

MATHNIC TOOLS— STORIES OF USE IN REAL CONTEXTS

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January 2018



Mathematics Network of Improvement Communities (MathNIC) is dedicated to building tools to support districts in improving mathematics teaching and learning.

Inverness Research served as developmental evaluator for MathNIC. In that role we observed teams from a diverse array of districts around the U.S.—regional consortia, urban districts with varying profiles of student achievement, and high-performing suburban districts—come together to advise the MathNIC team. Tool developers asked district teams to help identify problems of mathematics improvement where tools could be of use, then asked districts to pilot tools and provide formative feedback. District leaders reported that a valuable component of the project was the opportunity to engage in dialogue with other district teams about how they select, adapt, and use MathNIC tools in their specific contexts.

District leaders say they want two kinds of assurance before they invest effort in use of tools.

First, tools must be *high quality*, i.e., must embody the field’s best knowledge of content and pedagogy, be relevant to their needs, and be sound in their design. Second, tools must be *usable*, i.e., feasible for adaptation to a range of contexts and situations.

In short vignettes, we illustrate how three districts are effectively using MathNIC tools.

We elected to highlight two tools—*World Class Mathematics for Parents* and *Teaching For Robust Understanding in Mathematics (TRU)*—because they turned out to be two of the most sought-after tools in the collection. Together, the examples show how effective use of MathNIC tools can contribute to mathematics improvement efforts in a variety of contexts.

We hope these accounts of how some districts have implemented MathNIC tools will encourage many more districts to use them.

MathNIC tools used in three contexts

- ✓ A district supervisor of elementary principals uses *World Class Mathematics for Parents* not with parents, but with principals, to open their eyes to the math of the Common Core State Standards.
- ✓ An incoming district administrator uses *Teaching For Robust Understanding in Mathematics (TRU)* to build a bridge from the old district framework to the new.
- ✓ A mathematics department chair uses *TRU* steadily over time to re-culture the department from individualistic teaching to collaborative improvement.

VIGNETTE 1. A FIRST HAND EXPERIENCE WITH MATHEMATICS MOVES PRINCIPALS TO RE-THINK MATHEMATICAL UNDERSTANDING

When Nadia Hillman’s district began participating in the MathNIC project, she was the district supervisor of elementary school principals in a large urban district with 60 schools and 50,000 students. Nadia piloted the Math NIC tool, *World Class Mathematics for Parents*. She used it with school principals during one of their regularly scheduled professional development sessions.

The MathNIC website describes the tool as offering “detailed support for a meeting to introduce parents, including ‘concerned parents,’ to the mathematics that is taught in high-performing countries, and described in the Common Core State Standards in Mathematics and related State Standards. It may also be useful with other stakeholders: employers, school boards, and school and district administrators.”

Purposes for use

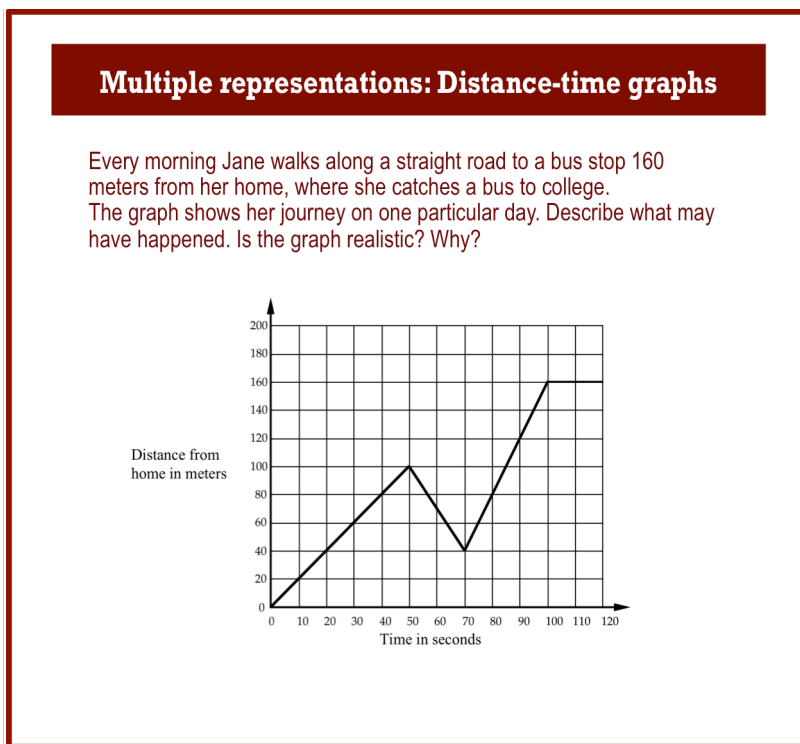
Nadia used the Parents tool with principals so they could get a quick hands-on experience of mathematics required by the CCSS. She believed this experience would reinforce the principals’ understanding of the mathematics students need to master so that, as administrators, they could better support their teachers’ efforts to implement CCSS. Secondly, she believed the experience would help principals better understand how they could use the same tool with parents. Thus she had dual purposes: 1) to build principals’ collective knowledge of the nature and power of the CCSS math approach (e.g., talking, working together, struggling together), and 2) to help the principals use the tool with other audiences.

