# Making Fractions Make Sense: Considerations for Secondary and Intensive Intervention

## Webinar Transcript

**Moderator:** Okay, well we'll go ahead and just start. Welcome everybody to our Webinar today, which is titled Making Fractions Make Sense: Considerations for Secondary and Intensive Interventions. My name is Neo Gebru and I will be facilitating this Webinar. Our panelists today are Doctor Russell Gersten, Doctor Robin Schumacher and Doctor Sarah Powell.

**[Slide 2 – Welcome]:** This Webinar is being brought to you by the National Center on Intensive Intervention and the new National Center for Systemic Improvement.

Before we get started I would like to make you aware of a few things.

**[Slide 3 – A Note about Questions]:** First, audio from this Webinar is being streamed through your computer and your sound has been muted. If you have a technical question regarding sound or the Center in general please type it into the chat box. We ask that you use the Q and A box which is right under that chat box to type questions related to the Webinar content that you would like our presenters or Center staff to address. You can submit your question at any time during the Webinar. This Webinar will last approximately seventy-five minutes with the first sixty minutes dedicated to the presentation and the last fifteen minutes for the Q and A section.

If we run out of time before answering all your questions, we will post a Q and A document with all questions and answers from this Webinar in the coming few weeks. Second, this Power Point is already available on our website at www.intensiveintervention.org under the Webinars page. And this Webinar as a whole will be archived too on the Webinar site after we conclude.

**[Slide 4 – Presenters]:** Now, let me introduce you to our presenters; Doctor Russell Gersten from the International Research Group, Doctor Robin Schumacher who is from Vanderbilt University and Doctor Sarah Powell from the University of Texas at Austin. They will be discussing the importance of fractions instruction and typical challenges faced by students, share recommendations for fractions instruction, and provide considerations for supporting students within secondary or Tier 2 and intensive intervention. Now I'll turn it over to Doctor Gersten to talk to you all.

**Russell Gersten:** Hi, I have a lot of material here so I'm going to go quickly. If I can go forward? Neo, can you move the slide forward?

**[Slide 6: Represents the Research Of]:** Oh, okay we've got it. Okay so I'm going to share some of the highlights from two; from two sources. One is from the Center for Improving the Learning of Fractions which is an IES supported Research Center out of the Special [Education] Research arm. And the other is a Practice Guide that came out several years ago now on fractions that tried to get together the most current research on teaching fractions to all and basically, provide a practical guide based on evidence on how to improve how fractions are taught in American schools.

**[Slide 7 – The Case for Emphasizing Fractions in Intervention]**: One thing that I think we're all going to stress implicitly or explicitly is the importance of, fractions and including fractions in interventions. There are; there is a history of remedial or Special Education kind of not doing that much with fractions and feeling that kids need to really be fluent in computations before they start working with fractions. And that seems not to be a good idea for a number of reasons of which I'll share. But, the main reason now is probably I think a good way and I am a former mathematician and still as a Researcher, I am an applied mathematician.

Is; I look at math in a lot of ways as moving towards abstraction. Its ways of abstracting out what we see or what we think. And in that sense, fractions are a great experience for kids to do that and know that although it's hard, it really pushes them into the realm of understanding of what's going on in middle school and high school. And pre-algebra, algebra related things; in science, economics, social science, etcetera.

**[Slide 8 – Case for Emphasizing Fractions]**: So, that push and that effort through interventions for kids who need it are critical. It seems, and this was something in the National Math Panel which I served on about; what was it; five or six years ago now. For us, stressed ] it was mathematically; our charge was how can kids get ready for algebra? As we all know, a lot of students do not do well in algebra and many are afraid it. And the idea that the mathematicians were very convinced; who were on the panel. Is that fractions were the key. That there is this level of abstraction present that isn't present earlier. The way that, that one of the panelists; Professor Ruth from Berkeley explained it is, everything in whole number arithmetic; division; even up to division and even up to long division, you can kind of either see; you can see in concrete things in front of you. Even if you're extrapolating up, you're really going to deal with one thousand nine hundred and six doughnuts or something. But, it's extrapolations from what's concrete and with fractions you enter levels of abstraction.

**[Slide 9 – Why Is This Important?]**: At that point I asked the panelists who were developmental researchers like Bob Siegler and David Geary if there was any research supporting this assertion? Which we may very strong fully and forcefully and did have influence of Common Core Standards and other contemporary state standards; and they said no. And I said can you look at the NAEP data? And then NAEP didn't have enough items.

