

## A Promising Future for Math Instruction: Preparing Effective Teachers and Tutors

Insights from Piloting Elementary Mathematics Training Modules with Teacher Preparation and Tutoring Programs

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Since 2015, Deans for Impact (DFI) has supported nearly 200 educator-preparation programs and districts to prepare novice and early-career teachers to implement **evidence-based teaching practices** through our instructional programming and tools. During the 2022–2023 school year, we piloted instructional modules designed to support aspiring teachers serving as tutors to be better prepared to teach, and tutor, elementary mathematics.

These modules were adapted from materials **originally designed in partnership with teacher-preparation programs** to support future teachers to effectively identify, analyze, and use **high-quality instructional materials (HQIM)** in math in support of student learning. They were embedded into college coursework and/or on-the-job training in four teacher preparation and tutoring programs situated in different geographical contexts around the country.

**High-quality instructional materials (HQIM)** are expertly-sequenced curricula designed to support students in meeting college - and career-ready standards. They can **lighten the load for novice teachers**, enabling them to focus on building relationships, deepening their own content knowledge, and adapting lessons to meet the needs of their students.



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*- Aspiring teacher*

## Background

Effective mathematics instruction is foundational for cultivating our future workforce; by 2032, STEM occupations are expected to grow **11%**, far outpacing non-STEM careers. Students' ability to master mathematical knowledge and skills not only has implications for their careers; mastering mathematics content also has valuable problem-solving and critical thinking applications in daily life.

Today, too many students in the United States do not have access to quality mathematics instruction. The 2023 **Program for International Student Assessment (PISA)** results reveal that one-third of 15-year-old American students scored below proficient in mathematics, and U.S. scores were lower than they were 20 years ago. Nationally, there are uneven levels of access to quality learning experiences among different student groups. On the **National Assessment of Educational Progress (NAEP)** assessment, 2022 mathematics performance results show that fourth-grade white students outperformed Black and Hispanic peers by 29% and 21%, respectively, and students eligible for the National School Lunch Program scored 26% lower than those not eligible.

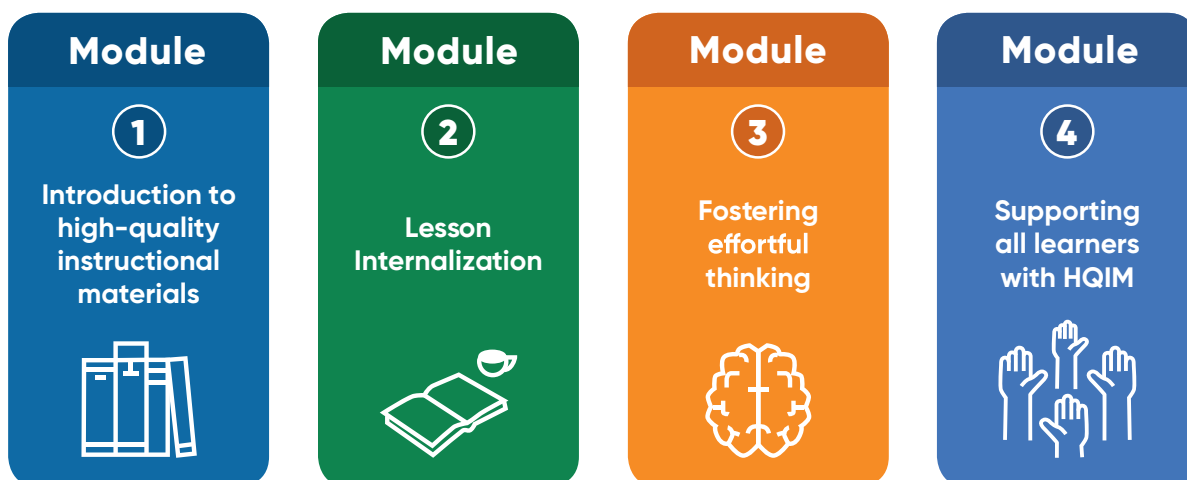
If we want students to thrive in their chosen careers and long-term aspirations, we must make sure that all students have access to rigorous, affirming mathematics instruction grounded in a scientific understanding of how students learn.

