Making Fractions Make Sense: Considerations for Secondary and Intensive Intervention

Webinar Q&A

Question: How do we best meet the needs of learners who are still struggling with basic number sense concepts when trying to teach more complex skills, such as fractions? Where can we find resources related to basic facts?

Answer: There are several strategies for teaching students who are still struggling with basic number concepts, for example, offering students the opportunity to see fractions in multiple ways, such as concrete representation; building fluency for basic mathematics facts; and reviewing previous material.

We know that different students learn in different ways, and so providing students with the opportunity to receive information in multiple ways reaches them on many levels and may provide them with greater understanding of the material. Rather than teaching fractions as an abstract fact (talking about a half of a number), showing fractions as a concrete idea (such as half of a pizza) and using a number line can be very beneficial to students. During the webinar, Dr. Russell Gersten discussed the use of number lines for fractions instruction. Drs. Powell and Schumacher reiterated the importance of number lines in helping students understand fractions within Tier 2 or intensive intervention. It may be helpful to show the representation in more than one way. Mixing up the medium for teaching fractions challenges the student to focus on the conceptual idea of fractions, rather than simply associating certain shapes with fractions. For example, if you're working with fraction circles, give them larger circles or smaller circles or use a Geo Board so as also to get at an area model of fractions, enabling students to attach a meaning to what the manipulative represents.

Starting fraction lesson with brief reviews or games that involve number facts can help to reinforce basic skills and build fluency with mathematical facts. Building fluency can allow the student to advance to higher levels of mathematical concepts. Mastery of basic multiplication or division facts greatly assists more advanced mathematical skills; reviewing these facts before lessons can reinforce the lessons of the day. The review may consist of a quick warm-up activity or game, as discussed in the webinar. In addition to the Fraction Sample Lessons and Activities shared in the webinar, the National Center on Intensive Intervention (NCII) has developed sample lessons and activities related to counting and number systems (http://www.intensiveintervention.org/resources/sample-lessons-activities/mathematics) and will be supplementing with guides to support the development of basic skills when completed.

Question: How many lessons or days would you use to work with a student on a concept or vocabulary such as denominator equivalence?

Answer: When new terms are introduced, they should be introduced one day and then practiced again and again. For example, if a teacher introduced the word *denominator*, the teacher might use explicit instruction and write that word out where students can see it and provide a student-friendly definition that defines the term using mathematical concepts. Teachers may encourage students to write the new term or add it to a vocabulary word wall, or the teacher may introduce a way for students to remember new terms by using mnemonic devices. For example, with *denominator* they might say "remember the "D" nominator is to remember that the unit is how much the unit is "D" vided." The next day, when students come back into the class, the teacher would review the term that was taught in the previous lessons. Repetition of vocabulary and methods is crucial. Vocabulary implementation is best achieved through consistency. For example, calling a numerator a numerator reinforces mathematical connotations, unlike calling a numerator "the top number." Consistently linking mathematical terms to their mathematical concepts reinforces the concept and adds to the overall understanding for the student. This was illustrated through the Tier 2 program that Dr. Robin Schumacher shared.

Question: What are some suggested resources for virtual instructional settings and online school platforms?

Answer: Although we are not well versed in teaching fractions in virtual instructional settings, we would suggest doing a search for resources while keeping in mind the important factors shared by the presenters during the webinar to guide your search. These included using concrete, representational, and abstract examples and connecting the algorithm to fraction representations. To find virtual manipulatives, you may find it helpful to visit the National Library of Virtual Manipulatives (nlvm.org)

Question: How might interactive journals be used to supplement interventions: having students record their thinking (to the best of their ability) and using the journal as a study resource?

Answer: Interactive journals can serve as a means for students to demonstrate their mathematical thinking and methodologies in solving a problem (Kostos & Shin, 2010). Journaling is a tool used in the core curriculum that may be deepened during the intervention time. For example, the journal can be used within the intervention as a way to dig deeper into a variable that may have been discussed during the core mathematics instruction and provide an opportunity for an interventionist to have students elaborate their responses and clarify any misunderstandings. Mathematical communication will allow the interventionist to understand the thought processes of the student and craft a response that will clarify any aspects of the problem the student does not understand. By encouraging the correct use of mathematical vocabulary, students are more likely to understand a concept correctly when they are asked to record their explanation (Kostos & Shin, 2010). An interactive journal also may provide a tool that students can use for review.

Although an interactive journal may be helpful, many students have poor mathematical writing skills, and so keeping a journal will require explicit instruction in how to structure and respond. This may be a challenge for younger students and it may be necessary to begin with having them orally share their responses as they build.

For more information see

- Kostos, K., & Kim, E. (2010). Using math journals to enhance second graders' communication of mathematical thinking. *Early Childhood Education Journal, 38,* 223–231.

Question: How do you determine whether a student should be in Tier 2 or Tier 3? Is there an assessment(s) you would recommend to pinpoint student mathematics deficits?