So, what Bob Siegler and Greg Duncan did; and these are two of the most important researchers right now in education related to math and early math. They looked at longitudinal data from Britain and the U.S. And they followed kids from the fifth grade to the eleventh grade.

**[Slide 10 – Poll Item]**: And what they found is that the Fractions items were not the best. This is something that I'd like for you to try for a second. To just remind yourselves of why the fractions things are so; and Neo if you could set up a poll? Is that correct that people can just plug in their answers to this that it will not take long?

**Moderator:** Yes, you should see it shortly.

**Russell Gersten:** You can figure it out and then just type in your answer.

**Moderator:** Yes

**Russell Gersten:** But the poll will be set up in a few seconds. While we're setting it up, let me go ahead and then we'll go back to the poll when it's up there.

**[Slide 11 – That Was a NAEP Item]**: This item that you're going to do yourselves. Okay, so we'll go back and it shouldn't take long.

**[Slide 10 – Poll Item]**: But, just give this a shot. And Neo, it would be nice if people could see how this comes in. Can we view; do a view of that?

**Moderator**: Sure. We'll do that after we close the poll.

**Russell Gersten:** Okay

**Moderator:** We'll give it about another thirty seconds or so.

**Russell Gersten:** Yeah because you probably have a sense of how many folks are finished.

**Moderator:** Yep. Okay, I'll close the poll now.

**Russell Gersten:** So, while we're waiting to see the tally from this group, when this item was given on the NAEP for eighth graders and it was in two thousand and seven. But it didn't do much better in two thousand and eleven when it was repeated. Only half got this item right in eighth grade; where probably about half of the kids had already taken Algebra. So, this seems to be information that kids learn but don't necessarily; many don't retain. This is another item that Bob Siegler recently gave to different groups of people.

**[Slide 12 – U.S. Children and Adults Have Particularly Poor Fractions Knowledge]**: And he intentionally used these kinds of Fractions. They're not tricky but they're ones that you can easily use your different rules. You know the way with the halfs and the quarter; you know or the half times a quarter. You can easily multiply them in your head. And this they had to do in their head. That's great, we are; well of those that responded virtually everybody got "C" which is the correct answer.

But basically, with this item when you're multiplying thirteen fifteenths by a number that's less than one, is it bigger? No, it's not bigger, it's smaller. But yet only thirty percent of sixth and eighth graders got that right. Another frightening finding is um, thirty percent of the pre-service teachers got this item right. So, it's in your head; can you do this item?

Can you basically estimate what happens when a fraction less than one or any number actually that's on the left is multiplied by a smaller fraction? Luckily, they also tried it with the Carnegie Mellon Math and Science students. And that's an excellent school that focuses on engineering. And in that case, ninety-five percent got it right. So that was good.

Another thing in the bottom bullet is that kids on the NAEP were also asked .029, which fraction does it represent? And only twenty-nine percent knew that it was twenty-nine one thousandths. And what tends to happen with us is that once we get decimals and transfer it to the calculator the meaning of fractions dissipates.

**[Slide 13 – Relations Between Fraction Magnitude Representations and Mathematics Achievement Scores: Eighth Graders]**: Another thing; this was work that was done predicting from fourth grade to eighth grade locating numbers. And in this case, they were whole numbers on a number line. Predicted very well how kids were going to do in two years and four years later. And the reason those were negatives is; the score was how inaccurate your answer was. So basically, a prediction as high as point eight, six is a killer prediction.

For just identifying points on a number line which is why of all the things stressed in the Common Core using the number line would seem to be the one thing and the one thing that should permeate interventions.

**[Slide 14 – Why Are Fractions So Hard for So Many?]**: Why are fractions so hard? You know I don't know that people have thought about it so much until the last, fifteen or twenty years. One thing is they look like two numbers but, they're really one number. So, three sevenths or thirteen seventeenths looks like a bunch of numbers that you do things. Another thing is that fractions is when kids really face head on subtle issues related to infinity. If it's between two numbers like in between two and four there's one and only one number, the whole number three. But, between a half and a quarter or between; once you open the world up to the world of fractions or more formally rational numbers there's an infinite number of numbers between a half and three quarters or whatever.

