Implementing RTI in Mathematics

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About this Talk

Join our experts **Amanda VanDerHeyden** and **David Allsopp** as they discuss "How can RTI play a role in helping students who are struggling in mathematics succeed?" while answering your questions about "Implementing RTI in Mathematics."

Transcript

Q ***Seymour S. Burack***

What specific diagnostic tests would you suggest to determine a true Math disability such as Dyscalculia, and how would the condition be treated.

A ***David Allsopp***

There has been quite a lot of discussion about what math learning disabilities are, how they are similar and dissimilar to other learning disabilities such as ones that affect reading, and how to assess their occurrence. Traditionally, a discrepancy model has been used to determine learning disabilities in mathematics as well as other areas of learning. This typically involves looking for a significant difference between a student's IQ score and one or more scores on subtests of a mathematics achievement battery. Additionally, some have also examined significant discrepancies among achievement and cognitive processing batteries; that is, looking for any obvious inconsistencies among particular areas of mathematical abilities (calculation, application) and cognitive processing (e.g., visual, auditory, motor, processing speed, etc.). The validity of this approach has been called into question in recent years. Some researchers suggest that students with math learning disabilities have common areas of difficulty including difficulty with numeracy/number sense , slow processing speed, and difficulty with working memory. Recently, RTI has been suggested as a possible alternative to identifying mathematics learning disabilities. Fuchs, Compton, Fuchs, Paulsen, Bryant, & Hamlett (2005) suggest its use as a process for identifying mathematics disabilities at the end of the 1st grade year. They found that the best predictors for identification were 1) low performance on end of the year mathematics achievement tests that assesses 1st grade concept application and computation; and 2) poor rate of growth across the year using curriculum-based measurement (CBM). Another resource that may be helpful is a document provided by the Center on Instruction titled Screening For Mathematics Difficulties in Grades K-3 (Gersten, Clark, & Jordan, 2007) The document can be downloaded at www.centeroninstruction.org. It is important to understand that the term "math disabilities" does not refer to one type of difficulty. Mathematics learning disabilities are multifaceted and can be the result of a variety of problematic areas of learning. In addition to those areas already mentioned, language difficulties can be an issue, as can be visual-spatial processing deficits and sequencing. A multi-lens perspective is likely the best approach at this point in terms of assessment for mathematics learning disabilities. One might want to place special emphasis on areas such as numeracy/number sense, processing speed, working memory, and combined performance on end of year achievement test and yearlong growth demonstrated via CBM. Any assessment should include both conceptual application (i.e., reasoning, representation, communication, connections, problem-solving) and computation. Another good source for information on mathematics learning disabilities is on LDOnline.

Vicki Peterman

Are there math probes for problem solving? Is there a need for probes beyond fluency for math?

Amanda VanDerHeyden

Yes. Intuitively we would all expect that assessment of computation and procedural fluency AND application or conceptual understanding would be important. particularly since so much of what we try to teach in math has to do with conceptual understanding (consider the stated goal of the National Mathematics Advisory Panel report just released that says the goal of primary math instruction is to get every child ready for algebra instruction by eighth grade). Beyond intuition, however, are some pretty good data indicating that these are two related but distinct skills that merit separate measurement (Thurber & Shinn, 2002). Dr. Jim Connell at Temple University has completed a study replicating and extending the work of an earlier study completed by Lynn Fuchs and colleagues (1994). Typical correlations between computation probe scores (digits correct per minute) correlate with more comprehensive measures of mathematics performance in the range of r = .3 to .6. Connell developed a set of application measures or measures of conceptual understanding for primary grade students and adding these items to computation items improved the correlation from r = .6 to r = .8 with Iowa Test of Basic Skills scores. Importantly within RTI, however, is the idea that we are making different decisions at different stages. Some mathematics probes might be more efficient and more accurate for some types of decisions compared to other types of decisions (e.g., Connell's data suggested that computation probes were sufficient for screening decisions).

Karen Decker

Can you suggest some universal screeners in math, specifically for K-5?

Amanda VanDerHeyden

Sure, here are some ideas from my work. I suggest sitting down with a set of the state standards and identifying all the computation and procedure skills. This process alone is useful for teachers and administrators because often people are surprised to see an expected skill at a certain grade level and so this simple exercise prompts them to be sure that the instructional program is covering all that it should during the year. Given a sequence of expected skills, decision makers can identify those that will be most useful for three purposes

1. Determining whether system-level learning problems exist (i.e., many students are below expectations)
2. Identifying individual students who might need intervention and
3. Monitoring learning progress as the instructional program progresses.

With math, I always suggest two probes at each measurement occasion (a screening probe and a progress monitoring probe). If you start with a probe that represents a skill that students are expected to be able to perform at that point in the instructional program to continue to benefit from instruction that will be provided in math at their grade level, then you can determine whether there is a class-wide, grade-wide, or even system-wide learning problem in math (if a large percentage of students are below criterion). If a system-level learning problem is detected, it should be addressed first through Tier 1 intervention efforts (prior to identifying individual children for assistance). The reason for this is both logical (many children need help) and empirical (decisions about who is at risk are more accurate when the base rates are not high or stated another way lots of children are not below criterion).

