



Tennessee Scales Up Improved Math Instruction through Coaching

Initially fueled by resources from a Race to the Top grant, Tennessee state leaders undertook an education reform agenda to improve teaching and learning. Tennessee helped lead the national movement toward college- and career-ready standards. The logical next step was to support teachers and students as they aim for those higher standards. Yet given their distance from classrooms, state policy-makers and leaders typically find it challenging to influence what happens there.

If students are to meet higher standards, all educators in the system have to learn how to engage students in reasoning about complex ideas. But what levers can state boards of education and state education agencies pull to support the professional learning that makes this possible? A research-practice partnership in Tennessee may shed light on this question. The group's task was to support mathematics teachers across the state through instructional coaching.

The Role of Coaching in a Standards-Aligned System

Alignment with state learning standards was part of Tennessee's systemic reform strategy from the beginning. The Tennessee Department of Education, with support from the governor and legislature, invested in instructional materials, teacher and leader training, and a teacher evaluation system, all of which were aligned with new state standards. For example, several hundred educators were selected through a competitive process and trained to serve as professional development leaders. After intensive professional development from the Institute for Learning,¹ they were charged with turning that training around

and delivering it to other teachers. In the summer of 2012, 13,000 Tennessee educators participated in teacher-led mathematics training. More than 25,000 educators (representing over 40 percent of all Tennessee K-12 teachers) enrolled in optional trainings the following summer. The state's education department also provided standards-aligned instructional materials for use at local districts' discretion. For example, content experts in mathematics contracted with the Institute for Learning to develop lesson guides for high-level, cognitively complex instructional tasks, videos of teachers instructing students on carrying out the tasks, and videos designed to deepen teachers' understanding of mathematical ideas.²

Evaluations of these training sessions revealed that teachers appreciated them, particularly the fact that their peers were leading them. More important, these teacher leaders may have had a lasting impact: State analyses found that teachers in buildings with a summer professional development leader scored higher overall on the state's assessment than did teachers in other schools.

Much energy and time went into these trainings and materials. Yet research suggests that this strategy alone is insufficient to produce the instructional change necessary to ensure that all students can meet ambitious standards.³ When they are well designed, workshop-based, short-term trainings can increase teacher knowledge, which is important for improving teaching practice. However, making instructional practice more rigorous and conceptually demanding is not a trivial undertaking. Full mastery requires engaging in the skills to be learned with guidance from a more expert

State's embedded coaching process for math teachers sparks deeper professional development.

Jennifer Russell, Mary Kay Stein, Richard Correnti, Victoria Bill, Laura Booker, and Nate Schwartz

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practitioner, and through job-embedded learning opportunities.

In theory, an instructional coach fits the bill, providing long-term, job-embedded support around key instructional skills. Indeed, many schools in Tennessee (and elsewhere) hired such coaches with Race to the Top funds. However, the investment in coaching nationwide has likely not yielded its full potential. Research suggests that coaching programs have variable outcomes due in part to implementation challenges such as insufficient coach training, guidance, and support.⁴ For example, coaches chosen because they excel in teaching math to children may know little about adult learning. Additionally, coaches are often asked to take on duties that have little connection to teacher learning, such as running testing programs and providing remedial instruction for students.

TN Math Coaching Project

Researchers at the University of Pittsburgh, professional development providers from the Institute for Learning, and the Tennessee Department of Education began partnering in 2014 to create the TN Math Coaching Project as a way to prepare classroom teachers who were now stepping into full-time coaching positions. We built on Tennessee's earlier investments in a standards-aligned system and are now focusing on training full-time instructional coaches to work with teachers as adult learners, with teachers reconsidering their practice and taking ownership of it. And we developed a mathematics coaching model to guide schools and districts in building mathematics coaching programs.

We focused on instructional coaching because it can be a critical link in the standards implementation process. Good coaches support teachers intensively so they can help students think and reason in complex ways. In our model, we specified practices that characterize quality coaching while also helping the coaches adapt the model to the needs of their local teachers and to accommodate local priorities.

Over two school years (2014–15 and 2015–16), we specified and elaborated our coaching model by trying it out in schools and collecting and analyzing data on its effectiveness. During

three improvement cycles each year, coaches and teachers shared data about their practice, researchers and professional developers analyzed that data, and coaches, state leaders, professional development providers, and researchers changed the model based on that analysis. In subsequent cycles, coaches put the refinements to the model into practice. See sidebar example (page 25).

