



YEAR 01 REPORT



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Executive Summary

In 2019/2020, the New Jersey STEM Innovation Fellowship:

- Recruited a statewide applicant pool with the help of partners including NJ Department of Education, NJ Education Association, NJ School Boards Association, and others.
- Selected a diverse group of 30 exceptional teachers representing 24 districts and 29 schools.
- Launched the fellowship with a summer institute attended by Governor Phil Murphy.
- Convened monthly professional development meetings at Montclair State University, Princeton University, and Rowan University.
- Transitioned to a fully remote professional development model following the COVID-19 outbreak.
- Documented an increase in teacher participants' use of innovative teaching practices, efficacy, and the spread of best practices to colleagues in districts and schools.



NJ STEM Fellows engage in online professional development following the COVID-19 outbreak.

History of the Fellowship



The New Jersey STEM Innovation Fellowship (NJ STEM) is based on MfA's proven teacher fellowship program in NYC. In the MfA 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.

MfA tailored the new program 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), MfA determined that the pilot year would 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. MfA built support for the new initiative with the help of JerseyCAN, an advocacy group that focuses on equitable learning opportunities in STEM. Several corporate and family foundations joined together to fund a pilot program, including the Overdeck Family Foundation, PSEG Foundation, Celgene, BD, the Maher Charitable Foundation, and ADP. The program is administered by a university partnership led by Montclair State University, and includes Princeton and Rowan Universities.

After Governor Murphy announced the program in January 2019, MfA spread word about the new initiative with the help of key stakeholders such as NJDOE, the New Jersey Education Association, the New Jersey School Boards Association, the New Jersey Principals and Supervisors Association, and others. The program received five applications for each available space. 30 teachers were ultimately selected, representing 20 districts and 29 schools. 50% of these teachers work in schools where more than 60% of students receive free and reduced lunch.



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



2019-2020 Program Highlights

Following the institute, each university partner hosted regional professional development meetings on a monthly basis that focused on collectively investigating the successes and challenges that teachers were having implementing number strings in their classrooms. Teachers were given cameras to record their lessons, and the videos were analyzed as part of the professional development. As fellows learned to



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.

implement number strings, they also began to share what they were learning with other teachers in their schools and districts. Some fellows did this informally by inviting colleagues to visit their classrooms, and others were asked to facilitate professional development for colleagues in their schools and districts. In the fall, program leaders discovered that teachers asked for more opportunities to refine the associated practices that provide the basis for number strings, such as facilitating mathematical conversations or understanding the mul-

iple pathways that students may take in solving a problem. This delayed the intended programmatic shift of focus on leadership skills to spread the innovation beyond participants' classrooms until closer to the end of the year, a plan that was ultimately derailed by the global pandemic. The pandemic also interrupted the recruitment and selection of new fellows for year 2. For these reasons, program leaders decided to award all fellows a second-year fellowship, as opposed to the original plan to renew a portion of fellows alongside new applicants.

The pandemic forced all teachers to move to remote teaching in the spring. The program responded by shifting focus to supporting teachers in implementing the innovation in remote environments so that fellows could best support their students in an unprecedented time. Monthly regional meetings moved to Zoom, and focused not only on implementing number strings in a remote setting, but also how to develop other effective remote practices.

"I've learned that it is still possible to have meaningful [remote] mathematical discussions with my students. I love that we explored a lot of different platforms to help get our students involved and participating, and I love that we used Zoom while we were figuring everything out together. I hope to be able to follow a similar format with my students and establish routines for rich, productive math lessons regardless of what our schedule looks like next year."

- NJ STEM Fellow

Impact



Tragically, program evaluator Colin Mably died in March. The New Jersey STEM Innovation Fellowship is deeply indebted to his work, especially as it related to collecting video used for professional development and evaluation. He helped to shape many aspects of the program that contributed significantly to its success. Following Colin's passing, MfA obtained all evaluation data and passed analysis and MfA completed the remaining evaluation work internally.