Answer: Screening and progress monitoring data are used to support decisions about whether a student should be in Tier 2 or Tier 3. Students within intensive intervention or Tier 3 include those students who have not responded to a standardized intervention program at the Tier 2 level, students who present with very low achievement, or students with disabilities who do not meet their IEP goals. To learn more about looking at data and using progress monitoring data to understand students' response to interventions view our past webinars on academic progress monitoring (http://www.intensiveintervention.org/video-resource/using-academic-progress-monitoring-individualized-instructional-planning) and on using progress monitoring data to guide instructional decisions (http://www.intensiveintervention.org/video-resource/data-rich-information-poor-making-sense-progress-monitoring-data-guide-intervention).

Although we do not recommend or endorse any assessments to pinpoint student mathematics deficits, NCII has developed an academic progress monitoring tools chart that includes a number of mathematics progress monitoring tools. The chart is available here: http://www.intensiveintervention.org/chart/progress-monitoring. In addition, NCII has a training module that explores the use of informal diagnostic data to understand a student's skill deficits and target interventions to match the student's need. Parts 3 and 4 of the training module Informal Academic Diagnostic Assessment: Using Data to Guide Intensive Instruction provide information for miscue and skills analysis for mathematics (http://www.intensiveintervention.org/resource/informal-academic-diagnostic-assessment-using-data-guide-intensive-part-3-miscue-and-skills) and identifying target skills (http:/www.intensiveintervention.org/resource/informal-academic-diagnostic-assessment-using-data-guide-instruction-part-4-identifying).

Question: What are some research-based interventions that work for students receiving special education services, particularly those students with short-term or long-term memory processing issues and processing deficits in working memory?

Answer: Students with intensive needs frequently have issues with cognitive processes related to elements of executive function and self-regulation, including memory, attribution, attention, and strategies to set and monitor learning goals. Although some students with significant learning difficulties have underlying neurological or information-processing disorders, research does not support the notion that practitioners can identify these disorders (e.g., auditory processing disorders) and then treat them in isolation (e.g., training a child in auditory processing apart from his or her academic learning; Lyon, 1985; Mann, 1979; Vaughn, Wanzek, Murray, & Roberts, 2012). Instead, research that integrates understanding of executive functions with academic instruction has yielded the most positive benefits for students with intensive needs. That is, interventions need not prioritize cognitive processes before academic learning can occur. Rather, interventions should support both issues concurrently.

Students with memory processing deficits may have difficulty remembering content that was just covered, confusing multistep directions, following steps in a sequence or multistep mathematics problems, or failing to associate previous learning with new content. You may notice that students with memory processing challenges have low scores for digit span or other measures of working memory on cognitive assessments, frequently forget steps in a process or routine, or require more prompting than peers, need repeated presentation of new material in order to remember it, fail to recall information taught during the previous lesson, day, or week (in certain contexts), or get lost easily.

Strategies to support these students—such as helping students to develop organizational skills, using multiple methods for disseminating information, using consistent routines, and reviewing previous lessons before introducing new material—all contribute to the education of those with memory deficiencies. More information on this topic is available in the Designing and Delivering Intervention for Students With Severe and Persistent Academic Needs training module at http://www.intensiveintervention.org/resource/designing-and-delivering-intervention-students-severe-and-persistent-academic-needs-dbi. Practice 3, Combine Cognitive Processing Strategies With Academic Learning, includes a number of slides targeting strategies for supporting students with memory processing deficits. A webinar that includes additional content on this topic also is available at http://www.intensiveintervention.org/video-resource/so-what-do-i-do-now-strategies-intensifying-intervention-when-standard-approaches-d-0.

- Lyon, G. R. (1985). Neuropsychology and learning disabilities. Neurology and Neurosurgery, 5, 1–8.
- Mann, L. (1979). On the trail of process. New York, NY: Grune & Stratton.Vaughn, S., Wanzek, J., Murray, C. S., & Roberts, G. (2012). *Intensive interventions for students struggling in reading and mathematics: A practice guide.* Portsmouth, NH: RMC Research Corporation, Center on Instruction. Retrieved from http://www.centeroninstruction.org/files/Intensive%20Interventions%20for%20Students%20Struggling%20in%20Reading%20%26%20Math.pdf

Question: Where do you find or borrow the time from for Tier 2 or Tier 3 instruction?

Answer: Students with intensive needs often require much more practice, as many as 10–30 times in order to fully grasp concepts (Gersten et al., 2009). Increasing the amount of time a student spends in an intervention allows more instruction to occur, provides more practice with feedback (because the teacher is present), and increases students' engaged learning time, all of which can help to accelerate student learning. It is important to note that in order to achieve the greatest results, increasing the time should (in most cases) be combined with changes to content and method of delivery.

