RTI and Mathematics

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About this Talk

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Implementing RtI in mathematics presents unique challenges and new questions. Join David Allsopp and Chuck Gameon as they explore the application of multi-tiered systems of support in mathematics and answer your questions about key issues including effective instructional practices for interventions, strategies for screening and progress monitoring, and criteria to think about when selecting intervention curricula. They will also offer examples to illustrate the application of effective RtI practices that increase student achievement in mathematics.

Transcript

Q ***Sue Jenkins***
Do you have suggestions for where to find the time for Tier 3 students to get interventions?

A ***Chuck Gameon***
Sue, finding time for Tier 3 intervention in reading or math can be problematic. You cannot make more time in a school day, so you have to try to look at the amount of time you have critically. It comes down to a matter of priorities. In our school we have maintained that reading and math are the two most important academic areas. Because of this, every other time slot (science, social studies, etc.) can be sacrificed to some degree to help a student achieve academic targets in reading or math. We try to avoid pulling students from library, PE, music, or their recess time. You can also look to before school or after school for interventions. Students needing Tier 3 supports may require a before school intervention period and an additional intervention time during the school day. I feel this is a school-based decision where everyone needs to provide input and be willing to support the decision of the staff.

Q ***Donna Raspa***
Do you have any suggestions regarding websites to locate scientifically researched based math interventions?

A ***Chuck Gameon***
When looking for websites to review research-based math interventions you need to know about

A the What Works Clearinghouse. This website is a part of the U.S. Department of Education?s Institute of Education Sciences. It reviews and reports on existing research on programs for math (as well as other content areas, including behavior). What Works Clearinghouse has established rigorous standards to judge the research on programs and will give ratings to programs based on their effectiveness. Another website is Best Evidence. This sight also reviews programming for effectiveness.

Q ***Ron***

We have instituted an intervention period during the school day to provide more targeted instruction for children falling behind their peers in math skills. Our Special Education students continue to fall farther behind. Any advice?

A ***David Allsopp***

Ron, I am glad to know that you are providing more targeted instruction for your struggling students. However, it is difficult to answer your question without knowing more specifics like: What are the disabilities that students who fall behind have (e.g., learning disabilities, ADHD, emotional/behavioral disabilities, ASD, intellectual disabilities, physical disabilities, sensory impairments, etc.)? With what mathematical areas are they having the most difficulty? To what extent are research supported mathematics instruction practices being used for these students? With what particular mathematical concepts/skills are they having difficulty? These are just a few important considerations. I would recommend that you visit the MathVIDS website to learn more about research supported effective mathematics instructional practices for students with disabilities (and other struggling learners).

Q ***Katie Flowe***

Do you have any suggestions on how to set appropriate goals when using math concepts and applications to progress monitor?

A ***Chuck Gameon***

Katie, that is a very good question and one that is important when problem solving with students. You always want to set appropriate goals for the students. When you are problem solving, you need to remember the goal of everything you are doing for students at Tier 2 and Tier 3?to get them to reach grade level benchmarking targets (to achieve proficiency of math content). It is important to consider their present level of performance and the time frame you have to achieve the goal when setting appropriate goals so they are not too ambitious and are achievable. Another piece of the puzzle comes with experience. You will get an idea over time how much you can expect students to grow when provided with intervention support. This helps to set appropriate goals for progress monitoring. Since your question specifically asks about math concepts and applications (M-CAP) I am assuming you are using AIMSweb probes. A good place to start is to look at the AIMSweb norm chart. You will find percentile scores from all of the students who have taken the M-CAP probe. You can use the 50th percentile as a goal for your progress monitoring.

Kim
What are good interventions for students who have trouble with math word problems?

David Allsopp
In order for students to have success solving word problems, they must be able to do a number of things including reading and comprehending the text of the word problem, recognizing the mathematical situation represented within the word problem (e.g., addition, subtraction, multiplication, division, etc.), identifying the relevant, and irrelevant information, applying a process or procedure for solving the problem, and being able to ?estimate? the reasonableness of their answer. Of course, students also must have an understanding of and proficiency with the mathematical concepts, processes and procedures that a particular word problem addresses. So, first, a good diagnostic assessment should be done to evaluate students? abilities to engage in these activities. Then, any intervention would need address whatever area or areas with which students are having difficulties. The most promising approach to teaching students to solve word problems is explicitly and systematically teaching them metacognitive strategies that assist them in learning how to engage in the thinking aspects of word problem solving. Montague and her colleagues at the University of Miami (FL) have done quite a lot of work in this area where they focus on helping struggling learners develop schemas for solving word problems including the use of graphic organizers. A number of research supported mnemonics have been shown to result in success as well. For example, the FASTDRAW strategy (see Mercer & Mercer, 2007 ? Teaching Students with Learning Problems or the MathVIDS website) provides an explicit structure for students to determine what needs to be solved, the important information, and setting up an equation (FAST) and them for how to solve the equation (DRAW). The STAR strategy is another example (see Maccini & Gagnon, 2006).

Sharon LeBlanc
What software is available for diagnostic testing and progress monitoring for math?