To understand how well our innovation was supporting teachers and students, we have been using three data sources:

1. Teacher surveys: We surveyed our teachers in December and June, in order to gain a perspective on how (and how often) number strings 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 in August before the school year started, as well as at

the time when teaching moved remote in March. This instrument provides information about how frequently teachers are using practices that are and are not aligned with improved student outcomes.

3. Classroom videos: videos from all classrooms were collected from September to March. The videos were collected to understand how students benefited from instruction using number strings. We will be using the Mathematical Quality of Instruction tool, developed by Dr. Heathe Hill and the Center of Education Policy Research at Harvard University, as one way to understand how strings influenced student learning over time.

Through these data sources, we have worked to understand the success of the fellowship by investigating

- (1) the implementation of number strings,
- (2) teacher leadership, and
- (3) student outcomes.

Implementation of number strings

"Participating in the fellowship has reignited my love of math and teaching math. Before the fellowship, I was a good math teacher but I had become complacent. Being a part of the fellowship has inspired me. I have wholeheartedly embraced number strings and incorporate them into every math lesson."

- 2nd grade teacher in Carneys Point

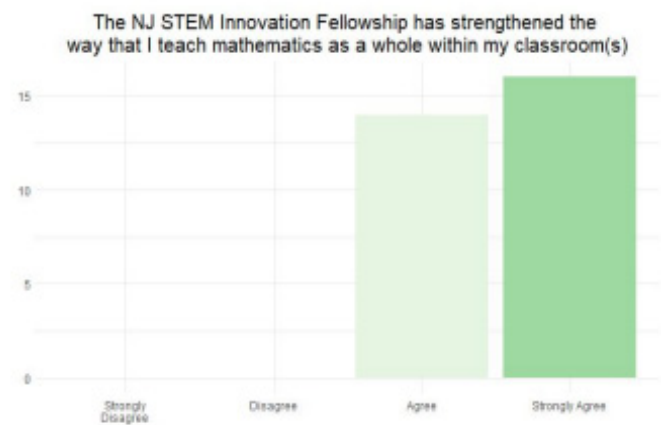
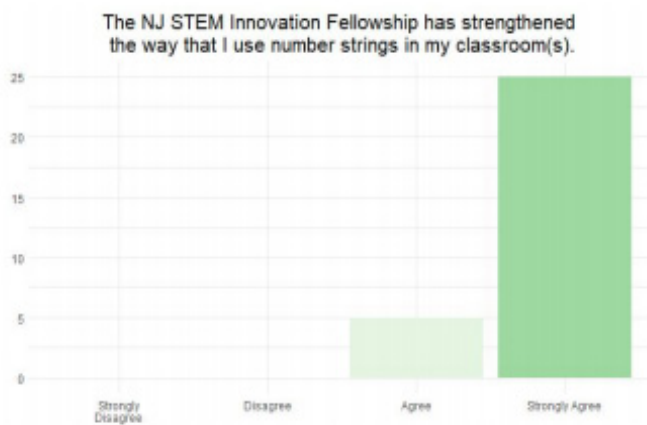
Over the course of the 2019-2020 school year, our teachers gained proficiency in using number strings, in orchestrating productive discussions in their classroom, and in increasing their confidence as mathematics educators. According to the survey administered in June, 97% of the teachers reported using numbers strings at least twice per week prior to the move to remote instruction.



Implementation of number strings

- In December of 2018, incoming NJ STEM Fellows had effectively never tried a number string in their classrooms.
- In June of 2020, **all** of the NJ STEM Fellows reported using numbers strings, on average, at **least three times per week** prior to the move to remote instruction.

Moreover, 100% of the teachers agreed or strongly agreed that the fellowship strengthened the way they used number strings in their classrooms and how they taught mathematics more generally.