**High-impact tutoring** is one of the most effective means of improving student learning; however, limited training for tutors often results in a high rate of turnover, leaving programs understaffed with quality tutors. One means of addressing this challenge is by mobilizing aspiring teachers as tutors. This generates a meaningful supply of tutors that can support the acceleration of math learning for students while simultaneously providing aspiring teachers with **meaningful practice opportunities** to strengthen their instructional skills, build more confidence and joy for teaching, and earn compensation. Integrated practice opportunities are also a key component of comprehensive preparation, which enables novice teachers to be more effective in the classroom and **2-3 times more likely to stay**.

## What We Piloted

These **asynchronous practice-based modules** represent approximately 24 hours of content that support the ongoing training and development of aspiring teachers serving as tutors in elementary mathematics (K-8) through the identification, analysis, and use of HQIM. Each of the modules follows a research-based learning cycle that allows aspiring teachers to understand, analyze, and apply the concepts covered in the materials. Through engagement with the modules, aspiring teachers:

- Build background knowledge about math content by exploring a key concept or practice at work
- Explore strategies related to the practice, grounded in real instructional artifacts
- Complete a culminating activity where tutors 'put it all together' in response to a real-world example



We provided these modules to programs to embed in their tutor training experiences or in teacher-preparation coursework. Modules are intended to be completed in sequence and in full:

**Module 1:** Identify and use HQIM to focus student attention on the knowledge and skills that help students master ambitious academic standards

**Module 2:** Intellectually prepare to teach a particular unit or lesson to free educators up to focus on and respond to student thinking in-the-moment

**Module 3:** Anticipate student misconceptions and ask questions that encourage higher-order thinking about ambitious content and skills

**Module 4:** Attend to the specific needs of all learners, including students with disabilities and emergent multilingual learners, as they engage with ambitious academic content

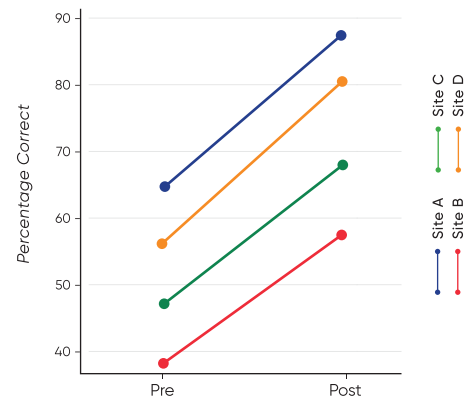
## What We Learned

We partnered with researchers at Texas A&M University and University of Virginia to collect pre-and post-assessment data to examine the extent to which completion of training modules is associated with changes in aspiring math teachers' **mindset and beliefs and instructional knowledge and skills**, and whether there are variations in these changes across teacher-candidates with different demographic and other characteristics. As teachers are the **most important factor** impacting student learning, their mindsets, beliefs, and ability to enact effective instruction is critical for student success. We also explored whether and how completion of the training modules is associated with changes in aspiring teachers' preparedness to teach math and plans to stay in teaching.

### Takeaway #1 Supporting educators to use high-quality instructional materials meaningfully strengthens their instructional knowledge and decision-making.

Using HQIM should not be conflated with reading from a script. Skillfully using these materials requires educators to engage in deep intellectual preparation to internalize the complex content so that they're ready to support their students with rich instructional tasks. In pre-post results (see Figure 1), **we saw increases across all four programs, with an average +20 percentage point growth** in instructional skills and knowledge. These outcomes underscore the important role HQIM play in guiding novice and aspiring math educators to make effective, evidence-based instructional decisions, increasing the likelihood that their students will have access to rigorous, grade-level learning experiences.