Chuck Gameon
Diagnostic testing or progress monitoring software/programs for math are available and the options continue to grow. Here are some computer-based options for diagnostic assessments that I know of: Diagnostic Online Math Assessment (DOMA) and Stanford Diagnostic Mathematics Test (SDMT). Math Access is advertised as a benchmarking, progress monitoring, and diagnostic assessment program. Progress monitoring programs: Easy CBM and Yearly Progress Pro, both are on-line progress monitoring programs. In reviewing some of the math assessment (progress monitoring or diagnostic) programs that are available, one program appears to be very interesting to me (although it is not a computer-based program). This program is Key Math 3. It requires 1 on 1 administration and it is for students in K-12. It takes 30-90 minutes to administer and it is designed to assess understanding and application of critical math concepts and skills from counting through algebraic expression. What it does offer is an instructional piece that aligns to the diagnostic assessment. It supports K-6 skill level with 30/40 minute lessons. It offers assessments

A for readiness and mastery and recommends either long-term supplemental support or you can choose a particular topic for targeted instruction and can be done with an individual student or small group.

Q ***Kathy Kane***
What are some really good progress monitoring tools for middle school math? I understand the need for normed referenced tools for specific learning disabilities but what are some effective easy, tools for Tier 1 and Tier 2 when the student will probably not end up identified for special education?

A ***David Allsopp***
Kathy, I think that a lot of folks are finding themselves in the same quandary! A central tenet to RTI is implementing more intensive instruction for students who need it that is supplemental to the core mathematics curriculum. So, I agree with your belief that students who are below state benchmarks should not be removed from receiving instruction in the Tier 1 core curriculum. With respect to specific interventions, particularly at Tier 2, it is important to first ensure that these interventions target the foundational concepts (big ideas) that under gird the scope and sequence of concepts/skills that any particular core text or program emphasizes for any particular grade level. The National Council of Teachers of Mathematics (NCTM) Focal Points are a helpful aid for determining what these big ideas might be for any particular grade, grade range, and corresponding core text. Students who struggle oftentimes do so because they lack true conceptual understandings of the various mathematical operations they are asked to compute (e.g., that 2 x 3 = 6 really can be described as two groups of three totals six; ? x ? = 1/8 can be described as one-half of one-fourth is one-eighth). Students can visualize these understandings by using materials to represent the meaning of mathematical representations (e.g., draw a line down the middle of an one-quarter circle piece and compare the area of one side of the divided one-fourth circle piece to an one-eighth circle piece). When students are able to visualize and describe the underlying concepts of the mathematics they do, then they build a strong foundation for problem solving and making meaningful cognitive connections among different mathematics concepts and skills. Therefore, the second important aspect of Tier 2 and 3 interventions is to ensure students are provided explicit and systematic math instruction utilizing practices that highlight the conceptual meaning of targeted big ideas that correlate to the core curriculum (e.g., concrete-representational (drawing)-abstract sequence of instruction, language experiences/verbal expressions, use of graphic organizers, teaching mathematics strategies, etc.).

Q ***Laura Jones***
What process do you use to group students for Tier 2 and Tier 3 intervention?

A ***Chuck Gameon***
Laura, students are grouped for instruction based on data. You start the initial steps to this end with the benchmarking data. Your benchmarking program may give you enough information to begin your groupings but, typically, you will need to do some diagnostic assessments. Depending

A upon your programming options you could also do placement tests, either from your core math program or from optional intervention programs. If you are going to group your students for instruction you need to group them by skills they are missing. Don?t just group kids to group them.

Q ***Jan***
How can we help students get "caught up" once they've been left behind?

A ***Chuck Gameon***
You can help any student get ?caught up? through a systematic plan?that?s really what RtI does for children. The first step would be to identify where they are performing. You must establish an instructional level and identify skills they have in relation to grade-level expectations. Once this is established you plan the educational programming for the student?the intervention. Within an RtI model it will be a research-based intervention that is specifically aligned to the student need. The staff member who will deliver the intervention will have been trained so they can offer this intervention to a high degree of fidelity. The plan will include a measurable goal, the programming, how often it will happen (eg. daily for 30 minutes), and how you will be monitoring the student growth (progress monitoring). The plan will be reevaluated every 4-5 weeks for effectiveness by examining the progress monitoring and fidelity data. The intensity of the intervention will be determined by the gap between the student and his/her grade level expectations. All students will need 60-90 minutes of quality math instruction for their core programming and the student who needs to ?catch up? will need more. Obviously, there is a lot more to creating a system where this is embedded within all that you do in your school. The RtI process creates a system where student aren?t ?left behind? because of the constant monitoring of student data.

Q ***julie***
Is there ever a time to 'stop' interventions for high-school-age students and 'hand them' a calculator so they can learn the higher math and get the skills they need for the high stakes tests (most of which ALLOW calculators)?

A ***David Allsopp***
Julie, great ?stop intervention? question! My initial response is that at the high school level, if the only reason a student is receiving Tier 2 or 3 intervention service is that they have difficulties with performing basic computations, then I wonder what is the focus of the intervention. If the focus is to make them fluent in memorizing basic facts or performing algorithms in written form only, then I would question the necessity of these things given their age and grade level, particularly if this is at the expense of students getting exposure to mathematics that is critical for them receiving a regular diploma (e.g., Algebra 1 & 2; Geometry). The most important consideration, in my opinion, is whether or not a student has the conceptual understandings of the mathematics that underlie the procedures that we often mistake for mathematical proficiency for K-12 mathematics. Let them use calculators if the only barrier for them is the algorithmic aspect of mathematics! However, if they don?t conceptually understand the mathematics behind the algorithm, then interventions

A should focus on these things, not recall of tacit information like the sum of a certain operational fact.