So, that is a complex idea. That idea is not intuitive to any of us. That's not what we see in front of us. It's critical and foundational for understanding physics, algebra and the calculus of what a function is.

**[Slide 15 – Why Are Fractions So Hard for So Many?]**: But that is something that we want to set the stage for. Kids also get thrown by the fact that the number fourteen twenty-firsts is the same number as two thirds but they look different. And then when numbers get bigger, sometimes the fractions get smaller as you see in those examples.

**[Slide 16 – Incorrect Whole Number Strategies]**:Kids; and this is the most common thing that they use. Whole number strategies and there's a whole; in Nancy Jordan's research; there's a whole array of things that kids do. Ranging from just adding all of the numerals up to adding the tops and adding the bottoms together to do and God knows; God knows what. But here in the example, three quarters minus one quarter is two over zero. That's a very common error and one that happens if kids don't think.

**[Slide 17 – Why Is Early Fraction Knowledge Uniquely Predictive of Later, More Advanced, Mathematic Achievement?]**: And one way to get them to think and I'm going to skip this slide.

**[Slide 19 – Fractions on the Number Line]**: And this one. Is to work on fractions on a number line and to work on it much more intensely, then we ever have in the past. And this would be the kind of thing that Nancy did in her longitudinal research; in terms of where three quarters goes and a lot of kids goof up. They just see if you really look and think about that number line, then you see what's happening in the middle; that number is one half. Even though it's a big hash mark, it's only half way there. But, you see that over almost half of the kids are screwing up and they're just doing it as quickly and not taking in and showing real understanding and real familiarity with the number line.

**[Slide 20]**: A lot of texts until recently had only a few lessons on it and so less than half of the students got it correctly.

**[Slide 21 – Sense of Betrayal]**: Another thing that we tried to correct for in the interventions that you'll be hearing about in a few minutes is what I call a sense of betrayal. And it's the fact that; we teach kids often in third grade and sometimes as early now as first grade or Kindergarten. Or even some parents like Robin might be teaching her four year old that; what a fraction is. And you start with it's a part of a whole. But then one day you start getting these problems like half the class went to the museum, there are eighteen kids in the class. How many went?

And you think wait a minute, fractions had to do with pizzas and cakes and splitting up you know; packages of things and cans. And you think, what is this with eighteen people? And the teacher goes

well the whole is eighteen, it's the class. And then the kids are like what are you talking about? You told me for years that a fraction was a part of a whole.

**[Slide 22 – Mathematics Fractions Practice Guide]**: We want to pre-correct for that. The source is the Fractions Guide. You can download it this way. You can just Google IES Practice Guide or Fractions Practice Guide and you'll find it.

**[Slide 23 – Levels of Evidence]**: And this is a quick; I have about a minute left. This is quickly showing you the level of evidence as of several years ago. On the two things that we're going to stress today which is the two that I've shaded in; in darker blue that, kids need to be able to recognize fractions on the number line. So, there is some moderate evidence. And this is using some rigorous; like FDA standards supporting that. And there's also some evidence supporting work which is real hard to do which should start especially in fourth grade and fifth grade. Like fractions computations and procedures and make sense because, the theory behind it; and again, data is now supporting it.

That is; that, if something is meaningful to you, you might remember it. But, if it's just an algorithm that you learn in the fifth grade or sixth grade it may go in one ear and then three years later it's gone. And it's like we see in the NAEP scores.

**[Slide 24 – What Prerequisite Skills Do Students Need Before They Encounter Fractions?]**: So, that is the big picture of the research and the theory underlying the intervention.

**[Slide 25 – So What Does This Mean For Struggling Students?]**: And, I'm now going to turn things over to Robin.

**[Slide 26 – Evidence-Based Fraction Intervention at Fourth Grade: Tier 2]**: **Robin Schumacher**: I'm going to get started in talking about Tier Two interventions.

**[Slide 27 – Role of the Coach]**: And so the big ideas to build on and what Russell spoke on was about was, to build conceptual understanding of fractions as numbers and to focus on too interpretations. So as Russell discussed, our primary focus for this work is looking at measurement understanding and increasing that for students. Which include primarily number lines and much discussion and understanding about magnitude and to provide an ability to students to reasoning about the size of fractions. For them to discuss infinite equivalencies and just as a note, this type of instruction is the main focus for introducing and teaching fractions in Asian countries.