Tailoring the tool to the context

To remain under her allotted 45 minutes, Nadia skimmed over the section devoted to explaining the Common Core standards because her audience had solid familiarity the standards. She devoted most of the time to having the principals review the mathematics problems. As part of this, the principals engaged deeply in a challenging mathematics activity (shown on the following page). Nadia describes the power of this mathematics experience:

My goal was to really increase the mathematical understanding by my principals. I saw this an opportunity to dig into their mathematics. We did the activity where the girl walks to the bus, and holy smokes it was so powerful, and they struggled and engaged with it. It opened their eyes to the importance of understanding mathematics at a higher level. After we did the activity we discussed the benefit of students talking and working together, and the fact that some of the kids who aren’t always “good” at math might be able to understand it better by talking through it. It was very powerful.

Figure 1. Activity in *World Class Mathematics for Parents Tool*



“It opened [principals’] eyes to the importance of understanding mathematics at a higher level.”

Nadia appreciates that the tool is designed for use in groups because, “That’s the way we want to see instruction in our classrooms now. You don’t sit by yourself and do this. The kids working in groups produce a lot of discourse.” Her advice to audiences grappling with what’s important for students is, “Let them (the audience) know that it’s the thinking along the way that’s important.” Her group of principals gained this insight through their first hand experience with the mathematics activity.

As a supervisor of principals, Nadia tailored the tool to help them facilitate its use in their own school contexts, saying, “I shared the tool with the principals, and gave them my edited version so they could use my notes.”

Advice for other users

Nadia also demonstrated the Parent tool for the attendees of the April 2016 annual conference of the MathNIC, where she stayed right on script without making any adaptations. After both uses—following the script as written, and adapting it for her short principals meeting—she found that the tool is more useful when broken into shorter sessions. She says, “I followed dutifully through [at the April conference], and it went way longer than would have been meaningful. My suggestion would be to break it into sessions, little trainings, to get people to fully understand.”

Another concern is that the tool might feel a little remote for parents, especially those who don't have a strong understanding in mathematics. Nadia suggests tying the example problems directly to what students are doing at school and bringing home. She explains:

Our families really appreciate understanding math as it relates directly to what their kids are doing in the classroom. They might not be able to generalize to what their students are doing from the example problems used in the parent tool.

Nadia also thinks it may be interesting to have parents engage in the problems together with their kids—in particular, by having them focus on the discourse, or mathematical practice #3: “construct viable arguments and critique the reasoning of others.” For this, the tool could be used as is, or streamlined to focus solely on the activities.

After her successful use with principals, Nadia also thinks the Parent tool could be used with school boards and district leadership teams so they can experience first hand the depth of mathematics understanding called for in Common Core.

VIGNETTE 2. TRU (TEACHING FOR ROBUST UNDERSTANDING) AS THE FOUNDATION FOR ONGOING DISTRICT-WIDE EFFORT TO MOVE TO MORE STUDENT-CENTERED MATHEMATICS TEACHING

Michelle Tindall is Coordinator for Global Learning in Birmingham Public Schools (BPS), a district of about 8,000 in Oakland County, Michigan. Michelle first used the TRU framework early in the school year with the BPS K-12 mathematics leadership team, which includes teachers, department heads, and building level administrators. She wanted the TRU framework to scaffold their ongoing district effort to shift mathematics teaching from mostly teacher centered to more student centered.