Q ***julie***
How do you accelerate students while keeping them in their core class?

A ***Chuck Gameon***
Accelerating students in the regular classroom can require some extra effort by the regular education teacher. The first thing that must be addressed is the grade-level skills. Do you have a system that can assess whether this student has mastered the math skills that the other students are expected to have at that grade level? If not, you will need to do this. Oftentimes, math programs will have unit assessments or even end-of-the-year tests. If this student can pass these tests, then they should go on to the next year?s curriculum. You can repeat the process until you establish the student?s instructional level. Once this is done it is actually easier to address their specific learning needs. Like reading, math instruction should be within a small group setting for at least a portion of the math instructional block. This student, or others who have similar needs, can have small group instruction at their level. Rotating students through learning centers (systematically planned and implemented with a high degree of fidelity) within your classroom is another effective instructional practice that allows you to provide appropriate instruction to students who are ?above grade level.? Differentiating instruction is yet another option to use for accelerating instruction. Differentiating instruction is a little more complex as it takes quite a bit planning effort. When looking at differentiating instruction, if you remember to focus on the content, product, process, or pace of the instruction it makes it a little easier.

Q ***Cynthia***
Where do I begin with progress monitoring at the middle school level? Over 75% of our students are below grade level in math.

A ***Chuck Gameon***
If 75% of the students in your middle school are below grade level, then you do not want to start with progress monitoring. You will need to start by looking at your core math program and what is offered every day in your math classes. If 75% of the students do not have the skills they need, you need to do something different for all kids. Instruction at the core level must also be addressed:

- Are students engaged in instruction?
- Does the teacher plan effectively?
- Is the program a research-based program?
- Have teachers been trained on the program?
- Is there any fidelity to the program?

The list of questions could go on. The point is, look at where you are now and plan how you can systematically change to better meet the needs of the students. You definitely want to discuss the performance of your students with the 6th grade teachers (not assigning blame). In terms of school

A improvement, you always get ?the most bang for your buck? by improving instruction.

Q ***Jodie Giannakopoulos***
What are some Tier 2 and Tier 3 math interventions used with students in grades 4 through 6 that do not require additional staff?

A ***Chuck Gameon***
Jodie, when looking at interventions for students who need intensive supports, Tier 3, I believe it is imperative that they have interactions with staff members. You want them to receive the highest quality instruction from the most capable staff. This instruction needs to be systematic and explicit, which relies on a person to execute. The only option for Tier 3 interventions that does not require a staff member would be computer-aided instruction (CAI). This would be effective to some degree if you can find a program that is capable of meeting the specific needs of your students needing Tier 3 supports. There are research-based CAI programs available, however they are very costly pieces of software. I am thinking if you can?t afford to have extra staff work with children, then it may be cost prohibitive for you to purchase this software. Tier 2 students can benefit from CAI programs as well, but again, the cost. They can benefit from other software programs that are designed for practicing math skills as long as there is instruction before they go and practice on the computer. These programs are much more affordable. The next possible way to provide appropriate instruction for students needing Tier 2 supports would be to look at the core programming structure. If students are grouped for instruction, then they can receive appropriate instruction at their level. If you also incorporate learning centers for these students you can provide aligned practice opportunities as well as increasing the total number of times a student can interact with the concept. One last part to this would be looking at pre-teaching and re-teaching for the Tier 2 students from the core content.

Q ***Tina Cole***
I am teacing math intervention for first grade. Students are working to correctly identify the numbers 11 to 20. The 11, 12, 13, 15, and 20 are difficult for them...mostly 12 and 20. Any ideas?

A ***David Allsopp***
Tina, without knowing more about the students it is difficult to provide specifics. However, here are a few ideas: Since identifying numbers is related directly to the number sense concept of magnitude or quantity it is important that students can ?visualize? the relative quantitative differences among numbers. So I would suggest doing number work with them where they use materials to build their number sense as it relates to quantity. For example - Is a group of ten teddy bear counters more or less than a group of twenty? How do you know? How many more teddy bears are in the group of twenty (count up strategy)? As you do this, use language cards with both the written number name and number symbol to explicitly associate different numbers of teddy bear counters (or any other appropriate counting objects). Students can practice placing these language cards next to the groups of objects, same the number, and then talk about why

A they think the number is the same as the number of objects in a group. Using number lines are also very helpful. Students can use counting objects to practice/play instructional games with number lines where they place them along the number line to show different quantities from 1-20. Also they can start with a quantity (e.g., 3) and count up and back to reach another number (student counts up 5 to reach 8). As students do this, ask them how many more or less the target number is from the number at which they started (e.g., I counted five more to get to 8 from 3). One thing that young students often have difficulty with when it comes to identifying numbers greater than ten, like eleven through twenty, is that the language we use does not correspond to the quantity they represent. Interestingly in some languages they do. We use ?eleven? for the actual quantity of ?ten and one.? Our traditional number system represents a base ten process but the language we use does not in some instances. This is difficult for students oftentimes. Again, we can help students by helping them understand the words/language we use. So, for example, you can help students learn ?other? ways to say eleven (ten and one), twelve (ten and two), etc. Then, students can play instructional games matching groups of objects to the other way to say the number and then the traditional way to say the number. So, a student may have a group of fourteen objects. They count the objects, choose the language cards that match. As they do this, students can be taught to count up to ten first and then count up from there. Again, this is all trying to help them make conceptual sense of quantity and to help them begin to understand how our base ten system operates. Overall, it is really important to help student make sense of the abstract representation of numbers to meaningful experiences by explicitly associating them to meaningful representations (e.g., materials, language, drawings) and allowing them multiple opportunities to work with these associations.

