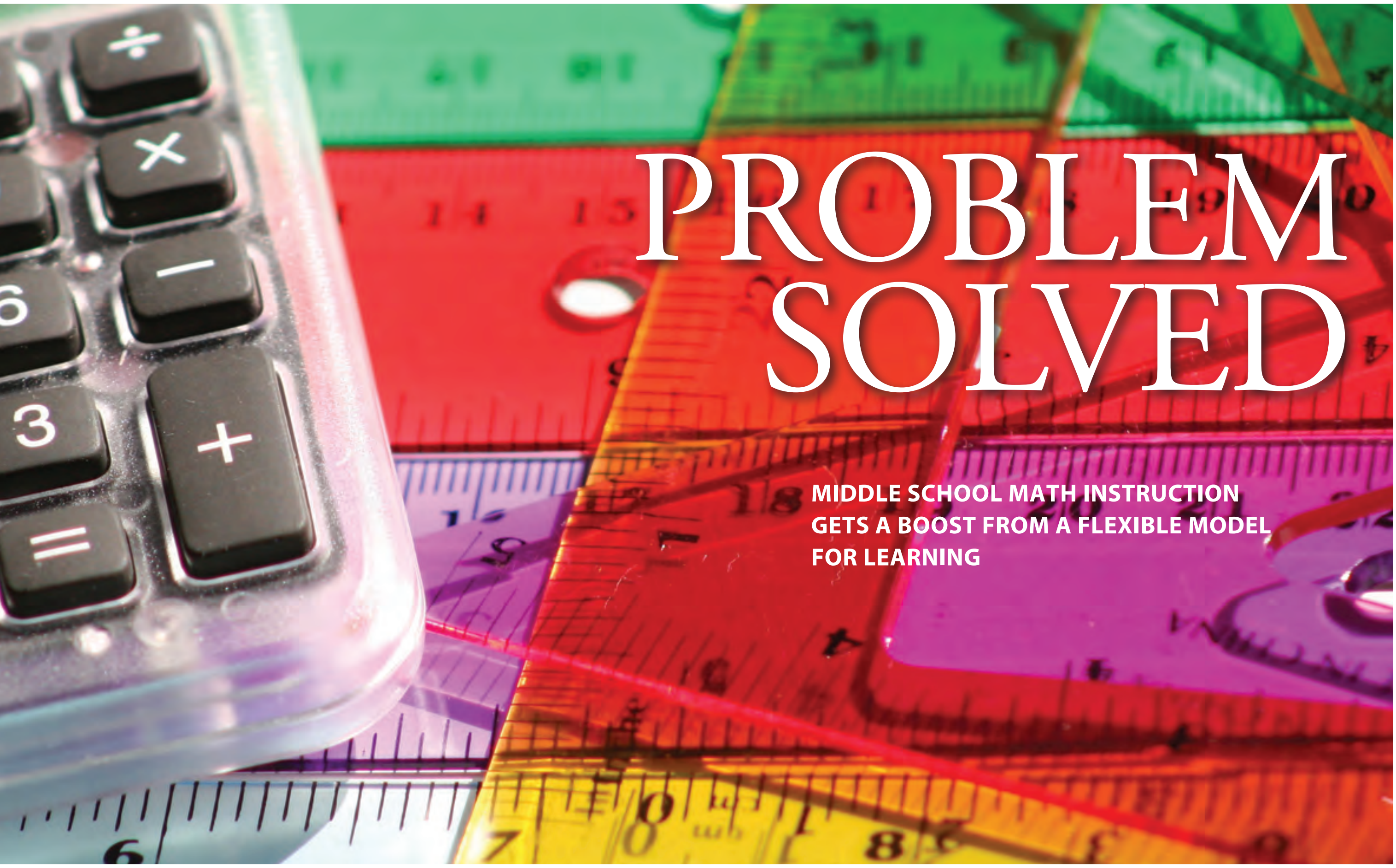

PROBLEM SOLVED

MIDDLE SCHOOL MATH INSTRUCTION GETS A BOOST FROM A FLEXIBLE MODEL FOR LEARNING

By Jennifer Jacobs, Karen Koellner, and Joanie Funderburk

Education researchers frequently seek out districts, schools, and teachers as partners for professional learning projects. They share their ambitious vision — a new model of professional learning that will support an empowered community, instructional improvement, and student achievement. The researchers' unabashed enthusiasm is frequently met with uncertainty, skepticism, and discomfort.

"We've tried many types of professional development before. None of them really caught on," district administrators will lament. Principals will shake their heads and caution, "Our teachers already have their plates full. They don't have time to add one more thing to their schedules." Teachers will explain, in barely concealed frustration, "Every time we turn around, we are given something new to implement. Just when we start to get comfortable with one approach, that is gone and we have to start all over again."

These concerns are understandable and valid. In a quest to improve both teacher practice and student achievement, schools across the country are met with a dizzying array of ever-changing professional development options. However, few of these options are backed by statistically significant results. Although most schools are committed to providing opportunities for teacher learning, decisions about how to invest their limited resources are difficult to make.