If there is no system-wide learning problem, you can proceed with individual screening decisions. Decision makers would need to weigh the pros and cons of going the route of selecting an easier screening task/probe and administering that in the face of a system learning problem.

In addition to screening probe(s), a probe for progress monitoring is needed. The progress monitoring probe should represent a range of key skills that students are expected to master by some endpoint in the instructional program. So you could select a probe that allows you to monitor learning progress through the end of the first semester or through the entire school year. This means that early on, probe content would be difficult, but growth would be reflected as instruction is introduced. This approach to measurement is often tough for teachers and administrators to understand and they might ask, "why in the world would we assess a child on a skill for which they have not yet received instruction?" The answer to that is we want to make apples to apples comparisons to detect learning that occurs as instruction proceeds. So if the content of the measure changes then it will yield incomparable data. We use the same measure at all timepoints and as instruction progresses, performance will increase. The early measurement occasions can be thought of as baseline. Practically, with students, it only requires two (2) minutes of time to administer and students can be told that it’s a challenging worksheet for which we will see growth during the year.

	Screening Fall	**Screening Spring**	**Progress Monitoring**
1st Grade	Sums to 5	Sums to 18 or 20	Addition and Subtraction 0-20
2nd Grade	Addition and Subtraction 0-20	Multi-digit addition or subtraction without regrouping	Fact Families Addition/Subtraction 0-20
3rd Grade	Fact Families Addition/Subtraction 0-20 or 3-digit addition and subtraction with and without regrouping (this is hard for most third graders but reflects a skill that most are expected to be able to do)	Multiplication 0-9 or 0-12	Multiplication and Division 0-12
4th Grade	Fact Families Multiply/Divide 0-12	Multi-digit multiplication without or with regrouping	Multi-digit division with and without remainders
5th Grade	Multi-digit multiplication with and without regrouping	1 digit into 2-3 digit dividend with remainders	Reduce fractions

A

6th Grade	Decimals multiplication	Find least common denominator	Substitution of whole number to solve equations

Q

Sue Keasler

I teach preschoolers who are at risk. How will RTI affect and help me in a very hectic classroom w/ children who have a myriad of issues? What can I do for math readiness at this level?

A

Amanda VanDerHeyden

We have something in common! I've been running research on early mathematics skill development with preschoolers at risk for a few years now. We built and tested a set of measures in 2004 (paper appeared in Journal of Early Intervention). They are timed CBM probes of early numeracy and assess skills like number identification, number naming, counting (one-to-one object correspondence), free counting (count as high as you can), and visual discrimination (find the object/number/letter that is different). Others have built similar measures (e.g., Robin Hojnoski has a paper in *School Psychology Review* in 2006 describing a set of measures). Our measures are administered typically during the center play period.
The scores have been shown to be:
(a) reliable over time, forms, and across scorers,
(b) to correlate well with other measures of early skill development including the "Brigance Screens" and the "Test of Early Mathematics Ability,"
(c) to correlate with performance at kindergarten, and
(d) to discriminate expected performance differences by grade level and risk status (this is some evidence of sensitivity).

We published the longitudinal data and the sensitivity data in a paper in *Journal of School Psychology* in 2006. What we have struggled with is demonstrating sensitivity of the measures for monitoring growth due to instruction and making short term (like week to week) decisions about altering instruction to improve learning (as you can do with CBM with older kids). We failed to demonstrate this type of sensitivity in both the 2004 and 2006 study, and others seem to struggle with this. too. Probably practitioners would not be surprised by this in thinking about working with typical preschoolers (they are variable and often unpredictable little creatures!). So based on our early failures, we designed and have now completed two follow-up studies. We are analyzing those data now, and I think we are on the right track. I have a set of kindergarten measures, too, and these are available through www.isteep.com.

Q

Linda Martinez

As a parent, what can I do to encourage my child's school to implement RTI in mathematics to help him with his math problems?

A

Amanda VanDerHeyden

I can't help but wonder about the (likely) possibility that if your son is struggling then many children may be struggling in mathematics. When we conduct universal screenings in schools, we often find system-wide learning problems in mathematics. Often the deficits are apparent by end of year at grade 1 and just grow across the grades as the instructional program advances and children missing the prerequisite skills to benefit from that instruction.

If your school is using RTI for reading, then adding mathematics would not be too difficult. If RTI is new to your district, it might help to share some of the resources from this Web site with the district (www.RTINetwork.org). It also might help to take a look at the district data on the school or district Web site (most districts seem to have these data available now). You could probably detect from those data whether many children are struggling in the area of mathematics.

Ideally, you might find someone who is willing to screen even just one class. It only takes 2-5 minutes of time. A picture is worth a thousand words and people want to see their own data. When teachers select the probe, help administer/score and then see the graph showing child performance relative to expected performance, they are usually very enthusiastic to get on with the next step, whether it's class-wide or individual intervention.

Tracy Hurd
How would this apply to high school students?