Q ***Diane Cotton***

There are a myriad of researched based interventions for reading, but they are not as easy to find for math. Where can we get these interventions without having to buy a canned program?

A ***Chuck Gameon***

Diane, you are right. There are some research-based interventions for math available, but they are very few in comparison to reading. Remember, within an RtI model we also talk about ?research-based curriculum and instruction.? Instruction as a basis for intervention is sometimes overlooked as a research-based practice. I have always maintained that good teaching is good teaching, no matter the content but there are research-based instructional practices specific to math. Before that, there are some interventions that you can do to intensify instruction. For example, change the group size. If you create a small group for instruction you are increasing the response opportunities and, most likely, the engagement of the students. Another example is to pre-teach or re-teach from the core program. This gives the student a longer period of time during a school day to attain the objective that you want. Effective instructional practices will go a long way in helping all students and, when intensified with a small group setting, will be even more powerful. There are a number of specific instructional strategies for math that David could address in his response.

A ***David Allsopp***

A Diane, the term ?research based intervention? can be difficult to interpret, as I am sure you are aware. To be honest, there are very few packaged programs that have an evidence base to suggest they are effective. Even those that do, only seem to have a small to moderate effect. So, thinking about mathematics interventions as instructional practice is a much more promising approach in my opinion. That is, integrating the use of research supported mathematics instruction practices that are targeted to address both the mathematical content and learning needs of individual students. Examples of such practices are: use of Explicit Systematic Instruction that incorporates concrete-representational-abstract sequences of instruction, teaching problem solving strategies, explicitly connecting language to mathematics, using graphic organizers to help student connect mathematical ideas, providing students multiple opportunities to apply new understandings in order to develop proficiency, engaging students in multiple ways to express what they understand and can do (i.e., communication, representation, problem solving, connection-making, reasoning/proof), etc. The MathVIDS website provides extensive information about these practices including video models and more. Also, check out the resources listed on the webpage for more ideas. Several provide explicit direction for how educators can critically evaluate what they are currently doing and how they can integrate these research supported practices in ways that meet the needs of their students and teaching contexts.

Q ***Courtney Havens***

What are effective interventions that can be done at the middle school level? Our data always seems to show that the area of number sense is weak but teachers aren't sure how to address that other than through the use of flashcards. I'm not sure this is best practice....

A ***Chuck Gameon***

Courtney, I have a question for you?what assessment are you using to tell you your middle school students are weak in number sense? If you will post this I would gladly respond further. A few issues come to mind with your question. First of all, flashcards will not help in any way to develop number sense. Flashcards are a means to try to facilitate the memorization of facts. In my mind number sense is almost the opposite. Here is my school?s definition of number sense:
A person?s ability to use and understand numbers: ? knowing their relative values (counting, recognizing numeral & quantity) ? how to use them to make judgments (comparing & ordering) ? how to use them in flexible ways when adding, subtracting, multiplying and dividing (composing & decomposing) ? how to develop useful strategies when counting, measuring or estimating.
Developing number sense is a process where students are given a variety of opportunities over a period of time to interact with numbers in various contexts using the concrete-representation-abstract instructional method. The second issue is teachers should not have to come up with interventions or supports for students on their own. RtI is a collaborative effort where you are drawing on the expertise from all staff members. Collaborative problem solving is an essential component of the RtI process and is used as a decision making tool. You can find a list of research-based interventions for math at What Works Clearinghouse. I have referenced in several of my response the importance of effective instructional practices as a means to positively affect student understanding of math. This is the first area I would recommend

A you look at as a means of supporting your struggling learners and all students for your core (Tier 1) instruction.

Q ***Heidi Erstad***
Can you recommend any specific screening tools for Math or share thoughts about what's key at different stages of development to predict future struggles in Math?

