districts. The NJ STEM Emeritus Fellowship Program is a one-year renewable fellowship with the purpose of providing elementary mathematics educators the opportunity to focus on furthering the NJ STEM Innovation Fellowship goals to develop (1) expertise and confidence in sharing number strings and related teaching practices with colleagues both formally and informally; and (2) collegial relationships that support risk-taking and reflecting on teaching. This component of the emeritus Community of Practice (CoP) focuses on developing teacher leaders who "foster a collaborative culture of continued educator development and improved student learning" (Teacher Leadership Exploratory Consortium, 2011). Teacher leaders also help their peers (1) engage in sensemaking and productive struggle with regard to their teaching; (2) foster agency and identities as professionals; and (3) identify personal strengths and weaknesses for continuous professional growth.

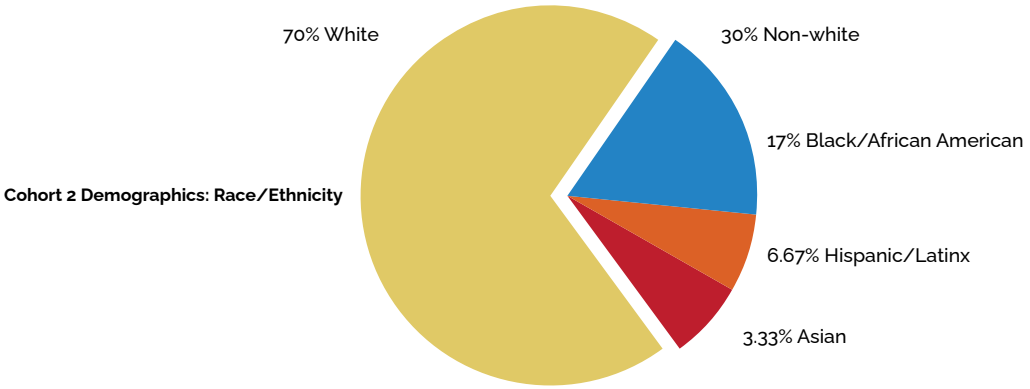
The opportunities to engage in this fellowship will provide explicit support in helping emeritus fellows expand their impact beyond their classrooms by developing expertise and confidence in how to share number strings with others and collectively reflect upon teaching practices that support number strings.

The related teaching practices include: making student thinking visible; analyzing, interpreting and reflecting on student solutions; and engaging students in making sense of peer solutions, which have been the central components for NJ STEM.

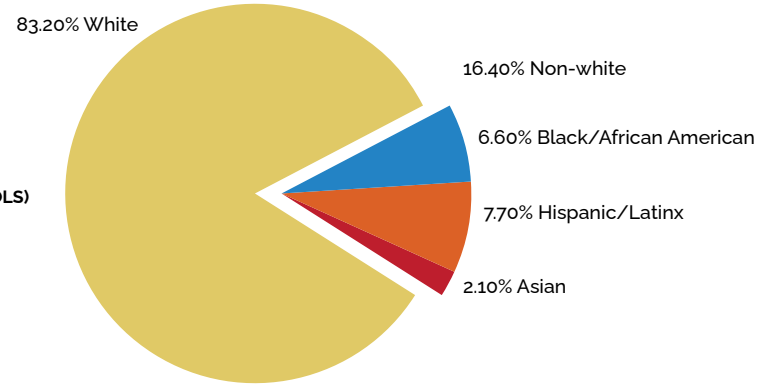
Introduction to Cohort 2

In August 2021, we will officially welcome our second cohort of NJ STEM fellows into the program. This cohort was made possible through the generosity of our private funders and includes educators from 25 districts across the state, all of which received Title I funding. The new cohort consists of 24 classroom teachers and six instructional coaches and is more diverse racially than the state's public school teacher population.

The fellowship will begin with a summer institute. The fellows will then engage in monthly meetings within their regions in a mix of remote and in-person events.



Cohort 2 Demographics: Race/Ethnicity

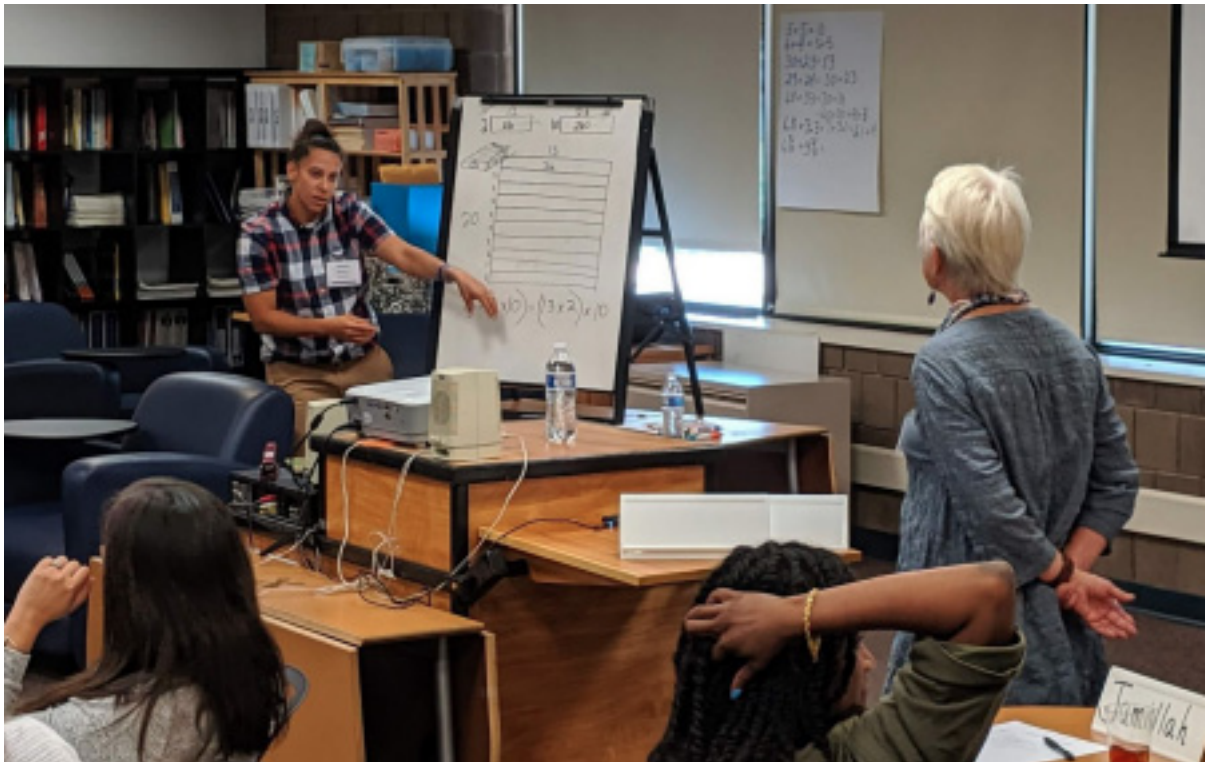


NJ STATE OVERALL (ALL SCHOOLS) 2019 Data

Looking Forward

The NJ STEM program continues to grow with the addition of our second cohort of fellows and the emeritus fellowship. These opportunities have been possible with the continued generosity and support of our partners through private funding, and with support from other key stakeholders such as JerseyCAN. The goal has always been to cultivate support for a true private-public partnership with funding from the state. We are excited to report that the Fiscal Year 2022 Appropriations Act that was signed into law by Governor Murphy on June 29 included funds for the NJ STEM program that will be used to expand the program to elementary science. This expansion will continue to support the governor's agenda and NJDOE efforts to promote broad and equitable learning opportunities for students and provide important professional development for teachers.

We are optimistic that this private-public partnership will continue to grow and thrive as we continue to provide much needed support to teachers and students across the state.



Nationally renowned elementary math education expert Dr. Cathy Fosnot works with NJ STEM Fellow Alison Mahfouz at the Summer Institute held at Montclair State University in August 2019.

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NEW JERSEY STEM INNOVATION FELLOWSHIP