To achieve the amount of practice needed for students with more intensive needs, evidence suggests that students may benefit from 60 to 120 minutes of intervention per day. This may make scheduling intervention time difficult. Staff may consider breaking this time into more than one session during the day. For example, students might receive intervention for 20 minutes in the morning and 20 minutes in the afternoon, rather than a single 40-minute session (Gersten et al., 2009; Vaughn, Wanzek, Murray, & Roberts, 2012). Breaking interventions up into multiple sessions per day can help to address scheduling challenges, facilitate preteaching and

reinforcement of new concepts, and support young students who are likely to have shorter attention spans and less stamina than older students (Vaughn et al., 2012). The use of entry or exit routines also can provide independent or peer-mediated practice opportunities for students (e.g., mathematics facts practice, letter writing, and paired oral reading) that minimize unengaged waiting time and allow multiple small groups to run at once. Entry and exit routines that offer students opportunities to practice skills may allow interventionists to manage several overlapping small groups. In addition, incorporating these routines may reduce the amount of time students spend waiting and increase engagement.

Planning schedules prior to the school year that incorporate time for interventions, using time before or after school, or using elective periods have all been used by schools to ensure students have access to the interventions that they need. Additional information about schedules and ways elementary, middle, and high schools have thought about scheduling is available on the Center on Response to Intervention at American Institutes for Research website.

- Elementary School Scheduling Webinar: http://www.rti4success.org/video/rti-implementation-developing-effective-schedules-elementary-level
- Middle School Scheduling Brief: http://www.rti4success.org/sites/default/files/0681MS_RTI_Rescheduling_Brief_d2.pdf
  Middle School Scheduling Webinar: http://www.rti4success.org/video/rti-scheduling-processes-middle-schools
- High School Tiered Interventions Initiative document on lessons learned: http://www.rti4success.org/resource/tiered-interventions-high-schools-using-preliminary-lessons-learned-guide-ongoing

For more information, see the following:

- Gersten, R., Compton, D., Connor, C. M., Dimino, J., Santoro, L., Linan-Thompson, S., & Tilly, W. D. (2009). Assisting students struggling with reading: Response to Intervention and multi-tier intervention for reading in the primary grades. A practice guide (NCEE 2009-4045). Washington, D.C.: U.S. Department of Education, Institute of Education Sciences, National Center for Education Evaluation and Regional Assistance. Retrieved from http://ies.ed.gov/ncee/wwc/PracticeGuide.aspx?sid=3
- Vaughn, S., Wanzek, J., Murray, C. S., & Roberts, G. (2012). *Intensive interventions for students struggling in reading and mathematics: A practice guide.* Portsmouth, NH: RMC Research Corporation, Center on Instruction. Retrieved from http://www.centeroninstruction.org/files/Intensive%20Interventions%20for%20Students%20Struggling%20in%20Reading%20%26%20Math.pdf

Question: If you had a short time to work with a student (for example, in a tutoring situation) would you recommend just focusing on the conceptual understanding, or would it be important to also link it to the algorithms?

Answer: The research on this (especially research using the Clinical Research Associate model) indicates that students need a combination of the conceptual and procedural. Linking the

algorithm (or abstract) with the concept reinforces the overall lesson that is being taught. For some students, this may mean starting with the conceptual and moving to procedural; for other students, it may be the reverse. It is likely best to combine these approaches. So, if you're using manipulatives to discuss fraction concepts, continually refer to the abstract form of the fraction (e.g., 3/4). As you start to teach algorithms (e.g., finding common denominators), teach the steps and then use manipulatives to validate why this works. This lesson must be relayed explicitly. Some students understand lessons easily, but for others who do not understand as quickly, relating the conceptual and procedural can greatly improve understanding.

Question: What strategies are most effective in supporting English language learners (ELLs) to develop skill mastery of fractions?

Answer: Though not written specifically for ELLs, a lot of the strategies in NCII's fraction resource (e.g., http://www.intensiveintervention.org/sites/default/files/Fractions%20as%20Numbers_Combined%20Document.pdf) also will be helpful for ELLs. Since ELLs are acquiring English simultaneously with instruction, many ELLs benefit from some nonlinguistic support and active engagement with the concepts, such as using everyday objects, multimedia, demonstrations, captioned videos, visuals, sentence frames, actions, hands-on work, and peer-to-peer learning. Another resource that may be helpful to explore is a website at Stanford University geared for meeting the needs of ELLs in the Common Core State Standards. On the site there is an entire section devoted to mathematics http://ell.stanford.edu/teaching_resources/math (Understanding Language at Stanford University). Finally, the recent Institute of Education Sciences practice guide on teaching content and literacy to ELLs might be a useful resource. Because ELLs are acquiring English, many also benefit from some literacy instruction within the content area. As discussed in previous questions, focusing on vocabulary and helping to foster mathematics academic conversations (like providing sentence frames) can be helpful, and these are touched on in this guide: http://ies.ed.gov/ncee/wwc/PracticeGuide.aspx?sid=19.