A ***David Allsopp***
Heidi, excellent question! I?ll try to respond to each part of the question separately. Screening tools: The National Center on Response to Intervention provides a great resource for evaluating possible screening tools a school might use for mathematics and other areas. Stages of development: This is a great? but quite complex question. So, I will try and address it as succinctly as I can. There is growing consensus that number sense and algebraic thinking have similar significance to mathematics success as phonemic/phonological awareness have to reading success. So, development in number sense and algebraic thinking should be closely monitored. Another important aspect of development that I have found very helpful is the manner with which students move from acquisition of understanding to proficiency to maintenance to generalization to adaption (Stages of Learning). Oftentimes we measure students at only one point along this developmental continuum of learning and use that to determine whether or not students ?have it? or ?don?t have it.? I would suggest that any math RTI process incorporate evaluation practices that assess where students are along this Stages of Learning continuum, particularly as it relates to key foundational number sense and algebraic thinking concepts/skills. By doing this, instruction can be pinpointed to address where students actually are along this continuum for target mathematics concepts/skills. Also, level of mathematical conceptual understanding (concrete, representational/drawing, abstract) is also an important developmental consideration, particularly for foundational math concepts. Assessments that evaluate what students know, understand, and can do at each level of understanding provides educators with important information that can inform instruction (e.g., if a student has difficulty at the abstract level but has some understanding at the representational/drawing level, then instruction can be directed at enhancing their representational level understanding and explicitly associating it to the abstract in order to enhance the student?s abstract level understandings). Whether or not students can ?recognize? (correctly choose an example) or ?do? (correctly represent a mathematical situation or complete a mathematical process/procedure) are also important developmental considerations. Oftentimes we think students know nothing about a particular concept/skill because they cannot ?do? it. However, sometimes, students can recognize an example when provided choices. Again, such information can be used to inform instruction and make intervention decisions. A last consideration is to make sure that assessments evaluate students? mathematical thinking. As adults we often assume that our students should think as we do. Well, we know that our brains develop continuously through early adulthood, particularly as it relates to executive functioning, which is part and parcel to critical thinking. Therefore, probing students? thinking about target math concepts/skills is also an important consideration. Sometimes younger students think differently than adults about mathematics, but not necessarily incorrectly.

Kathy Probst

I'm looking forward to all the topics mentioned in the description. I am an Academic Intervention Services (AIS) elementary teacher looking to put some RTI practices into place but I'm also in a quandry. I usually reinforce classroom program to help students be successful before they need specific interventions. How do I blend the 2 concepts? My AIS students scored 2's on the NY State math assessment, which requires them to receive academic intervention services.

Chuck Gameon

Kathy, I feel I have to clarify a few things first in order to answer this question appropriately. The first question is what does ?reinforce classroom program? mean? The second is what does 2?s on the NY State Math Assessment mean? Is it a 1-10 scale? Are they categorized as intensive or strategic? If you can respond to these questions I feel I can give you a better answer. I will try to broadly answer your question first. I would take a close look at your programming as an AIS teacher. Are you simply helping the students get their class work done or are you specifically targeting math skills and providing meaningful instruction to lead the students to mastery of those skills? In an RtI model you should be providing instruction through the use of a research-based, effective instructional program using research-based, effective instructional practices. Another issue that may be connected is the core math program that all students should benefit from (unless their instructional level is two or more years less than their grade-level peers) during the course of their regular classroom math period. Is this an evidence-based curricular product? If not, this could be part of the problem. The amount of training a teacher receives in using the program can also affect student learning. I already mentioned the importance of instruction, is this part of the problem? It sounds to me like the Academic Intervention Services piece, which you provide, is part of a system change that aligns to the RtI process. You are trying to prevent targeted/at-risk kids from failing?that?s a big piece of what the RtI process is all about.

Mary Kay Glassman

Please advise best practices for developing fact fluency and specific curriculum that accomplishes this.

Chuck Gameon

Mary Kay, I like to compare fact fluency to reading fluency. We all have a good understanding that fluency is related to automaticity of phonics skills (decoding and blending), high frequency word recognition, and vocabulary. Math fact fluency is similar in that we are looking at an application skill related to number knowledge (the relationships of symbol to quantity, relative value in relation to other numbers, etc.). If you want to build math proficiency with facts, then look for a program that builds the foundational skills to understanding numbers. A program that I have some experience with that does this is Number Worlds. The bottom line in making a recommendation concerning products is to identity what it is you want the students to get from a product and find the one that best meets those needs.

Mary Kay Glassman

Why are spiraling math curricula still so popular in private schools? Please specify best researched curriculum that builds, scaffolds, and teaches math facts to mastery.

Chuck Gameon

Mary Kay, I do not have any experience in a private school or working with a private school in Montana, so I am not sure why they are popular with those schools. Spiraling curricula has found a place in public schools because it is constantly reviewing previously taught material. The idea of a spiraling curriculum is wonderful as you want your students to have many opportunities to interact with content over time. The idea behind spiraling curriculum is it will help with retention of information/content.

As far as best researched curriculum that builds, scaffolds, and teaches math facts to mastery?I will recommend visiting What Works Clearinghouse or Best Evidence. Both of these sites review curriculum. I have my own opinions on math curriculum that I don?t feel are addressed by textbook companies. The first and foremost issue is they provide too much and really expect mastery of none. When you examine products, they simple move from topic to topic without teaching so students can fully understand what they are doing. I believe the integration of the Common Core Standards will be big help in this area, as are NCTM?s Focal Points because they give specific direction at grade levels and lead schools and teachers to teach students to understand math as opposed to understanding how to do an algorithm.

In my own case, are school was looking to improve math achievement by improving math instruction during the 2008-2009 school year. At that time it was very difficult to find any research on instruction specific to math. I feel the programs available also reflected this fact. It was at that time that we decided we wanted our students to truly understand numbers so they could apply this understanding to solving problems (including math facts). We began to condense our curriculum through a collaborative review process to narrow the focus of math instruction at each grade level within the elementary school. At the same time we researched and found ways to create meaningful learning opportunities for the students using the concrete-representational-abstract method. There was also a book that we read as a learning community by Dr. Allsopp titled, *Teaching Mathematics Meaningfully* that also helped increase our understanding of math acquisition. We continue on this process of becoming better math teachers as a school. We have seen an increase in math achievement by 60% on our state achievement test.