Our analyses provided promising evidence in support of the model. Participating coaches did in fact use its key coaching practices during the two school years, as evidenced by videotaped coaching interactions. Likewise, partner teachers improved their capacity to provide rich opportunities for students to understand key mathematical concepts.⁵ A more formal test of the model's effectiveness through a quasi-experimental study with a new group of coaches and teachers is under way.

Fundamentally, our model aims to ensure that schools and districts are getting their return on investment in coaching by focusing on particular practices that help teachers improve. Our coaching framework identifies these key practices and includes a coach-teacher discussion process and a stance that coaches take in their work with teachers and for their own continuous improvement.

Three Key Coaching Practices

Drawing on the Institute for Learning's extensive experiences with coaching, we identified three key practices: (1) deep, specific conversations about the instructional triangle; (2) mathematical and pedagogical goal setting; and (3) evidence-based feedback. For example, coaches have deep, specific conversations with teachers during prelesson planning, helping them identify what students should learn as a result of the lesson (the goal), anticipate how students might approach complex tasks, and identify moves they might make in order to shift students' thinking in ways that align with the goal of the lesson.

The Coach-Teacher Discussion Process. We designed a process to guide one-on-one coaching cycles that incorporates these key coaching practices (figure 1). The routine includes four phases. First, the coach and teacher identify a

Box 1. Conversations with Coaches

In an earlier cycle of our work, we found that many coach-teacher discussions were staying at a general level: They talked mostly about materials they would use and how they would group students. We also noticed that some coaches were having more substantive conversations with teachers and that this tended to occur when they talked through very specific aspects of teaching a mathematics task, as in this example of a math task geared toward helping fifth graders develop conceptual understanding of mixed numbers:

Five hallways needed to be decorated by three children. What portion of the hallways will each do?

This coach-teacher planning conversation ensued:

Coach: As you are circulating, what might you see or hear students doing when solving the task?

Teacher: They might draw five rectangles and divide each into thirds. They might number each hallway as 1, 2, 3 representing three students. Then each student will decorate $\frac{2}{3}$ more of the last two halls that are left.

Coach: Suppose a student says each student will decorate one hall. What assessing and advancing question will you ask this child?

Teacher: Tell me how all of the five hallways will get decorated by the three students?

Coach: I wonder what they will say?

Teacher: Each student painted one hallway?

Coach: Now ask an advancing question.

Teacher: I will say, 'You painted three hallways. What part of the hallways that are not yet decorated will the three students decorate? Show me on your model?'

Coach: What if the student can't get started?

The coach helps the teacher anticipate how students will solve the task and plan questions to advance student understanding. Our analyses revealed that deep, specific coach-teacher conversations predicted improvements in teaching, so this became a critical component of our model.

mathematics task and learning goals. Second, the coach and teacher meet to plan for the lesson. Third, the coach observes the teacher teaching the lesson and gathers evidence about teaching and student learning. Finally, the coach and teacher meet to discuss the evidence and reflect on the lesson.

While this process critically supports a routine for instructional improvement, it also can inform and guide other processes that involve coaching, such as professional learning community meetings.

The Inquiry Stance. Inquiry characterizes the stance our coaches take in their work with teachers and in the ongoing improvement of their own practice. Coaches try to engage teachers in making sense of their practice and defining ways to improve it. Coaches use statements that begin with "I notice" and "I wonder" rather than directives about what teachers should do.