Researchers, as well as school and district administrators, want teacher buy-in — a commitment from teachers to engage fully in their professional learning program. At the same time, teachers — along with principals, district coordinators, and other stakeholders — want to know that the professional development not only works, but is also more than a passing fad. Teachers want some assurance that the program will be of value and will not be taken away as quickly as it came.

Across stakeholders, there is agreement that any professional development effort should be effective and sustainable. In many ways, these two critical elements go hand-in-hand. A professional learning model that has proven to be effective is more likely to be sustained. But in the burgeoning field of mathematics professional development, where few, if any, models have garnered sufficient empirical evidence to be touted as effective, how can researchers ensure a model will be sustained long enough to gather adequate data? Therein lay the crux of the challenge faced by the two first authors of this paper, as we sought to persuade the relevant parties — including the third author — to take up our professional development.

THE PROBLEM-SOLVING CYCLE

The two first authors, along with other members of their research team, designed and piloted a model of mathematics professional development called the problem-solving cycle (Koellner et al., 2007; Jacobs et al., 2007). At its core, the problem-solving cycle provides a focus and structure to school-based professional development, such as professional learning communities (DuFour & Eaker, 1998). The problem-solving cycle is closely aligned with Learning Forward's Standards for Professional Learning (Learning Forward, 2011) and shares the same tenets of professional learning. For example, the problem-solving cycle is designed to be implemented by teacher learning communities that promote collaboratively developed goals within a cycle of continuous improvement. By supporting classroom teachers to be workshop facilitators, the problem-solving cycle includes a structure for developing leadership capacity. A highly adaptable model, the problem-solving cycle requires relatively few additional resources, and workshops can be tailored to fit within allotted time frames according to individual school or district needs. The problem-solving cycle is intended to be an ongoing long-term model of professional learning. Here is how one district began implementing the problem-solving cycle, and how it became the professional learning model for all of the middle school mathematics departments across the district.

In the problem-solving cycle, teachers take part in a series of workshops, where they work on a designated mathematics problem, are videotaped teaching the problem, then watch and discuss video clips from their lessons together. As they move through multiple iterations of the problem-solving cycle (typically one iteration per semester), teachers engage in cycles of feedback and reflection that support long-term, continual growth.

This relatively simple design has strong initial appeal to teachers (Koellner, Jacobs, Borko, Roberts, & Schneider, 2011). They like the fact that the focus is on mathematics, classroom instruction, and student learning. Teachers report that they appreciate the opportunity to engage in conversations with their peers about specific issues related to teaching and learning, and they can see the direct impact on their practice and student learning. While some may be skeptical about the videotaping component or the requirement to teach a problem outside of their normal curriculum, those concerns tend to be short-lived.

PUTTING THE MODEL TO WORK

With funding from the National Science Foundation, we established a university-district partnership to explore the potential for the problem-solving cycle to be implemented in a scalable, sustainable, and effective manner. Beginning in fall 2008, researchers partnered with administrators in the Cherry Creek School District in Centennial, Colo., to implement the problem-solving cycle in the district's middle schools. A critical component of the project involved building capacity within the district for mathematics teachers to run the problem-solving cycle workshops at their schools.

Cherry Creek is a large, urban school district, with 50,000 students and 11 middle schools. At the outset, researchers were optimistic that the problem-solving cycle was a good fit with district needs and would be readily adopted. The researchers envisioned that the middle schools would see the problem-solving cycle as a valuable opportunity and eagerly sign up to take part. It quickly became evident that most schools resisted the best recruitment efforts of both the research team and district administrators. However, this predicament turned into a learning opportunity and helped to answer a central research question: What is the process through which initially skeptical schools might be persuaded to join a professional learning effort?

During the first year of the problem-solving cycle project, four of the district's 11 middle schools opted to

HOW THE PROBLEM-SOLVING CYCLE WORKS

- The problem-solving cycle starts with teachers working collaboratively on a math problem, and then using that problem in their classrooms.
- Everyone is videotaped and the group analyzes and discusses select clips.
- The learning design uses active engagement, where teachers' voices and classroom images are highlighted.

take part. Each participating school nominated one or two teacher leaders to learn to be facilitators. The teacher leaders met regularly with the research team, working in conjunction with the district mathematics coordinator, to learn the nuts and bolts of the problem-solving cycle. After meeting for a full semester, followed by a weeklong summer academy, the teacher leaders implemented the problem-solving cycle at three of the four schools. The following year, six schools elected to participate. And the year after that, all 11 schools signed up. As the district prepares to enter its fourth year using the problem-solving cycle, the research team has taken an intentional backseat. In year three, the district mathematics coordinator was largely responsible for oversight of the problem-solving cycle, with only minimal input and support from researchers.

Implementation has not been without snags and bumps, but, for the most part, teachers praise the facilitators, the focus on rich mathematics, the learning that occurs when one is videotaped, and the professional conversations around teaching and learning.