My recommendation for choosing a math product would be to be an informed consumer. Look critically at the instructional design and instructional methods, as well as the content of the different programs. You know the student population of your school. Select the best program to meet the needs of your students and teachers. If you have data on specific areas of math achievement that are problematic areas, find a program where this area of the instructional program is strong. You can also use future data to decide where the math program needs to be

A improved and target that area.

Q ***Melisa Cellan***

Please break down the major skill areas in math (for example, reading has 5 main components). What are some of the best progress monitoring tools for each of these areas?

A ***David Allsopp***

Melisa, first of all, like reading, mathematics heavily involves communication of ideas. Interestingly, the five areas of effective reading practice - phonemic awareness, phonics, fluency, vocabulary, and comprehension ? do have relevance to mathematics and can be used to help think about what might be parallel concept/skill areas for mathematics. A parallel to phonemic/phonological awareness in mathematics is the number sense aspect of the number and operations content strand (See the National Council of Teachers of Mathematics (NCTM) content standards). Closely related to number sense is algebraic thinking (See NCTM content standards). These two foundational areas of the K-12 mathematics curriculum are critical areas to emphasize, especially for students who struggle with mathematics. The recent National Advisory Mathematics Panel emphasizes the importance of these areas as the foundation for K-8 mathematics. Without deep understanding of these areas, students will have difficulty with conceptually grasping important concepts/skills related to other important areas like geometry, data analysis and statistics, and measurement (See NCTM content standards). Fluency as it relates to reading involves the accuracy, rate, and prosody of reading words in text. Prosody emphasizes the meaningfulness of the words being read in context. Well, fluency is also an important aspect to mathematical success for students. Like reading, fluency in mathematics also has to do with accuracy, rate, and prosody in context. Too often, the ?context? aspect is left off of discussions about mathematical fluency. For example, the term ?automaticity? is often used in mathematics. This places all of the emphasis on accuracy and rate. It leaves off the most important aspect ? prosody (the meaningful application of target mathematical concepts and skills). Take basic facts for example. It is far more important that students can apply their understanding of facts within mathematical contexts where there use is actually necessary (e.g., using addition facts within double digit addition situations). Vocabulary in mathematics is very important. The relationship that students make between what they see (abstract symbols) and what they understand is intricately tied to language and the meaning that students can communicate (internally and externally) about the abstract mathematical representations. So, it is critical to emphasize language that students can use to communicate what they do and don?t understand about the mathematics they have learned and currently are learning. Importantly, vocabulary development doesn?t start with technically accurate terms for many students. Connecting students? own vocabulary to technically accurate vocabulary is paramount for struggling learners. Comprehension in mathematics, as with reading, is multifaceted. Comprehension in reading is making meaning out of text. Comprehension in mathematics is making meaning out of and communicating meaning through mathematical representations that occur in abstract ways (e.g., numbers, math symbols, charts, graphs, tables, etc.). Comprehension (i.e., conceptual understanding) in mathematics has to be a primary emphasis across the Pre-K-12 curriculum. Therefore, meaning/conceptual understanding has to be and explicit area of emphasis

A if we hope to improve mathematical learning outcomes for our students. Now, I have touched on only one-half of the your question. Oftentimes, we are conditioned to think mostly about the ?what? aspect of mathematics and forget about the ?how? of mathematics. The NCTM emphasizes not only content standards (the ?what? of mathematics) but also the ?how? (ways of doing) mathematics. Going into this aspect may not be within the scope of this type of forum. However, I encourage you to investigate the Process Standards emphasized by the NCTM ? Connections, Representations, Problem Solving, Communication, Reasoning/Proof.

As to your second question, What are some of the best progress monitoring tools for each of these areas?, the only response that I can provide is that I do not know of any progress monitoring tools that systematically address the areas that I have described. However, I think that there are several that you might want to investigate and think about adapting: EasyCBM and National Center for Response to Intervention Tools Chart: Reading and Math. I would also suggest that you consider developing progress monitoring probes that actually address what your school believes are best for your context and students.

Q ***Amy Wiley***

Our elementary building is having difficulty finding time to schedule intervention for math. We have a Tier 2 block in our existing schedule but a lot of the students who are receiving additional assistance in reading (Tier 2 or Tier 3 intervention) also need intervention in math and there is no additional time. We are taking students out of special area subjects and some students are missing science and social studies. I am wondering how other schools are able to schedule intervention times for struggling learners particularly those needing assistance in both reading and math.

A ***David Allsopp***

Amy, this is such an important question. Many are trying to figure out what to do when there is only so much time in the day. To be honest with you, I don?t know of any particular process used by a school that addresses your concern very well, other than lengthening the school day or providing interventions before and after typical school hours. If this is done for every subject then students would be in school all day. And, of course, teachers, administrators, and staff would be expected to extend what they do all day with little or no additional recompense! However, this doesn?t mean that I think that there are not ideas that schools can try. First, I would suggest that grade level teams work closely together to inform each other about students, about what they are really emphasizing (or not), students? performance, and issues they have from a teaching and learning perspective. My opinion is that commercially packaged curricula are having too much influence on what students experience and what teachers emphasize within and across grade levels. When grade level teams (within the elementary, middle, and secondary levels and between them) communicate and flexibly adjust what is done for students then students have greater potential for success overall. Second, students can benefit from building leaders who flexibly utilize the talents of their faculty and staff. Oftentimes, there is more talent and expertise within a particular school than one might think on first glance. In my opinion, schooling has become way too compartmentalized in nature, whether it be by subject, student, or teacher. When we begin by