Leadership

"My participation in this program has been inspiring. As an educator, you rarely have the opportunity to grow through trial and error of best practices with frequent collaboration and support. I am encouraged because I see the progression of my students at various levels, and they are learning new strategies to help them understand a core concept for their grade band. I wish this program could certify us to be teacher leaders for strings. I see teaching others, facilitating mini workshops in district, and afterschool string classes as future opportunities."

- 4th grade teacher in Orange

For teacher leadership, we focused on teachers' ability to lead by example and to support school and district colleagues in learning about and implementing strings. According to the June survey, 87% of the teachers reported sharing number strings with other colleagues in their schools/districts, up from 63% of the teachers reporting in December that they had been asked to share their work with colleagues.

- In December of 2019, **63%** of the NJ STEM Fellows had already been asked to share the work of number strings in their school or district.
- In June of 2020, **87%** of the NJ STEM Fellows reported sharing the work of number strings in their school or district.

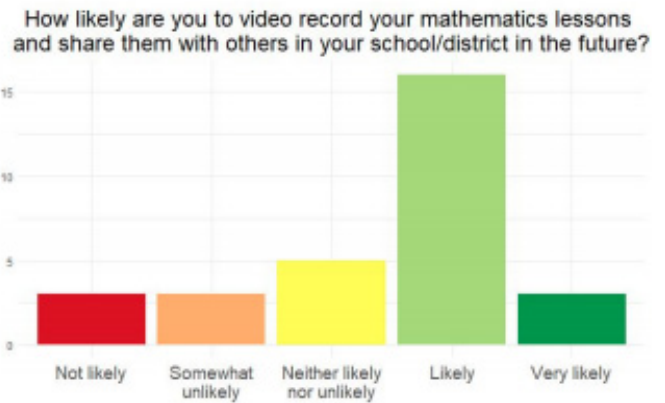
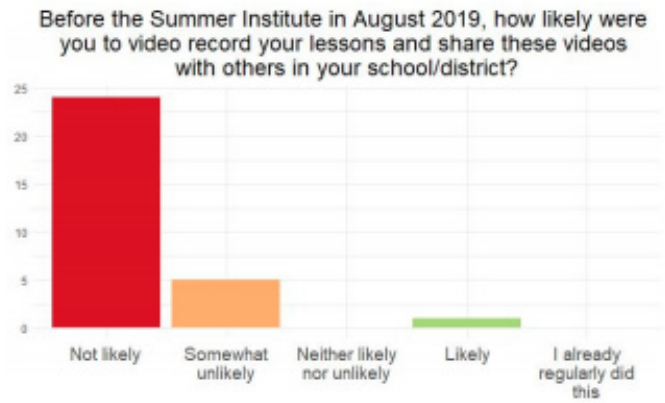




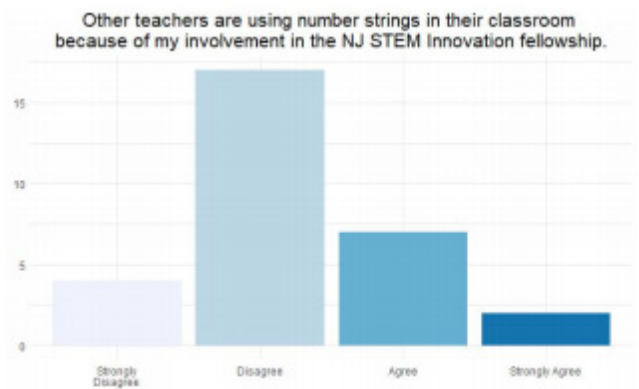
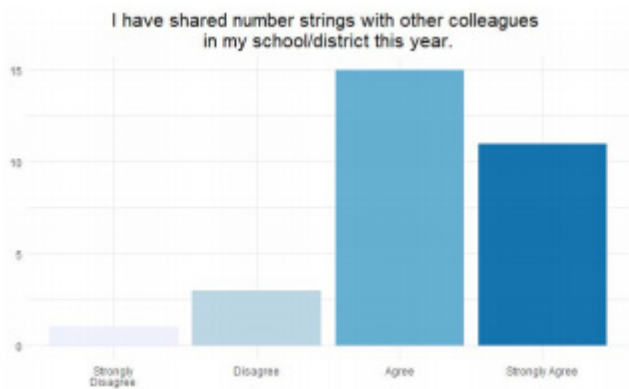
teachers can open their classrooms to one another in ways that build capacity to implement the innovation effectively. Video has been shown to be an effective tool for teacher professional development. Many teachers, however, are reticent to open their classrooms through the use of video to their peers. Early results of the New Jersey STEM Innovation Fellowship are especially promising in this regard, where teachers have created and shared video from their classrooms extensively, both in monthly meetings and online.