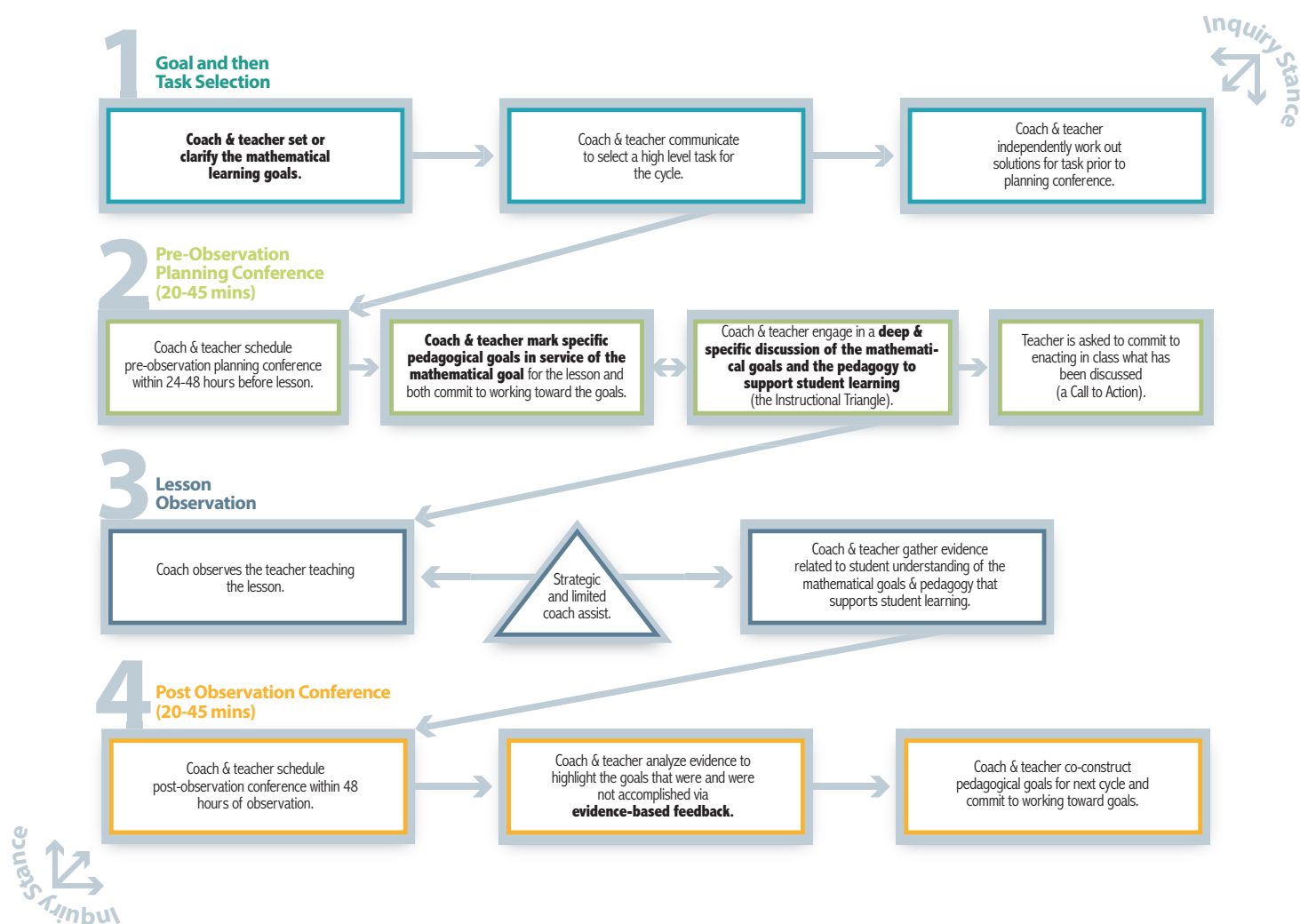
Inquiry also characterizes how coaches implement the coaching framework in their own school or district context.⁶ For example, some coaches were getting pulled away from coaching work to support other school functions. These coaches experimented with ways to better communicate with principals and district leaders on their need to protect scheduled time to follow through on the discussion process with their teachers.

Our model also includes a combination of face-to-face sessions, webinars, and opportunities for coaches to apply what they are learning to their practice. We are thereby catalyzing a network of instructional change agents. So far, we have trained two cohorts of coaches representing 30 Tennessee districts (20 percent of the total). Our goal is to expand and sustain the network to support transformation across the state.

Lessons for Other States

There are compelling reasons for state boards of education and state education agencies to get involved. Without a state-designed, state-executed plan, support and training of teachers falls to districts and schools, which perpetuates variation in performance and inequality. That is, more affluent districts and those with

Figure 1. Coach-Teacher Discussion Process



higher capacity get better at teaching while those serving relatively disadvantaged regions fall further behind. To combat this, the Tennessee Department of Education recognized that they had to do more to shore up the quality of teaching.

In Tennessee, the state board of education's role was to establish systemic goals through the identification of state content standards, while the department engages in initiatives like the TN Coaching Project to support schools and districts as they implement those standards. Our experience in Tennessee points to a number of ways that state education policymakers and leaders can influence teaching and learning:

Invest in coaches and coach training. Our work contributes to a body of research showing that well-designed coaching programs contribute to teacher learning and improved instruction. Yet coaching is typically funded and

operated at the district or school level, so a state that wants improvement across all its districts and schools will have to find ways to promote it statewide. What can state policymakers do? First, a state-specific coaching model can be disseminated to districts throughout the state. The model should underscore coaches' need for guidance in how they work with teachers and help districts understand ways to make the most of their investment in coaching. Second, states build local capacity for coaching directly through trainings such as those offered by the TN Math Coaching Project and Tennessee's early literacy initiative, Read to Be Ready.⁷ These actions signal the importance that the state attributes to coaching. States can also publicly disseminate stories about coaching successes and spotlight sessions on coaching in state-sponsored conferences, meetings, and training opportunities.