A dividing a total number of students by number of faculty members hired (teacher units), then we have already set ourselves on a path that is very difficult to change. A teacher is assigned to teach a subject or subjects and based on that subject or subjects they are allotted a certain number of students ?to teach.? Oftentimes, little thought is given to what each student actually needs! What begins to happen is that individual students either find success or they don?t by per happenstance in many cases. The effective use of universal screening and progress monitoring is critical to changing the emphasis ? from populating student schedules based on teacher units (?teacher unit ?need) to scheduling students based on ?student need? first. Third, the APPROPRIATE use of collaborative teaching structures can help. There are a lot of different ways that administrators, faculty, allied professionals, and support staff can work collaboratively to provide truly differentiated instruction/learning experiences for students. If we first thought about what is it that our students need with regard to learning generally, and learning subject specifically, then maybe we could more effectively and efficiently work out structures where students can be provided the differentiated instruction that they need (and deserve). Fourth, continuous professional development has to be of paramount importance if we are ever going to be able to truly affect mathematics outcomes for students, particularly students who struggle.

Q ***Kate Gearon***

What is your suggestion for progress monitoring the Test of Early Numeracy. There are four categories in that test so that is a lot of instructional time spent on monitoring.

A ***Chuck Gameon***

Kate, when you are looking at progress monitoring using Test of Early Numeracy (TEN) you should be focusing on one specific piece at a time. If a child is low on all four areas, start with one for the targeted area. Set a specific, measurable goal and plan an intervention to meet the goal. Align your progress monitoring to that goal and move forward. By doing this you are focused and your progress monitoring is only 1-2 minutes per week. Once you have achieved the goal by analyzing progress monitoring data, move on to the next low area. It is very easy to get too many interventions going for a student who is struggling in all areas. We have found it to be much more beneficial to stay focused to one specific area.

Q ***Anne S.***

I have a son in NY state in 8th grade diagnosed with ADHD/Aspergers/NVLD/Dysgraphia. Math is a huge struggle due to slower processing and his difficulty with writing and his ability to line up problems. What technology if any, is available to help him with this issue currently in the classroom and with regard to state testing?

A ***David Allsopp***

At the 8th grade level, there really should be little need to require your son to do mathematics using only ?paper and pencil.? Using either a handheld calculator or a calculator ?app? (e.g., on a laptop computer, iPad, or smartphone) would address the difficulties that your son experiences

A with lining up numbers, etc. Also, there are a growing number of Internet sites that provide ways for students to input information for calculations, data analysis, graphing, and other purposes. An interesting site that you both might want to check out is the National Library of Virtual Manipulatives. It provides virtual manipulative experiences to help students better understand mathematics including number and operations, algebra, measurement, geometry, and data analysis & probability. When your son does need to use paper and pencil or ?worksheets,? a simple accommodation can be made to lessen the spatial processing demands by reducing the number of problems on a page. Also, a simple ?math window? can be made out of tag board where an area is cut out in a rectangular or square shape and placed on top of a worksheet. Then the student only sees what is in the cut out area. They can focus on those problems and then when finished slide the ?window? to the next column or row of problems. With respect to state testing, I would suggest that you and your son visit his IEP to evaluate whether or not appropriate accommodations are identified for him for state testing purposes. This is a required section of the IEP. At a minimum, he should be getting extra time and the option of taking the test in an alternative setting. Also, most states allow use of calculators, particularly at the middle/secondary level. If he is not receiving appropriate accommodations then, I strongly encourage you and your son to request them. Hope these ideas are at least of some help.

Q ***Julie Zollinger***

Who facilitates/provides your interventions for Tiers 2 and 3?

A ***Chuck Gameon***

Julie, Tier 2 and 3 interventions in a school can be provided by a variety of staff members. Ideally, Tier 3 interventions are provided by the more qualified staff (more training and expertise in teaching). These interventions are also typically more structured or scripted, which allows staff members who do not have the expertise to facilitate the interventions after training on the program. Anyone who is available and can be trained is utilized as an interventionists in my building. I will give you an example: We have a reading block in the morning and have no special classes (PE, music, library) during the block. I have utilized my librarian and my PE teacher to provide instructional support and interventions for classrooms during the mornings. Here?s a quick run-down of possibilities: Title I, paraprofessionals, aides, principal, special education teachers and aides, secretaries, etc. I hope I am making the point that, when you develop an RtI system in your school, everyone is involved and part of the solution for kids. I can?t answer this question without coming back to fidelity. You cannot give training on a program and then just let the staff member go unsupervised. You need to plan on spending time refining their skills with the intervention program to help them increase their expertise in delivery.

Q ***Vicki Norris***

What interventions would you use for students who struggle with dyscalculia? Would "touch math" be a viable option, especially for younger children with this type of learning problem?