The launch went so well that Michelle decided to use the TRU framework as the basis for all aspects of her professional development that year. TRU has become the foundation for their mathematics improvement work because, Michelle says, “It really gave us a lens to look at our mathematics instruction. And it was in math talk, not in just generic instructional talk.”

A user-friendly, content-specific tool for improvement

Teaching for Robust Understanding in Mathematics (TRU) is a research-based framework for emphasizing robust understanding of mathematics content. The five dimensions of TRU are: (i) the mathematics, (ii) cognitive

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demand, (iii) access to mathematical content, (iv) agency, ownership and identity, and (v) formative assessment. If things go well in classrooms along these five dimensions, students will become powerful thinkers and problem solvers.

Michelle says that the TRU tools were user-friendly, with clear summaries each dimension and easy-to-understand observation guides. In her mathematics leadership team workshop, she used the observation guide and the overview of the 5 dimensions as the introductory pieces, and then the team members were easily able to dig into those documents and tease out observations that fit each one of the dimensions.

Michelle especially liked the TRU for the way it enabled district staff to envision important principles in action in mathematics classroom. She says,

I was really hoping to shift that focus onto students and student engagement, and on having our students feel like mathematicians, and modeling for (the math leaders) some best practices in teaching and learning. I thought that the TRU really hit on some of those important components for our staff. So for example, when you talk about agency, ownership and identity, I felt that it was important for our staff to see what that looks like—what some of the look-fors were—and really take a look at that through a lens for our math site visitations. When we talk about cognitive demand, what does it really look like in terms of productive struggle? There are all of these buzz words that were kind of flying around the district, but what does it really look like in the context of a math classroom?

Michelle adds that the specificity of the TRU is helping the team become more effective in supporting shifts in the classroom, saying, “We have had the 5D framework¹ in our district for four years now, and it says many of the similar things (as the TRU), but in a generic way. Our folks did not translate that instructional framework into practice nearly as much as they did the TRU. I think that was one of the most powerful pieces that I saw happen with my leadership group.” Leadership team members quickly became able to use dimensions of the TRU framework to observe math lessons at all grade levels.

An effective tool for multiple audiences

Michelle has also used the TRU framework with two other groups in her district. One was a group of grade 8-12 teachers who were preparing to start using CMP², a new integrated math series. Michelle explains how the TRU framework helped bridge the teachers to the different approach:

¹ 5 Dimensions of Teaching and Learning, developed by the University of Washington and available free. See <http://info.k-12leadership.org/5-dimensions-of-teaching-and-learning>

² Connected Math, developed at Michigan State University. See <https://connectedmath.msu.edu/> and <https://www.pearsonschool.com/index.cfm?locator=PS1yJe>

As part of the on-ramping to this instructional philosophy, I had the group look at the TRU framework. I wanted to give them a lens for looking at their instruction and for looking at the instructional philosophy of the new program, and take that as a springboard into what they were going to be doing this year.

The teachers were able to use the TRU framework to identify instructional approaches in CMP that addressed some of the areas of improvement that they had identified. After a one-day workshop, Michelle reports, “Teachers were saying, ‘Wow, I could do this differently’ or ‘I could change up that.’ It gave them some motivation, even, to dig into the new curriculum materials and pick out some things to do differently in the instruction far before we even started the new program.”

Michelle used the TRU framework a third time with her secondary staff at the start of the school year. Again, she found the tool easy to implement, and staff members were able to use the observation guides to look at classroom teaching. She said the guides—with their two-column approach of what would be happening with students, and what it would look like from the teacher perspective—was a helpful lens for both teachers and administrators.

With so much experience using the TRU framework, Michelle has some advice for others. While TRU worked with all the audiences she presented it to, she thinks that TRU is most powerful when used with a leadership group or with teachers who are ready to grow and reflect on their own practice. However, even with more reticent groups, she thinks TRU can be beneficial because it provides a common language and an ability to have conversations that likely would not happen without the lens that TRU provides.

VIGNETTE 3. OVER TIME, TRU HELPS A MATHEMATICS DEPARTMENT SHIFT TEACHING PRACTICE AND PROFESSIONAL CULTURE

Robert (Bob) Marley is a public high school mathematics teacher and department chair at Barrington High School in Barrington, Rhode Island. Barrington is suburban community with a population of 16,310 that is located within 10 miles of Providence. The high school has roughly 1,000 students; in 2016, 84% of its graduates went on to a 4-year college or university.