And we did include secondary focus on part-whole understanding. Which is really the; has been the typical focus on instruction in the United States and that includes the shaded reasons and parts of a pie. And we chose to keep that focus in the intervention work so that students could build on things that they may have already learned and already have context for since number lines could be relatively new for many of them.

**[Slide 28 – Fraction Skills Addressed]**: So the fraction skills that we addressed were really more of the earlier fraction skills. And you'll see how these also tie into the recommendations that Russell just mentioned. So, understanding fractions as numbers and being able to name fractions from regions; understanding equivalencies to one half and one whole and to be able to come up with quick retrieval of those. Finding fraction equivalencies through multiplication and then being able to identify proper and improper mixed numbers less than two and converting.

**[Slide 29 – Fraction Skills Addressed]**:We also included with that several magnitude activities which as I said is a very big part of being able to move forward with measurement understanding. So, we included

comparing two fractions. Ordering three fractions and placing fractions on a zero to one or zero to two number line. We also had a smaller focus on fraction calculations. And we; we really limited this to addition and subtraction and taught different denominators where only one fraction would need to be re-written as an equivalent fraction. So, we did limit it to where both fractions did not need to be changed.

**[Slide 31 – How Do You Think About Fractions?]**: So before I get into how we taught all of these things, I have a couple of polls as well. So I don't know; before the poll gets up what I want each of you to think about to compare four sixths and five twelfths. Then determine which is bigger and then answer the poll question. So, I'll give you about ten seconds to think about how you might solve that and then I'll give two polling answers.

**[Slide 32 – How Do You Think About Fractions?]**: Okay, so choose "A" if when you saw; if when you compared those fractions you found a common denominator. And choose "B" if you tried to evaluate the magnitude versus a different um, benchmark fraction or another quantity. And then Neo, I'm sure if we're able to see results as they come in as we did with Russell's?

**Moderator:** Yes, in a moment, ten more seconds.

**Robin Schumacher**: Okay, so it looks like there was you know a pretty even split for how, the participants here today decided to find the answer. So, if you solved this finding a common denominator then you applied procedures to come up with an exact answer. And if you chose "B" then probably the most common is to think four sixths is greater than one half and five twelfths is less than one half. And then therefore, four sixths is greater than five twelfths. And the way; if you solved it the way that item "B" asked about that is one thing that we taught in the intervention to these fourth graders. It's how to reason about fraction size without always applying an algorithm to the magnitude problem. So now, let's look at the next one.

**[Slide 33 – How Do You Think About Fractions?]**: I have another poll item. So, before you answer on the poll because you don't know what the two poll items are. Think about if you have a zero to one number line, where would you decide to place seven twelfths? And also think about how you would make your decision.

**[Slide 34 – How Do You Think About Fractions?]**: And then your options are; did you mentally divide the number line into twelve equal parts? Or, did you think about where half of the number line would be to approximate seven twelfths? Hey Neo, do we have some results?

**Moderator:** Yep, they're coming in right now; one second.

**Robin Schumacher:** Okay and again as we move forward. If you did it in the way of "B" that was one of the strategies that we also taught students in the fourth grade. All of which were at risk for math difficulties and to think about where they would place fractions on a zero to one number line is then applying whole procedures to the number lines. So, we were trying to move kids to being able to think about the number line more fluidly.

**[Slide 35 – Instructional Design]**: So I'll move on now. And talk about the instructional design of the program and how we taught the various skills. So, whenever we taught something new, we would introduce the concept with manipulatives and visuals which included fraction circles, fraction tiles and number lines. So they are; those three items are what you think they would be. Sort of moving from fraction circles being a very strict part whole shaded region type of representation. Fraction tiles still being 3D but linear and then moving to the number line.

And so that would always be our first reference for anything that we were teaching. And then we would provide context to any real life understandings that students might have. So one thing that we talked about with unit fractions was equal sharing. Kind of what Russell had mentioned. That if you had a cake and you share it with ten people then each person gets one tenth of the cake. And that was a way to help think about the difference in size of sharing with ten people versus two people to know that one half would be larger than one tenth.

Then we moved to provide procedures for how to think about and solve each task. And we tried to decrease the demand of working memory by you know allowing students to have a prompt card to go through the steps of the problem solving. And then we gradually faded those as they became more intuitive to the students. We also included fluency practices for foundational skills and independent practices to demonstrate student learning.