**Figure 1**  
Improvement from Pre-to Post Assessment by Site



*Pre-post results demonstrate an average +20 percentage point growth in instructional skills and knowledge across the four programs. This change was statistically significant at a 99% confidence level. The pre-post change was approximately the same across each of the four sites. While there was substantial variability in terms of the average score on the pre-assessment, tutors from each of the four sites grew by the same amount, on average.*

## Reflections From Tutors



*"After taking the training I feel more confident that it is doable for me to become a teacher – I feel better prepared. At the beginning when I was hired, I wasn't sure about tutoring math. But going through the DFI trainings, I feel like I was doing a better service to the students I was working with. [They] gave me a solid foundation."*

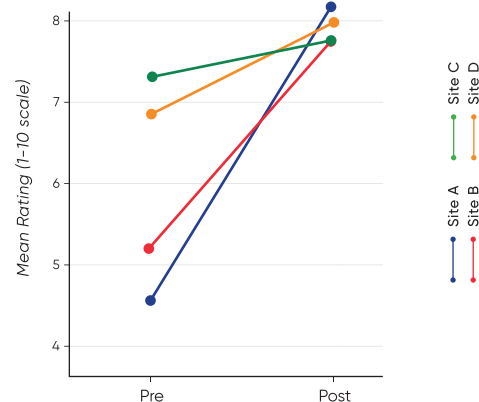
*"I have been on and off the fence about having a classroom for a while, but overall, it shows me how important lesson planning is. You have to think about how to explain this in ways—not just the ways you learned—but how students might be thinking. It taught me that teaching is a lot but if you prepare yourself, your students will be successful."*



## Takeaway #2 Providing tutors with practice-based, instructionally-focused training increases their feelings of preparedness to teach.

Teachers have **2-3 times the impact on student learning** than any other school-based factor when it comes to math (and reading). When aspiring teachers have quality opportunities, such as high-impact tutoring, to put instructional knowledge into practice, they can build the skills and confidence to be more effective in the classroom. **Across pilot programs, tutors saw an average overall increase of +49 percent in feelings of preparedness** to teach math after completing our training modules (see Figure 2). This is particularly crucial given that the first year of teaching can often be overwhelming. When novice teachers are prepared to identify and use HQIM, this not only strengthens their instructional skills but also lightens their cognitive load in the first few years of teaching.

**Figure 2**  
Change in Feeling of Preparedness From Pre- to Post Assessment by Site



*In pre- and post-survey responses, tutors rated their preparedness to teach mathematics on a scale of 1 to 10 in response to an item that explicitly asked them to rate whether their preparedness has increased as a result of the HQIM modules. The mean rating of preparedness increased by 2.6 points (statistically significant at a 99% level) between the pre- and post-survey, from 5.3 to 7.9 points (+49 percent increase). Despite the large differences on the pre-survey, the post-survey means are very similar. They are also quite high, on average, hovering around 8 out of 10, indicating that tutors feel fairly well prepared to teach.*

## Reflections From Tutors



*"Working with the actual standards and the lesson plans and preparation showed how mentally involved being a teacher is...When I have thought about teaching it has been about supporting kids to be having fun. But education is more than that; you do have to help them learn and that this information is important."*

*"Doing things step by step and giving specific praise was a good thing that I learned and integrated into my tutoring. The **'how'** and **'why'** questions were really helpful...Allowing them to think of the answer themselves before jumping in and giving them the answer. And coming prepared with questions and how to address misconceptions."*

## Closing

Every student deserves **well-prepared teachers**. When educators are better prepared to engage their students in rigorous and affirming mathematics instruction, their students will be more likely to thrive within and outside the classroom.

DFI is committed to supporting more teacher preparation and tutoring programs to implement training for educators to effectively identify and use HQIM in mathematics instruction. We are continuing to improve the modules based on feedback and data from the programs in this pilot and look forward to partnering with other programs to ensure tutors and future teachers are well-prepared to support meaningful learning for students.

To learn more about our work, visit [deansforimpact.org](https://deansforimpact.org).



### Interested in these modules?

DFI provides these modules, and additional resources, to teacher preparation and tutoring programs across the country for educator training and development. If you are interested in receiving support from us for your own program, please **contact us**.



### Acknowledgements:

*This research study was conducted by:*

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Tracey Weinstein, Deans for Impact

*Program partners involved in this pilot include:*

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