Foster networks to support continuous improvement and scaling up. Building networks is an important component of a state strategy for instructional improvement for several reasons. First, a network can help coaches get access to learning opportunities that their districts lack. Districts typically focus on teachers' professional learning, but coaches need their own learning and development opportunities. It is inefficient for small districts to provide these opportunities to what may be just a few people. A state or regional network can fill this gap. Second, a network enables collegial, informal sharing of what they have learned. As coaches continue to participate in a network, they can support more novice colleagues locally and throughout the state.

The network has also refined our coaching model. As mentioned earlier, coaches engage in inquiry to overcome implementation challenges. They collaborate with other coaches facing similar challenges, plan tests of new approaches, and share what they learn. For example, coaches have focused on adapting the model to support beginning versus veteran teachers; to attend to students' conceptual understanding in schools and districts where teachers and leaders have typically emphasized procedure-oriented teaching (e.g., worksheets to practice math algorithms); and to aid literacy coaching. As network leaders, we developed a repository of strategies and tools that coaches identified and tested to respond to these challenges.

Engage in research-practice partnerships. We could not have developed a robust coaching model without a partnership that enabled collaborative engagement in practice improvement. The history of failed educational reform efforts suggests that it is difficult to scale up externally developed interventions while maintaining their design integrity, because those designs typically do not take the many inevitable and diverse local implementation challenges into account. From the start, we sought to learn directly from coaches working under diverse conditions. And we developed guidance for coaches and our training program in collaboration with coaches actually doing the work. Consequently, both practitioners and researchers informed the model.

How can a state tackle the challenge of improving instruction so that all students reach higher, more ambitious learning standards? The road to student achievement runs through improved teaching. Teachers who are well supported and feel that they are part of a larger movement toward more ambitious instruction will flourish, and students will benefit. One of the most promising strategies for supporting teachers is the careful selection and development of instructional coaches. Our Tennessee experience offers states a way to play an active role. By developing and disseminating a statewide model for coaching that is flexible enough to take into account district variation but specific enough to standardize coaching processes in ways that have real impacts, Tennessee state education leaders are contributing to improved teaching and learning at scale. ■

¹The institute, based at the University of Pittsburgh, provides research-based training and development for districts and states.

²In a subsequent analysis using a fixed-effects model (to adjust for selection effects), not only was there a benefit to coaches and participants in the initial training session, participants in schools with a TN core coach also had more advanced questioning than participants without a TN core coach in their school. Thus, when participating teachers had access to a TN core coach, they continued to improve their practice.

³M. M. Kennedy, "How Does Professional Development Improve Teaching?" *Review of Educational Research* 86, no. 4 (2016): 945–80; H. C. Hill, "Fixing Teacher Professional Development," *Phi Delta Kappan* 90, no. 7(2009): 470–76.

⁴C. Gallucci, et al., "Instructional Coaching: Building Theory about the Role and Organizational Support for Professional Learning," *American Educational Research Journal* 47, no. 4 (2010): 919–63; M. A. Kraft, D. Blazar, and D. Hogan, "The Effect of Teacher Coaching on Instruction and Achievement: A Meta-Analysis of the Causal Evidence," Brown University Working Paper (2016); L. C. Matsumura et al., "Leadership for Literacy Coaching: The Principal's Role in Launching a New Coaching Program," *Educational Administration Quarterly* 45, no 5 (2009): 655–93.

⁵The partner teachers as a group demonstrated growth in their teaching based on expert ratings of video observations. However, many teachers had reached a ceiling on our rubric by the end of two years.

⁶For more information on iterative cycles and improvement research methods, see G. J. Langley et al., *The Improvement Guide: A Practical Approach to Enhancing Organizational Performance* (Hoboken, NJ: John Wiley & Sons, 2009).

⁷The Tennessee Department of Education launched the Read to be Ready campaign to increase Tennessee students' reading abilities in the early grades. The Read to be Ready Coaching Network is a state-district partnership that focuses on improving K-3 reading instruction. Each of the state's eight regions has at least one department reading coach consultant who trains district-chosen literacy coaches. The district coaches deepen their knowledge of reading instruction and coaching practices so they can more effectively support teachers in their districts.

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Jennifer Russell, Mary Kay Stein, and Richard Correnti are researchers at the **University of Pittsburgh's Learning Research and Development Center**. **Victoria Bill** is a fellow at the **University of Pittsburgh's Institute for Learning**, and **Laura Booker** is executive director of research and **Nate Schwartz** chief research and strategy officer at the **Tennessee Department of Education**.