David Allsopp

Vicki, let me respond to the touch math question first. Touch math is a program that can assist some students to understand quantity of number and perform basic computations. It really incorporates kinesthetic and tactile experiences at a representational (drawing/picture) level of understanding. A drawback to this is when students are never scaffolded to full understanding and skill at the abstract level. In other words, students oftentimes continue touching points on numbers for years and years. So, if touch math is used, it needs to be used appropriately (for its purpose) which is to help students transition from concrete understandings of number and operations to abstract. With respect to interventions for dyscalulia and other learning disabilities, I am aware of only a few commercial programs and they really only address basic operations (addition, subtraction, multiplication, division) including fluency building. One is Great Leaps Math (http://www.greatleaps.com/) and the other is the Strategic Math Series (Peterson Miller and Mercer ? Edge Enterprises, Inc.). Hot Math (Fuchs & Fuchs ? Vanderbilt University) is also something you might want to investigate. You might also want to get the book "Teaching Mathematics to Students with Learning Disabilities" by Bley and Thornton (Pro-ed). This book has very good ideas for students with dyscalculia in particular. Please see responses to other questions that relate to effective mathematics interventions/instruction for additional information.

James Carter

How does RTI look in a math class?

Chuck Gameon

James, it really depends. You have to remember RtI is a process, not a program. You will create a system of support for students using research-based programs with quality instructional practices to a high degree. You will monitor student growth and analyze data constantly. This process continues. RtI is founded on 8 essential components (in Montana, some states less, but all about the same) that must be address in this process. The flexibility to make it your own system is built in as you are creating a system FOR YOUR STUDENTS and your teachers. It looks like good teaching and students learning every day.

Mark

In reading, I think that we are getting better with screening and progress monitoring across the Tiers. I am not finding that to be the case in math. What are some important considerations a school-based leadership team should consider when trying to implement Tier 2 progress monitoring in math? In reading, we are working with CBM (DIBELS Next) for Tier 2 monitoring once to twice a month. What type of progress monitoring at Tier 2 works best? CBM?

Chuck Gameon

Mark, an important consideration would be what do you need your progress monitoring to do? What data do you need? Does the progress monitoring align to our instruction? Find the system that best meets your student needs. Curriculum based measures are the norm for progress

A monitoring. The one that works best is the one that works for you and your students.

Q ***Becky Frankel***
Do you have a suggestion for a free and/or easy program to progress monitor Tier 2 and 3?

A ***Chuck Gameon***
Becky, I will address the free program--there is only one that I know of, Easy CBM. Easy to use--that's difficult as I think a number of them are easy to use, it's relative to training. It really comes down to choosing the one that will best meet the needs of your school in terms of usable foramative assessment data for problem solving.

Q ***Kate Gearon***
As you look at the RTI triangle, the smallest percentage of you class should be in the Tier 3 catagory. When working in a low performing building where the triangle is actually reversed (most students need Tier 3 supports), how do we adopt this RTI model with so many needy students?

A ***David Allsopp***
Kate, it is likely that if so many students are in need of Tier 3 level supports, then your school might need to critically evaluate what is being done at the Tier 1 and 2 levels. In other words, it could be that the core instruction is not meeting the needs of your students.

Q ***Ross***
What benchmark, progress monitoring tools, and interventions are currently used that prove to have an impact on student academic growth?

A ***Chuck Gameon***
There are a number of tools in this category that have had an impact on student growth. Visiting with other schools you will always find a program (or several) that work for their students. The goal is to find what works for your students. Benchmarking and progress monitoring tools can all be reviewed on the Internet. Again, find the assessment tool that works for you. Research-based interventions can be found at What Works Clearinghouse.

Q ***Sheila***
Can you talk about effective progress monitoring tools that have been developed for Math to be used within an RTI setting?

A ***Chuck Gameon***
Sheila, there are a number of different effective progress monitoring tools that are available and they aren't all the same. You decide which tool will measure what you want it to measure. The

A important piece to the progress monitoring tool is if it is giving you usable data in order to problem solve for your students. There is no single program that works for everyone as you are creating a system that will help your student population in your school. Effective progress monitoring tools are sensitive to student growth in relatively short periods, can be administered consistently and scored consistently by a variety of staff members, results are easy to understand, and it is not too costly. Some schools want to use a computer-based tool, others use a pencil paper tool. Use the progress monitoring tool that works to have a positive impact on student growth.

Additional Resources on RTINetwork.org

- RTI and Math Instruction, by, Amanda VanDerHeyden, Ph.D.
- Mathematics Intervention at the Secondary Prevention Level of a Multi-Tier Prevention System: Six Key Principles, by Lynn S. Fuchs, Ph.D.
- Video Podcast featuring David Allsopp: RTI and Improved Math Achievement

Additional Resources

- Allsopp, D.H., Alvarez McHatton, P., Ray, S.N.E., & Farmer, J. (2010). *Mathematics RTI: A Problem Solving Approach to Creating an Effective Model*. Horsham, PA: LRP Publications.
- Allsopp, D.H., Kyger, M.M., & Lovin, L. (2007). *Teaching Mathematics Meaningfully: Solutions for Reaching Struggling Learners*. Baltimore: Paul H. Brookes Publishing, Co.
- Doing What Works
- Gersten, Baker, & Chard (2006). "Effective Instructional Practices for Students with Difficulties in Mathematics: Findings from a Research Synthesis." Center on Instruction.
- MathVIDS
- Minskoff, E.H., Allsopp, D.H. (2003). *Academic success strategies for adolescents with learning disabilities & ADHD*. Baltimore: Paul H. Brookes Publishing Co.
- The National Center on Student Progress Monitoring
- National Council of Teachers of Mathematics
- What Works Clearinghouse