What can account for the fact that the problem-solving cycle is the mathematics professional development of choice for most of the district's middle school mathematics teachers? Although we now have data to indicate that the problem-solving cycle had a significant impact on teachers' content knowledge, these data have only recently been analyzed and have not yet been widely seen by teachers, principals, or others in the district (Koellner, Jacobs, & Borko, 2011). In other words, the scalability and sustainability of the problem-solving cycle occurred before the proven effectiveness of the model.

KEYS TO SUCCESS

We have several theories about what led to the adoption and continued implementation of the model by the schools and teachers throughout the district, including those who initially elected not to participate. First, the nature and design of the problem-solving cycle ensured a comfortable balance of structure and flexibility. The problem-solving cycle specifies that teachers work collaboratively to solve and then teach a rich, open-ended mathematics problem. The videotaping component provides another layer of structure. Teachers share the experience of teaching a common problem, and then watching short clips from their lessons together. A structure of support for facilitators enables them to share and learn from one another.

Underlying these structural elements is a great deal of flexibility, intentionally built into the problem-solving cycle. For example, teachers are encouraged to modify the problem and construct individual lesson plans to reflect their students' needs. Facilitators, with some input from teachers, determine which clips to view and through what lens to discuss them (i.e. launching the lesson, student's mathematical misconceptions, teacher questioning). This degree of flexibility was especially critical at a site-based district such as Cherry Creek, affording each site the opportunity to adapt and take ownership of the problem-solving cycle as relevant.

Second, the problem-solving cycle took hold in Cherry Creek by enabling the district to build its internal leadership capacity, which was — and remains — a central district goal. Whereas many programs require an outside specialist, or perhaps a coach, to take over the facilitation role, the problem-solving cycle has the potential to be facilitated by a regular, full-time mathematics teacher. Our project provided support for these teacher leaders, on a gradually decreasing basis over three years. As noted, a number of new schools joined the project in the third year. Preliminary indications are that their workshops were successful and that they will continue to need only moderate district support to maintain their workshops in the future.

Finally, all of the middle schools in the district elected to take part in the problem-solving cycle by the third year due to positive word of mouth. At the end of the third year, the research team gathered evidence of statistically significant improvement on the participating teachers' mathematical knowledge for teaching (Koellner, Jacobs & Borko, 2011), but there is no other data-driven evidence of the model's effectiveness. The researchers are currently analyzing data towards this effort, including data from videotaped classroom instruction and standardized student achievement scores. However, teachers, principals, and other district personnel report that the problem-solving cycle is working well for them.

Implementation has not been without snags and bumps, but, for the most part, teachers praise the facilitators, the focus on rich mathematics, the learning that occurs when one is videotaped, and the professional conversations around teaching and learning. This kind of consistent, positive feedback, coupled with ongoing district support and resources, has propelled the program forward for the foreseeable future.

SHARED VISION

The researchers' vision of the problem-solving cycle is now largely shared throughout the district's middle schools. Cherry Creek's experience provides evidence that it is possible to sustain and scale a professional learning program with only emerging data on effectiveness. This finding is relevant to both researchers and practitioners in their quest to develop and implement models of professional learning that provide the most value to school districts. With adequate, albeit relatively minimal, support from district personnel, schools, and teachers, the research team found that the problem-solving cycle could get off the ground and then garner solid momentum over a three-year period, effectively transitioning from research project to district routine.

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SECOND-YEAR PLAN

As School 9's teachers gathered for the two-day planning session in June, they were encouraged by the results they observed in the test scores. School 9 teachers worked with grade-level colleagues from other schools in the consortium to design a yearlong plan for mathematics that would be implemented the following year. Teachers also created quarterly plans, deciding which topics would be addressed in each quarter. Many teachers exchanged email addresses to continue the work through the summer months.

As the new school year began, math curriculum plans were in place. The October professional development session focused on summarizing, the January session on note taking, and the May session on nonlinguistic representations (Marzano, Pickering, & Pollock, 2001). Consortium-level professional learning community meetings were held in the remaining months, and school-level professional learning community meetings were held monthly. Teachers shared, analyzed, and planned student learning based on the implementation of the research strategies learned. The practice of learning in communities was established as a routine at the school and consortium level.

SECOND-YEAR RESULTS

When the second-year achievement test scores arrived, teachers again plotted scores for comparisons of percentile growth. This year, each grade level except 5th grade showed positive growth. (See chart on p. 38.) The other teachers encouraged the newly hired 5th-grade teacher to continue with the professional learning community another year.

The normal curve equivalency scores showed that every class — including 5th grade — had at least one year's growth. Four of the six grade levels demonstrated more than a year's growth, since the growth scale for one year was -7 to a +7. (See chart on p. 38.) School 9 demonstrated the greatest growth among all the schools in the consortium and in the district.

MORE LEARNING FOR MORE TEACHERS

This journey in learning began with teachers in one school who recognized that they needed to focus on math instruction that would enable students to succeed. Their commitment led to the creation of a professional development program that incorporated three levels of community learning throughout the 12 schools in the consortium. The result is increased learning for both teachers and students.

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