David Allsopp
Your question is an important one. Unfortunately, it is also one where clear answers are not readily available. Mathematics for RTI for schools generally is not nearly as advanced as it is, say, for reading. This is much less the case for high school. Compounding the issue at the secondary level is that mathematics becomes much more specialized in terms of content. Additionally, graduation requirements and state assessments are tied to particular mathematics courses (e.g., Algebra 1, Geometry 1, etc.). I am not aware of any wide-scale application of mathematics and RTI at the high school level. This is not to say that RTI is not happening at some high schools. However, in terms of systematically applied and evaluated models, there are none that I know of at this time.

The good news is that there is a research base from which secondary educators can base their tiered instruction. There are a number of mathematics instructional practices that appear to be promising from a research perspective, all of which can be applied to secondary settings. They include 1) explicit systematic instruction within authentic contexts; 2) teaching strategies for learning and doing mathematics including use of graphic organizers; 3) grounding abstract concepts within concrete experiences (concrete-representational-abstract sequence of instruction); 4) providing multiple opportunities for students to apply their mathematical understandings (both newly learned concepts and those for maintenance); and 5) continuous progress monitoring/instructional decision-making. For more information and video models of these practices and others, go to the MathVIDS website: http://coe.jmu.edu/mathvids2 For a recent synthesis of research on effective mathematics instruction for students with mathematics difficulties, see Gersten, Baker, & Chard (2006). Effective Instructional Practices for Students with Difficulties in Mathematics: Findings from a Research Synthesis. Center on Instruction, www.centeroninstruction.org .

Several articles that address effective instruction for struggling learners/disabilities are:

Gagnon & Maccini (2001). Preparing students with disabilities for algebra. Teaching Exceptional Children, 34(1), 8-15. Maccini & Gagnon (2000). Best practices for teaching mathematics to secondary students with special needs: Implications from teacher perceptions and a review of the literature. Focus on Exceptional Children, 32(5), 1-22.

Andreia Ransdell
I am involved in a team in my district that is currently designing documents to guide instruction in math at each grade level (k-5) based on the TEKS. We are establishing Big Ideas, Units of Study, Essential Questions, Ideas for Differentiation, etc. Is there a way for us to integrate already-created CBM tasks into that document? My goal is to connect teachers (in the easiest way possible) with CBM task resources already available, in the event that a student is not successful at the Tier 1 Level. To your knowledge, has this already been done? Is there a "bank" of math CBM tasks organized in such a way that would lend itself to being linked to the type of online instructional document my district is in the process of creating? Thank you in advance for your time and any input!

David Allsopp
This is an excellent question and one that I hope elicits more action on the part of researchers. To date the vast majority of probes that are available are computation driven. One exception to this is the CBM work being done at Vanderbilt University. The Fuchs' and their colleagues have developed a series of probes that include computation and application type items. You might want to examine examples that are posted online to determine the extent to which they are aligned, or could be aligned, with your district's curriculum. A summary of their work with examples of probes are provided in Using Curriculum Based Measurement for Progress Monitoring in Math (Ideas That Work, US Office of Special Education Programs & studentprogress.org). Another group (Bryant & Bryant – University of Texas) has been working on an RTI tier 1-3 project and may also have some probes that might go beyond only computation type tasks. They have been piloting a tiered mathematics intervention for early grades mathematics. More information about this project can be found at www.texasreading.org. I believe they conducted a webinar through the Access Center where a copy of the presentation can likely be downloaded. Another resource that provides examples of mathematics probes is Aimsweb.

Amanda VanDerHeyden
We ran into this in our work in a district in Vail, Arizona and ended up building our own. You can make probes using worksheet factory software. This will give you many of the probes you

need/want. Sopris West sells their Basic Skill Builders product (Beck et al.) and in my opinion it's very good.

I'm not affiliated with Sopris and don't receive any kickback or whatever. I just like their basic skill builders series for reading and for math. Interventioncentral.org might be another resource for you.

Andreia Ransdell
What are some examples of universal screeners commonly used in math at the elementary level?

Amanda VanDerHeyden
see earlier answer to karen decker

Judy Jones
How does RTI for math differ from RTI for reading?

David Allsopp
In concept, RTI for mathematics does not differ from RTI for reading. The premise is the same - to provide all students with effective instruction that is supported by research in order to prevent school failure or the need for identification for special education services. In terms of process, there would be little difference. The structure (e.g., screening, tiered instruction, use of continuous progress monitoring) will not differ. What will be different is the type of instructional practices that will be implemented and the concepts and skills that will be emphasized. The fact is that the application of RTI for mathematics is in its infancy compared to reading and behavior. Therefore, there is much less to go on in terms of models at this point. Bryant and Bryant at the University of Texas are doing some initial research into a tiered mathematics intervention. You might find their work interesting. They describe a model for intervention at tiers 1-3. You can download a presentation of their work at the Vaughn Gross Center for Reading and Language Arts (VGC) Web site. They also completed a webinar with The Acccess Center. There are a number of mathematics instructional practices that appear to be promising from a research perspective.

They include: