Webinar Transcript

Assisting Students Struggling with Mathematics: What Works for Tiered Interventions in Elementary and Middle Schools

STEPHANY BROWN:

[AUDIO BEGINS] works for tiered interventions in elementary and middle school.

I welcome you to today's online seminar.

I'll begin with an overview of the webinar goals and objectives, today's agenda, and a little information about the Regional Educational Laboratories serving in the central region, who is sponsoring today's webinar. And then we'll introduce the presenters.

When you entered the seminar today, your audio was muted due to the number of participants. However, as Joe mentioned, you do have access to the chat box, which you can use to ask questions anytime during the webinar. The facilitator and panelists will see the questions, and will have several minutes at the end of the webinar for responses.

The online seminar will be recorded, and will be posted within the next few days to the Institute of Education Sciences' YouTube site. A link to the site will be provided at the end of this webinar.

So our goals and objectives for today's session are to increase understanding of research-based strategies, to improve mathematics instruction for struggling students, and to acquire a greater understanding of available resources and actionable knowledge that can be effectively implemented to meet the needs of students who struggle in mathematics.

Our agenda today features Dr. Russell Gersten providing an introduction to the IES practice guide, Assisting Students Struggling with Mathematics, our participant activity, discussion of fractions intervention by Robin Schumacher, and Introduction to Data-Based Instruction and the National Center on Intensive Intervention. And again, several minutes at the end for questions.

If you post your questions during the webinar, we will capture some of those and be able to answer them at the end. And then we'll also provide the information on participant contacts if you have any additional questions.

The Regional Educational Laboratories, or REL, work in partnership with educators and policymakers to develop and use research that improves academic outcomes for students. The 10 Regional Educational Laboratories work in partnership to conduct applied research and training with a mission of supporting a more evidence-based education system.

REL Central at Marzano Research serves the applied education research needs of Colorado, Kansas, Missouri, Nebraska, North Dakota, South Dakota, and Wyoming.

We welcome our colleagues from the REL Central states, along with everyone from other REL regions and states to today's webinar.

Our presenters today our Dr. Russell Gersten and Dr. Robin Schumacher.

Dr. Gersten is the executive director of the Instructional Research Group in Los Alamitos, California, professor emeritus in the College of Education at the University of Oregon, and a subcontractor for the Regional Educational Lab Southeast. He served as the chair of the panel that developed the What Works Clearinghouse practice guide that is being discussed in this webinar. Dr. Gersten has authored the book Understanding RTI in Mathematics, as well as multiple chapters in books on mathematics screening efforts and conducting rigorous group studies.

Dr. Robin Schumacher is a research associate with the Instructional Research Group, and currently manages an NSF grant investigating a fractions intervention for struggling mathematics students. She has coordinated several other large scale research studies funded by IES and NIH, all focused on increasing outcomes in mathematics. Dr. Schumacher has written on topics related to fractions intervention, intensifying instruction for low performers, and analyzing error patterns in mathematics, and has authored multiple articles in peer-reviewed journals.

Welcome, Dr. Gersten and Dr. Schumacher.

And Dr. Gersten, the panel is yours now.

And Dr. Gersten, if your phone is on muted, please--

RUSSELL GERSTEN:

Oh, I'm sorry. I'm very sorry about that.

Yeah, OK.

Good afternoon.

STEPHANY BROWN:

We can hear.

RUSSELL GERSTEN:

Yeah. Can you hear me now? Correct?

I'm Russell Gersten, and I'm going to quickly begin by introducing the practice guide and who helped create it. It was done a decade ago, when RTI in math was new and rarely implemented. I'm going to, at the end, give a quick update on some of the research since then. But in my

view— and I think a belief of some of the leadership at IES is— an update of a guide like this would be a nice project to begin in the near future.

In any case, I chaired it. We have, intentionally, a research mathematician, Sybilla Beckmann, whose text is used heavily in pre-service training courses. On the group, we had two folks with more of a school of psychology background, Ben Clarke and Anne Foegen, who knew a lot about screening progress monitoring; Laurel Marsh, who was then a math specialist, beginning some implementation of interventions for kids struggling in math, and is now an assistant principal or principal; Jon Star is more of a cognitive psychologist; and Brad Witzel, who had done some pioneering work, really, in algebra instruction for kids with learning problems.

What we tried to do here— and given the fact that 10 years ago, when the panel met and we did the research searches, there was not a lot out there on RTI in math, there was not a lot going on, we had to borrow pretty extensively from the special ed research at that point. Because that was pretty much all that there was. So our goal was to take all of this and figure out what can we create that's practical and coherent.

And these guides are downloadable for free. And Stephany can talk a little about that at the end, and how they may be used.

But basically, the idea was to try to make in clear, comprehensible language, ways to improve practice in this kind of neglected area, helping kids who struggle in math, before teachers or parents consider an actual special education possible placement.

So we wanted things that were not crazy, but that took some risks, that didn't have the typical thing that we read and hear about— I just came from a conference where— on the other hand, we can overgeneralize from this one study in whatever.

We were encouraged to take some risks. And most importantly, to develop something that was coherent. Because I think all of us have read literature reviews where there were all these things in there, but you don't really know how to fit and how to get a hold of what they're trying to say about improving teaching, or improving those folks who supervise or train interventionists to improve intervention instruction.

This document has been pretty consistently, over the past decade, the most frequently downloaded document from IES, which is the research branch of the Department of ED. And that's how to download it. And you can— what I usually do is just Google RTI practice guide in math, and you get it.

What each of these guys have— and I imagine quite a few of you are familiar with them in some area or other— is specific recommendations, and then some how-to steps, or just action steps, and levels of evidence. And this took a lot of work of us. And this was one of the early half dozen to figure out how to give relatively clear, sensible information on the level of evidence.

And we also talked about roadblocks, because anything you do in any field, any walk of life, you run into roadblocks— some ways how to overcome them.

The levels of evidence at that point-- and they really have not dramatically changed— were strong, meaning there were at least three high-quality, rigorous studies that met really rigorous standards that IES initiated 15 years ago when Congress decided it'd need to radically change the nature of educational research so that it had the rigor of many other fields like engineering, public health, economics, workforce studies, etc.

Moderate means there's one or two studies suggesting that this is a good way to go, but we're not totally sure.

Minimal means the panel thought it was a good idea, they'd maybe seen anecdotal evidence of it being effective, but there is no hardcore, rigorous evidence.

Now, in some cases, people believe more strongly in the minimals than they did in the strong. But we wanted this to infuse principles of the scientific method and rigor.

And this is a quick overview of the eight recommendations we made. And these are quite truncated, but you can download the practice guide. Some of you, in advance, have maybe taken a look at it and all. And what I used to do is walk through all eight of these. And then I realized I was starting to get bored by the time I got to about number four, and thought, if I'm getting bored, what about the folks out there.

So we've arranged for more either interactive— well, some level interactive way to do this. And what we've done is split them in two. And what I'm asking you to do is to look at each set of four— and many of you may be watching this together with colleagues, you can have a little bit of time to chat with your colleagues about them— and then we'll poll you and see which is the most surprising.

So I'm going to turn things over now to Joe, who's going to oversee this polling process. But essentially, the idea is to look at the first four, see which surprises you the most. OK, Joe?

JOSEPH BOVEN:

Indeed.

Here is the question. Which levels of evidence are most surprising? Please choose one from each group.

And I believe you'll now see the poll. And just go ahead and click on which one you think is the most surprising when you've come to a conclusion.

RUSSELL GERSTEN:

And remember, the one minimal one here— I don't know, Joe, if we can go— well, we probably shouldn't go back. But the one with minimal evidence is that the core should be instruction in

number, basically— whole numbers more or less. You can see that here, that that had minimal evidence. And screening was moderate, the other two strong.

Yeah. That's perfect.

JOSEPH BOVEN:

All right. People are still polling.

All right. It looks like everybody has chosen one. I'm going to go ahead and end the polling.

And here are the results.

RUSSELL GERSTEN:

So I'll talk these through and get a little context. Then if questions come up, please enter them in the chat area. And at the end, Stephany will go through those and ask me and my colleague those that can fit into this eight or so minutes.

It seemed like you were surprised about the importance, as we could imagine, of using word problems. And one issue that we felt very strongly about, we didn't have a lot of hard evidence on, is integrating word problems with computation work— be it with fractions, decimals, whole numbers, geometry, et cetera— doing more what Singapore, Korea, and hopefully, increasingly, as some American texts are doing to integrate them. And the idea that instruction needs to be systematic and kids need adequate practice and feedback surprised you.

Focusing heavily on number, that was an idea that was pushed— it was pushed very hard by the National Math Panel, which I also served on and chaired— the Instructional Practices Committee— it was pushed very hard in that period about 10 years ago. The idea being that in these earlier grades, if kids don't— and Sybilla, the research mathematician, said if kids don't understand number, especially rational number, the whole idea of geometry, which relies so heavily on proportionality and visualizing relationships among and between numbers— it's not going to sink in. It's not going to be meaningful. It's not going to be understood.

So that's why we focused so heavily on math. And there is an evidence update, which I'll share with you in a few moments. But at that point, it was simply a belief.

Universal screening— I'd be curious why people were surprised. But I think when we looked at the realities of the evidence on the screeners and how well they did, it was pretty good. It wasn't great— could be better, we think. Maybe there'll be newer ones out— I haven't necessarily seen them— that may do better. They tend to very often be time measures, looking at just one dimension of the numbers.

It seemed an important thing to do, but something that the evidence— it would be nice if there were measures that were better at predicting who might need help, and especially— what the tendency is for young students, especially— is to say these kids require intervention when studies have shown many of them would do fine without it.

So that's a little feel for the evidence for these. And let's do the same with the second set, Joe.

JOSEPH BOVEN:

Great. So here is your second set. Did you want to talk these through?

RUSSELL GERSTEN:

This is the first set again.

JOSEPH BOVEN:

Whoops, I'm sorry. Sorry about that.

RUSSELL GERSTEN:

Yeah.

So quickly, this is cryptic, but it's really stressed that kids use both concrete objects but semi-concrete, or visual representations, like tape diagrams, strip diagrams, and various other visuals to reinforce things. Fluency— I think the others are pretty self-explanatory.

So again, in the poll, which is the biggest surprise?

JOSEPH BOVEN:

All right. The polling is up.

All right. I'll give it a couple more seconds here. I saw a couple stragglers coming in.

All right. Closing the polling, and here are the results.

RUSSELL GERSTEN:

These usually are big winners, the two that came in the highest.

Progress monitoring— beginning when MTSS or RTI was implemented, progress monitoring was stressed extremely heavily. This is the reason why the level of evidence was minimal at that time and still probably is minimal. It may get into that moderate category, but not really.

Almost every study we read, and reviewed, and re-read, and looked into every detail, and sometimes inquired by the researchers what really happened when it was unclear— they did not do the progress monitoring that many of you are familiar with from AIMSweb, STAR, DIBELS Math, easyCBM. That's not what they did. Those measures, which tend to have better psychometric properties, tend to look at the big picture, be based on the year's objectives, or sometimes the semester's objectives.

Or, sometimes, even a test like STAR, or some of the math measures, go include material from lower grades and upper grades, but they tend to be big picture measures. And they tend to do a better job at correlating with various state assessments or other standardized tests.

What they did in these studies was either very often daily, but if not, weekly— is the kind of probes or quizzes that people have been doing in math since time immemorial— and in special education type interventions, and often in Title I interventions for about 50 years— that they did daily, that kids mastered this material, or do I need to spend more time on it during our next lesson tomorrow or the day after.

So there was no evidence that this was— people who did not give an AIMSweb or DIBELS or anything, they had the kids for four months— no evidence that there was any change, you know, due to this. So the kids did fine when they had the visual representations, and the explicitness, and the systems. So that's the reason for that motivation. It was upsetting many.

We looked at the National Math Panel, and they said motivation is very important. And they cited the work of Carol Dweck and others, but none of it was in math— not zero rigorous studies in math. So it's something to think about. It does seem to be key, as well as ways of moderating— basically, helping kids focus, ways to help kids increase the amount of time they persist and attend with tasks. But it has not really been studied in math.

Now, I don't know if this guide were updated. There may be some new studies. I hope there would be.

So that is the reason there.

I do want to say this. One thing that we have experienced— and Robin might be able to talk better about this firsthand from our research— is you don't necessarily want to overdo this constant praise, which goes back historically of praising everything positive. Because more contemporary techniques that really try to build a sense of self-regulation, or now called executive function— that kids develop inner motivation seems important.

So it definitely seems important, but minimal evidence, unfortunately.

And I just have one more slide before I turn things over, which is more or less on time. So, Joe, maybe it might be as easy for you to just click onto the next slide.

The only real update of the evidence is— and this is really quick— it needs to be done more exhaustively. This is just me, informally— that the evidence of the importance of teaching number— now, notice I didn't say not to also spend time on data science, statistics, which is increasingly stressed, especially in an upper elementary and middle schools— but a lot of time on number and making sure kids understand numbers.

It's not so important that kids— and you'll notice in most contemporary state standards, if not all, that some of the problems we did when we were younger about converting 9/51 into 17ths, and a lot of these more obscure fractions, are probably unnecessary. But understanding fractions, that we're doing things with fractions, even if an instruction involves primarily— and Robin will give some examples— halves, quarters, thirds, fifths, 10ths, and lead into then decimals as a tool for computation— but understanding number, and especially using the number line. And you will get that a lot more in-depth.

But there have now been about a half dozen studies. Robin's been involved in almost all of them, so it seems perfect time to turn things over to Robin.

ROBIN SCHUMACHER:

Okay, so just to revisit the eight recommendations that we polled on and discussed— and that Russell gave such a nice overview for— today, because of the reasons he stated earlier, really want to highlight two, three, and five. And I bring up two again mainly because that recommendation of the way that whole numbers and rational numbers were divided with K-5 and 6-8— now with the more contemporary state standards, rational numbers is really also becoming more included in grades 4 and 5 as well.

And so some of the material I'm going to talk about today are two separate fractions intervention programs that focus on grades 4 and 5. And we're also going to look at some systematic construction in terms of the design of building skills within fractions within an intervention, and then the use of visual representations within that. So those are really the three recommendations that I'm going to focus on for a few minutes.

So I'm unable to advance my side. There we go. OK.

So the two fractions interventions that I'm going to speak about, the first one is called Fraction Face-Off! And it was researched over five iterative years in a study— a fraction center funded by IES. And that was a focus primarily on fourth grade. And then TransMath is a curriculum that includes many content areas, but the approach to teaching fractions is really wonderful. And it spans fourth, fifth, sixth, through middle school, but the fraction material that I'm going to talk about today is levelled for fifth grade.

So some of the big ideas within Fraction Face-Off! is to build understanding of a fraction as one number, so really helping students internalize that a fraction is its own number with one magnitude rather than two separate whole numbers. And the approach that was taken in this program is the use of linear representations as a primary focus, which builds on the measurement interpretation of fractions, and that they are all a distance from zero on a number line or a ruler.

Fraction tiles were used as a concrete visual representation, as a way to transition from something that can be manipulated with hands and seen 3D to number lines that are represented, 2D, on papers. And really, linking those helps to build students' magnitude understanding and to help form some abilities to reason about the size of fractions with a focus on benchmark numbers.

A more secondary focus was looking at part-whole understanding, which is really the more traditional way of introducing fractions to young students, often talked about in the form of how many slices of pizza. And that's really been the hallmark of fraction instruction across the US for many years, whereas Asian countries and Asian curricula really stress the measurement interpretation and number lines.

So in terms of thinking about systematic construction and visual representations, the Fraction Face-Off! intervention started off with having number line representations, building on unit fractions, and adding unit fractions together to end up with fractions that have numerators larger than one, and connecting the different representations together, marking fractions on the number line.

So you can see how the visuals here link the understandings together to various computations. So showing the 1/8 plus 1/8 plus 1/8 equals 5/8 can be shown using the number line and moving across. Or, those different fractions are each added, and then tying it into the part-whole understanding— so really, linking part-whole and measurement.

And so this was how fractions began to be introduced in the program. And then moving toward understanding magnitude through comparing two fractions using inequality symbols or the equal sign, and also ordering fractions from smallest to largest or least to greatest. And in terms of thinking about this the systematic instruction, this was sequenced intentionally to start off with two fractions of comparison, then moving to three fractions that would be compared, and integrating similar thinking strategies for solving these problems.

So students learned about when fractions have the same denominators, and how you might think about those fractions first to evaluate magnitude, and then fractions with the same denominators, and then how to use 1/2 as a benchmark number.

And so you can see on those cards on the right side, it goes through the steps more clearly and more step-by-step. But that's essentially the process, is moving towards benchmark numbers, and then other methods for evaluating magnitude without doing cross multiplying, which is the way that I was taught in elementary school, and I know is still sometimes included. But that then precludes students from having to understand the magnitude of a fraction.

So then, to extend on that, number lines are continued to be used, not just as a representational tool but as a way to compare two or more fractions' magnitude, and really build on the magnitude understanding. So number lines are taught next, first with zero to one number lines, then with zero to two, and again, building on the idea of magnitude very intentionally and sequentially while including these visuals.

Then, after all three skills are taught, there's time devoted intentionally about building management understanding and how all three of these activities are essentially doing the same thing. The students are thinking about how big or small their magnitude is to try to order them, place them on the number line, or compare two fractions. And so this tying in together is also very intentional in pulling all of those understandings together.

So this study was researched over five years. This is results from three years. All the results that are grouped together, I didn't have all in one place.

So these are effect sizes for comparing fractions. 1.82 is quite large. An effect size of 0.8 is considered large, so a 1.8 was a very impressive effect size between students who received intervention and those that did not. 1.14 was for students' ability to estimate fractions on a

number line. The 0.94 was on an assessment of released NAEP items. And then the 2.51 was on a procedural calculations measure that looked at addition and subtraction. Again, this was for fourth grade.

So then, I'm now going to transition to TransMath. It also introduces things very systematically and with intention, and relies on visuals. That number line is also very, very much highlighted and centralized in this curriculum, and so are Cuisenaire rods, which are different than fraction tiles. You can see them on the right side of your screen there. They are wooden bars of different and increasing sizes so that different fractions can be represented with various colors representing the unit or the whole, and so different comparisons can be made in that way.

And so here you can see on the number line, as a tie in to the Fraction Face-Off! program, they used thinking about relative size as an approach for comparing fraction magnitude, or assessing fraction magnitude rather. So a fraction of 2/3 would be closer to 1, because the 2 is relatively large compared to 3, whereas 1/5 is closer to 0, because the 1 in the numerator— 1 part is relatively small compared to the denominator at 5.

And then building on number lines, TransMath uses them to teach all four operations. And because I'm focusing on fifth grade, we, I also included a whole number times a fraction, and a whole number divided by a fraction— how the number line can be used there.

So you can see addition, starting with the first fraction, moving to the right. And then with subtraction, similar procedures starting with the first number in the equation, and then moving toward the left. And these can also be used when fractions have different denominators. There's just the extra step within showing on the number line what an equivalent fraction with that denominator would look like.

And then you can see with the multiplication and division, when you're multiplying 3 times 2/5, students learn that it's similar, three groups of 2/5, and so moving on the number line that way. And then similar with division, if you start with 3 and you divide into 1/2, you have 6 as your answer.

So that was just a quick overview of different curriculum that really systematically presents information and builds sequentially in a smart way so that students can connect ideas, and then also uses visuals in a nice, smart, mathematically correct way.

And so what we're going to do next is view a video that— it's a short clip. And what I want you to think about and look for during the video is about foundational skills, and whether or not those were included, and if there was anything else regarding the design or explicit instruction that you noticed or want to comment on.

One thing that I forgot to highlight as I was talking is part of the systematic instruction in both of those programs is that foundational skills were included throughout as needed to build new understandings, and to remind students about why multiplication and basic facts might be important for finding equivalent fractions. And so earlier skills are embedded to help students have access to later skills.

So with that, move to the video, and I'll release control.

[VIDEO PLAYBACK]

TEACHER:
2/3 minus 1 times- Does everybody see mine?

[INTERPOSING VOICES]

TEACHER:
Everyone should write on their boards.

STUDENT:
Are we doing the boxing thing?

TEACHER:
So we're subtracting. So would we draw boxes in subtracting?

STUDENT:
Oh, no.

TEACHER:
No. Instead we followed other steps with making sure that what are the same?

STUDENT:
Denominators.

TEACHER:
Good. Denominators have to be the same when you add or subtract. Does that matter with multiplication?

STUDENT:
No.

TEACHER:
No.

TEACHER:
Okay. So let's look here. We have 2/3 minus 1/2. Are these denominators the same?

STUDENT:
No.

STUDENT:
No.

TEACHER:
No. OK. So when you see that the denominators are not the same, what should you do? Marley.

STUDENT (MARLEY):
You should find out each factors.

TEACHER:
OK. So factors is what we use when we're simplifying. So instead, we need--

STUDENTS:
Multiples. Multiples.

TEACHERS:
Multiples.

STUDENT:
I was going to say that.

TEACHER:
Okay. So 2 and 3. So the first thing that we would always do is look at the smaller denominator-- which is?

STUDENT:
2.

STUDENT:
2.

TEACHER:
2. And is 3 a multiple of 2?

STUDENT:
Yes.

STUDENT:
No

STUDENT:
No.

STUDENT:
No.

TEACHER:
No, it's not. Because you can't mult--

STUDENT:
[INAUDIBLE]

TEACHER:
OK. Just a second. You can't multiply 2 by any number and get 3— by any whole number, I should say, to get 3.

So instead we have to change both of these fractions, right?

STUDENTS:
Yes.

TEACHER:
OK. So we need to figure out what the least common multiple is for 2 and for 3.

And Dawson had his hand up. What do you think it is?

STUDENT (DAWSON):
I think it's 1.

TEACHER:
You think it's 1? Could we change 1/2 to be an equivalent fraction with 1 in the denominator?

STUDENT (DAWSON):
Well, wait. 1/2, that would be [INAUDIBLE].

TEACHER:
Then they wouldn't be equivalent, would they?

STUDENT (DAWSON):
No.

TEACHER:
No. OK. So we need the least common multiple. Remember the multiples for 2— 2, 4, 6, 8, 10. Let's list multiples for 3.

STUDENTS:
3, 6.

STUDENT:
JJ, stop

TEACHER:
9.

STUDENT:
[INAUDIBLE]

STUDENTS:
9, 12.

TEACHER:
So which is the least common multiple?

STUDENTS:
6.

TEACHER:
Very good. So what we need to do is rewrite each of these fractions with 6 in the denominator.

STUDENT:
I already knew this.

TEACHER:
You're making it harder than it needs to be, huh? OK. So what number times 3 gives us 6?

STUDENT:
2.

TEACHER:

So 2 is the factor we're going to use for 2/3. So what is our new numerator for 2/3?

STUDENT:
1.

TEACHER:
Who said that?

STUDENT:
I did.

TEACHER:
Can you say it again?

STUDENT:

1.

TEACHER:
Dawson, please talk normally. It's 4.

STUDENT:
4.

TEACHER:
It is 4. Because 2 times 3, we move down to the 6. 2 times 2 is 4. OK?

What fraction is equivalent to 1/2 with 6 in the denominator? What factor do we need here, Willow?

STUDENT:
Oh, 3.

TEACHER:
So what is our new numerator?

STUDENT:
3.

STUDENT:
I know it, 3.

TEACHER:
3, because 1 times 3 is 3. So what is the new problem that we have here? Marley?

STUDENT:
(MARLEY) 1/6.

TEACHER:
That's the answer. What's the problem?

[INTERPOSING VOICES]

STUDENT:
4/6 minus 3/6 equals 1/6.

TEACHER:
Good. So you were right, Marley. 1/6 is the answer. But the new problem is 4/6 minus 3/6. OK? So I want to--

[END PLAYBACK]

ROBIN SCHUMACHER:

OK. So we've seen the case study. If you have any questions specifically about the case study, you can pose them in the chat box. And the questions that I had posed before were thinking about which foundational skills might have needed to be reviewed or included, or was there anything else about the instruction that you noticed. So, we can wait and hold some of these video questions for the end as well, because I want to be sure to get through the rest of the slides before we have time for questions.

So one thing I want to mention is that both of the programs, Fraction Face-Off! and TransMath, include ongoing cumulative review. It's not sporadic and short-lived but included throughout lessons— sometimes just briefly, but usually included, as you saw in the video, with reviewing least common multiples for the students when it was relevant.

Also a key element of including cumulative review in a smart way is having problems embedded that caused students to discriminate between problem types and procedures. So to keep from doing multiplication of fractions over and over and over, and then have students forget about procedures for subtraction is one reason to keep all the different types of problems that have been taught included so that students learn that discrimination.

Also, all of them include very systematic learning progressions, as I went over, and have foundational skills to support grade level content like the multiplication facts for common multiples.

So also both programs offer the opportunity to give immediate feedback, which is more attainable in a small group intervention setting than it is in a large group intervention setting. But it's also extremely important because teachers are then able to eliminate false assumptions or other overgeneralizations before students become ingrained in thinking of them that way, which could potentially lead to longer inaccurate understandings.

Also, both programs are linked to the grade level standards. So Fraction Face-Off! was teaching fourth grade material. The material that I showed you from TransMath was fifth grade. However, they also include other time devoted to difficult essential concepts more often than is typical.

So other features of both, going back to the eight recommendations, both programs do also include word problem instruction. Fraction Face-Off! also includes embedded motivational systems. So Russell mentioned that that goes beyond praise. The motivation system that's included in Fraction Face-Off! includes trying to solve problems correctly and thinking about how many they solved to get better and improve each time they solve problems— so a self-regulation type of activity. And students are also motivated with a activity by staying on task and being focused.

What the programs are missing, as far as the eight recommendations go, is a progress monitoring tool and built in individualized components, which leads me to give a quick overview of the National Center on Intensive Intervention— NCII. Many and most of their materials, in fact, maybe all of their materials, are publicly available. They focus on databased individualization. And a lot of their resources talk about how that can really be a key for some students to progress to the next level of learning. They have a lot of resources.

This is their primary website.

They have a large focus on intensifying instruction and using progress monitoring. Their databased individualization framework looks like this, in that students start with a validated intervention program at Tier 2, are progress-monitored, and then might— if they're not

responsive— then might look at more diagnostic or academic assessments or a functional assessment, adapting intervention, continuing to monitor progress, and going through to try and get learning to accelerate.

So, these are also some extra links for mathematics resources that are free to you and anybody, available from NCII. So some cover counting basic facts, place value, and computation. Others look at college and career readiness standards with math instructional guides.

There's also specific resources for progress monitoring, diagnostic assessment, for planning intervention, and then also intervention design, and then also math interventions, and assessment tools for progress monitoring, and for screening.

So, I think I got us for 10 minutes of questions. I'm going to hand it back to Stephany to pose some questions for Russell and I to answer.

STEPHANY BROWN:

Great. Thank you so much, Russell and Robin, for a great presentation.

We have a couple of questions.

First is, going back to the practice guide, one participant asked, we were surprised by the whole number and rational because it had minimal evidence. We thought it would be strong. Can you give an explanation for this?

RUSSELL GERSTEN:

I can do that, because I was hoping to. I think there are two problems. One is that— maybe a major one is— not many studies or researchers think about comparing, let's say, a fifth grade curriculum or an intervention that focuses primarily on rational number and whole number like most state standards to do, versus one that covered a wide array of things including geometry, and measurement, and some data and probability, which would then be less intense on real— so in-depth understanding of rational number that Robin's two curricula had.

So as I say that, I think it would be a quite important study to do for that reason, that it's a critical issue. It's a common belief. And so it's good to have evidence to support belief. And there are a lot of intervention programs that are linked to— I know big programs are GO Math! in the elementary grades, and Everyday Math is big. And to compare those intervention programs, which tend to cover whatever is done that week, provide support in the week's topic for the fourth or fifth graders, versus something that really hones in on rational and whole number concepts, and use of the number line— it would be a good study to do.

Who knows? It's for another generation of researchers.

So it's just lack of hard evidence. So I was surprised, too.

But I will say this, that the big belief, going back to something like the '90s, was that math curricula should show that number quantity, geometric concepts, are all around life. They're in

our everyday experiences, and what you learn in your science courses related to astronomy, physics, biology.

So that idea is quite different than what we see in other curricula, where there really is-- no one says that isn't true, and that it's a great way to augment your curriculum. But the key thing, especially in intervention, is making sure kids really understand what equivalence is, that it's not something that you focus on for two or three weeks, and then you drop, and then you come back to it when you do adding factions, the parts of adding fractions, but then other times you ignore it when you're doing multiplication. That's really what you need to understand in grades 3, 4, 5.

So I think it will be a good study to do. They haven't really been done.

STEPHANY BROWN:

Great. Another question was, in regard to the motivational strategies, what about Jo Boaler's work— if I'm pronouncing that correctly. It seems that she's done a great deal of work on mindsets.

RUSSELL GERSTEN:

I think what we did— and it's not just our particular panel, Institute of Education Sciences does— is try to differentiate between rigorous experimental research, where we control for confounding factors, and other kinds of observational work, case study work, for actual hard evidence to rely on the latter, on the rigorous studies.

I believe a lot of Dr. Boaler's work has been more in the qualitative case study mode. I know she had done one quantitative evaluation. I'm not familiar with all the details. But that certainly would have been eligible for review. And if it didn't pass the standards, I'm not sure.

So people are definitely working, exploring. There's a lot of scholarship on mindset and motivation. But we really— we're looking for controlled studies that showed if you had a kind of motivational system in place and compared it to just more traditional teaching where every so often you may praise a child, or challenge a child, is it effective. We did not find such studies.

STEPHANY BROWN:

And there was a little confusion about the strategies that were shown to have minimal evidence. Do you still suggest these strategies as ones that should be used?

RUSSELL GERSTEN:

I think the answer is yes. And that comes up every time. And I've presented on practice guides and RTI in reading and English learners, and a little on algebra as well. Yeah, the panel did believe these were important. It's just there was no evidence as of, in this case, 2008. And as time goes by, they do need to be updated, especially in an area where there is— so much research has been conducted in the past decade.

So the answer is yes. We do believe them. But you do have to be aware that people— expert opinion has been wrong on everything from the rotation of the Earth to a thousand other things to Newton's laws, which are not scientifically valid. So we need to keep that in mind. But we do recommend those as practices, still.

STEPHANY BROWN:

And one last question. Marjorie Petit has some valuable insights for all of us around whole number reasoning applied inappropriately. Can you speak about the impact of this issue for struggling learners when fractions, 2/3 for example, are portrayed as two sticks or marks on top of a horizontal bar over three or marks under the bar? Do these programs use this way of portraying fractions?

ROBIN SCHUMACHER:

Do you want me to take that one, Russell?

RUSSELL GERSTEN:

Yes. Yes, Robin, that's you.

ROBIN SCHUMACHER:

OK. The programs do not portray them with two sticks over three sticks with 2/3. And there is, in both programs, a large focus on a fraction being one number and not two separate whole numbers.

So I've read several articles about whole number bias. I think it's another— is a term I've seen often used for whole number reasoning applied inappropriately. And so speaking to that a little bit, part of why many mathematicians believe that the number line is a superior way to represent fractions is that it helps students consolidate and integrate the whole number principles and understandings with rational number principles and understandings. Because it's really the best representation where you can include both of those kinds of numbers, and really start to integrate and consolidate rational numbers being part— you know, especially between zero and one, and then moving to fractions that have quantities larger than one involved— part of why the measurement understanding is becoming more emphasized in many curricula now.

So to answer your big question, no, the sticks are not used in these program at all— and in fact, really try to build the understanding of them being one number and the relationship between the numerator and denominator as determining magnitude.

STEPHANY BROWN:

Great. We had a couple more comments come in on Dr. Boaler's work, but we will forward those to the panelists, since we need to close out our webinar. But thank you all for those questions. We really appreciate it.

These are just some additional references on today's topic. Somebody asked if a copy of the PowerPoint will be available. And yes, it will be.

I will show that in just a minute. But wanted to thank you all for your time today, and really thank Russell and Robin for a great session, and you all as participants for joining us for this webinar focused on Assisting Students Struggling with Mathematics: What Works for Tiered Interventions in Elementary and Middle Schools.

This is the contact information for our presenters, in case you would like to get in touch with them with any additional questions or for more information on the work that they've done.

And this gives some information on the PowerPoint presentation materials, where they'll be available. There will be an archive. The recording of this will be posted on the Institute of Education Sciences' YouTube channel. And you can also follow our website, or follow REL Central on Twitter, for more information about our events and to access many of our free resources.

So thank you again, everyone, for participating. And we hope you have a great day.

ROBIN SCHUMACHER:

Thank you.