"The fellowship has taught me how to be vulnerable and receive feedback. It takes a very strong teacher to record themselves, and watch the video with peers to gain feedback. I have never really watched myself teach before and that has been a learning experience. This is the most reflection I have had on my lessons, and it has resulted in real change and growth in my classroom."

- 1st grade teacher in Trenton



Moreover, 30% of the teachers reported that their colleagues also began implementing numbers strings in their classrooms. This number is likely low because of the move to remote instruction and we will work on increasing this impact in Year 2.





Student outcomes

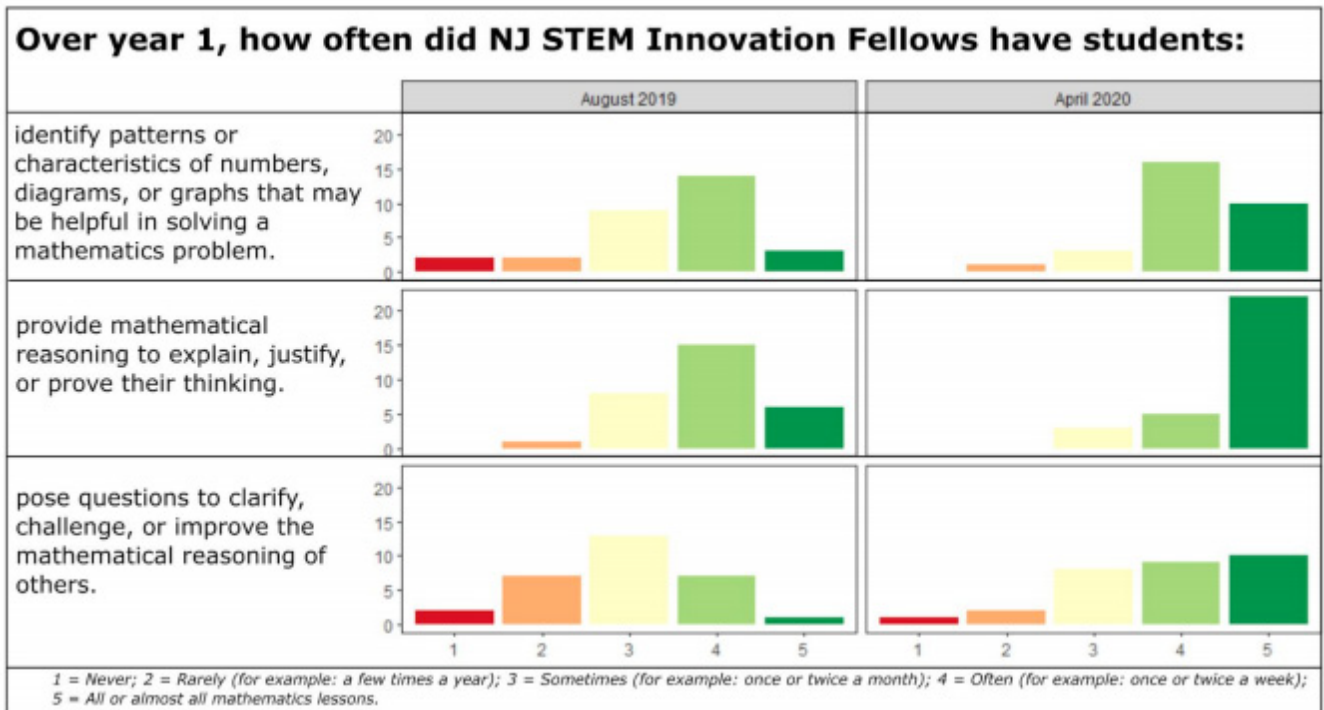
"My participation in the NJ STEM Innovation Fellowship program has helped my students in a variety of ways. As a teacher of English Language Learners, I often watch my students struggle with new mathematical concepts. Since implementing number strings in the classroom I have seen my students become more critical thinkers and take pride in their mathematical abilities."

- 3rd grade teacher in West Deptford

We use teacher efficacy and the rate at which teachers use positive teaching practices as proxy measures of student learning outcomes. In terms of teacher efficacy, or how our teachers feel about their ability to improve student learning outcomes, 100% of teachers agreed or strongly agreed that the New Jersey STEM Innovation Fellowship

(1) strengthened the way that they teach mathematics as a whole within their classrooms and (2) increased their confidence as mathematics educators this year. In terms of how often our teachers use practices that improve student outcomes in relation to number strings, results from the National Survey of Science and Mathematics Education showed that our teachers were significantly more likely to have students:

- Identify the math ideas that are helpful in problem-solving by talking with their classmates and/or using manipulatives, pictures, diagrams, tables, or equations.
- Provide mathematical reasoning to explain, justify, or prove their thinking.
- Pose questions to clarify, challenge, or improve the mathematical reasoning of others.





Ultimately, we are interested in using student achievement data as one measure of impact. We explored this possibility throughout the school year, and ran into various obstacles. New Jersey does not make test data available that is disaggregated by item, making it hard to link instructional goals for the innovation to student achievement. This difficulty aside, New Jersey ended up cancelling exams due to the pandemic. For future years we are considering the development of assessments tailored to the program goals. Even so, our teachers consistently shared stories of student growth as a result of their work with number strings, which provides evidence of positive student learning outcomes.

"One of the standards for first grade is fact fluency with addition and subtraction. Last year, we had to take a pre-assessment and

post-assessment. We did the same thing this year and my scores are higher. I feel like it is because of the number strings."

- 4th grade teacher in Orange

"I teach a high ESL population of students... Throughout the year, I observed many students using the strategies and models we developed and discussed while completing strings."

- Kindergarten teacher in Lindenwold

"I definitely feel my class had a stronger number sense than in previous years. I also saw their flexibility with numbers greatly grow. They were often able to see problems and situations from various angles and to think about them in many different ways (and see the connections between their different ways)."

- 3rd grade teacher in Montgomery

Looking forward

"Besides setting off an unprecedented public health crisis, the COVID-19 pandemic also unleashed an economic crisis that can only be rivaled by two other times in our state's entire 244-year history – the Great Depression and the Civil War."

- Governor Phil Murphy

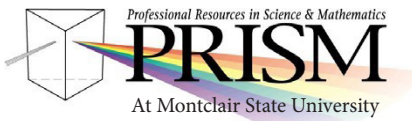
The original plan for year 2 of the New Jersey STEM Innovation Fellowship was to secure matching funds from the state in order to double the program size in its second year. While the COVID-19 pandemic made this growth goal unattainable, private funding will support the program in its second year, with a focus on developing fellows ability to spread the innovation and other best practices in remote-teaching environments. While the immediate prospect of state funding remains unlikely, the goal is to secure private funding for a third year of the fellowship, in which a new cohort of thirty fellows will be selected. Our goal is to continue to

cultivate support for a private-public partnership that is in part funded by the state. By focusing on building capacity for innovation in remote-teaching environments, the fellowship will continue to support the Governor's agenda and NJDOE efforts to promote a successful shift to remote and hybrid instruction.

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FUNDERS



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