“Ten years ago, we were all doing our own things and were all over the place. I have a lot of talented teachers that want to improve—and we’ve done a lot, and created a collaborative culture.”

Bob began using the Teaching for Robust Understanding (TRU) framework as a coaching tool in his role as department chair. As Bob anchored professional development days to the TRU framework over time, teachers reached the point where they used TRU to observe one another to support continued growth in practice across the department.

Focusing on essential elements of mathematics instruction

Bob says that TRU is valuable to him as department chair because the tool helps him focus his support for teachers: “What this has given me is clarity about what is important for math education.” The tools help him design professional development around topics that are essential. He says,

As the department chair I didn't always know what to do for the 7 professional development days that I have to present throughout the school year, but with these tools I feel so accomplished after we implement one because the tools are organized, structured, and the script is there, and I don't have to prepare for days to get ready. It has helped me tremendously as a department chair.

Bob's department colleagues, too, embraced the tool over time because it helped them home in on what's important in a math classroom. Bob believes this is one of the benefits of TRU: that it helps staff and administrators focus on essential elements in a mathematics classroom, as well as providing a cohesive structure for professional development.

Changing practice and culture takes time

When using TRU initially as a coaching tool, Bob saw his colleagues gain positive experiences with it in coaching conversations. He commented,

Through coaching and conversation, teachers can really grow. We look at the 5 components of a successful mathematics lesson, and I ask them to think about that and I give them insights.

Bob said these experiences made his colleagues more readily accept professional development targeted to the tool. He cautions that this acceptance can take time, however, because it takes time to deeply understand with the tool.

In June 2016 the mathematics team decided that it would be beneficial to observe each other teaching the same lesson using the TRU framework as the lens for the observation and post-observation conversations. Bob says that the teachers were initially worried that they were going to be “evaluators” of one another, but the tool eliminated that worry because it offered a lens to look at a math lesson in a focused way:

I don't think the experience would have been as rich with out the TRU tool. The observations would have been more superficial. By using the tool and understanding the components of a math classroom it allowed the conversations to be richer from having that tool as a guide.

MathNIC Tools: Stories of Use in Real Contexts

It was a long journey for the department to shift their culture such that peers could use TRU as a tool to observe one another. Bob believes that consistent use of the tool over time, and eventual embrace of it for peer observations, contributed to the change. He commented,

Ten years ago we were all doing our own things and we were all over the place. I have a lot of talented teachers that want to improve—and we’ve done a lot, and created a collaborative culture.

TRU helped the mathematics department find a powerful focus for math improvement, and over time, its use helped create the shared understanding needed for real change. Bob also commented on how use of TRU helped members of the department form a solid focus for change amid the noise of school improvement:

We have so many initiatives and we’re being pulled in so many directions, but the time that we’ve devoted to this has been valuable, and we’re now at the inflection point, at the cusp of changing what we’re doing. We’re seeing the big picture.

Advice: Start slow and stay with it

Bob has this advice for those interested in using TRU: Start slow. Get to know TRU really well through experience. Use it as a coaching tool a couple of times to get a sense of how to use it. Provide a training session, using the TRU tool as a guide so that others can become familiar with it, and then keep using it.

A FINAL REFLECTION

Good tools—i.e., well designed and usable tools—help people do the improvement work they want to do. These vignettes show that MathNIC tools function in many ways to scaffold districts’ efforts to improve their mathematics programs by bringing them into closer alignment with Common Core. Used with consistency and tailored for specific audiences and settings, the MathNIC tools help promote shared understandings across administrators, teachers, and parents about the nature and the aims of mathematics improvement. The tools also help administrators and teachers alike to focus improvement efforts on what is most important.

MathNIC tools are designed to help enhance teaching, professional development, and community outreach as districts work to align district curriculum and practice with Common Core standards. Funded by a grant from the National Science Foundation, the MathNIC suite adds to the Formative Assessment Lessons, Teaching for Robust Understanding (TRU) Framework, and other tools at <http://map.mathshell.org/>.

Inverness Research is a national educational evaluation group headquartered in Inverness, Marin Co., California. For more information, see www.inverness-research.org.