**[Slide 36 – Fraction Skill: Equivalency (One Half and One Whole)]**: So the first thing that we talked about was equivalency and the reason that we focused so much on equivalency and specifically to one half and one whole is that we used the students' knowledge of what fractions are equal to one half. To then be able to make magnitude comparisons in the different activities. So we first demonstrated with fraction tiles and fraction circles and number lines with varying denominators so that they could see that one half and two fourths and three sixths and so on line up all at the one half point on the number line. We also showed how you could find these equivalencies with multiplication. And then we specifically taught students the doubling rule for fractions equivalent to one half. In that if you double the numerator it equals the denominator.

And as I mentioned, our goal was to get to quick retrieval. And so getting there and using one half as a benchmark we were relying on students to rely the transit of properties. So, you can see number line graph. If "B" were one half, on the line there; let's just say that "A" is four twelfths and "C" is three fourths. They could evaluate each of those against one half to know that "A" is then less than "C."

**[Slide 37 – Fraction Skill: Comparing]**: So, moving on then with comparing two fractions; this is the prompt card that was provided. After students have experience with manipulatives and number lines; we discussed whether or not fractions had the same denominators and then how to think about fractions with the same numerators and same denominators. And then we moved through a sequence of having students ask themselves are they equivalent to each other. And in that, we really were prompting them to think are both fractions equivalent to one half? Or, is one fraction equivalent to one half?

And then if none; none of the fractions were equivalent to one half then they would compare each fraction to one half. They needed to decide if it was less or greater and then determine which was sign was needed. So we used that similar procedure then with ordering the number line as well as you'll see as I move through this.

**[Slide 38 – Fraction Skill: Ordering]**: So, with ordering we had a similar prompt card. In that they looked to see if the numerators or denominators were the same. And then for ordering, they compared each fraction to one half. And underneath, they would write "L" for less, "E" for equal and "G" for greater to decide what order they should go in on the three lines. So this goes back to the first poll item that Russell had.

In that ordering three fractions is a pretty common skill to be assessed especially on the NAEP and other large normed tests. And then there were other steps as you can see. So if there were two fractions less than one half or two fractions greater than one half students needed to compare the two of those against each other using some other rules that they had learned about rewriting equivalent fractions.

**[Slide 39 – Fraction Skill: Number Line]**: And then the number line as I move on was also very similar. Students were first taught to find where one half went on the number line. Compare the fraction to one half and then write "L" or "G" and then put it on the appropriate side of one half. And that was when we had a zero to one number line. The examples here are zero to two number lines. And the procedures are very similar in that they had to decide if it was a proper, improper or mixed number to know if it went between zero and one or one and two. And then they would apply the same procedures in either finding one half or one and one half to make their placement decision.

**[Slide 40 – Building Magnitude Understanding]**: And then to build magnitude understanding, we had a lot of discussion about how those three activities were similar by having students order, put on the number line and then compare the same three fractions of which included one half. And this sparked discussion about how really you're doing the same thing no matter what the activity you're thinking about or how big or small each fraction is.

**[Slide 41 – Fraction Skill: Computation]**: We also; once we had practiced and worked on the magnitude activities we did introduce the computation as I mentioned. And we limited the instruction to just a few days and we found as you'll find; as I'll get into. We found that we got really good results for computation once students had a really nice handle on the different magnitude of the fractions and really having an understanding about rewriting an equivalent Fraction.

**[Slide 42 – Fraction Skill: Improper to Mixed]**: We also taught students to change fractions from improper to mixed and vice versa. And we were limited; we limited our fractions that were improper to be less than two. So we taught them how to do that by subtracting out the fraction that was equivalent to one half on the number line or adding back in a fraction that's equivalent if you're going from mixed numbers to improper Fractions. And we chose to rely on addition and subtraction for our procedures here because we were working with fourth graders that were struggling. And we felt more confident in their prior addition and subtraction abilities than their multiplication and division.

**[Slide 43 – Fluency: Magnitude Understanding]**: We also included a fluency part which I spoke of at the beginning. And it was a game where students had to meet or beat their score and we would look at progress over three days and graph increases of their responses. And what we did is that we had two different types of flash cards and the game changed every three days. But, we had some cards that only had single fractions written on them and the game might be is the Fraction equal to one half or not? Or it might be getting better at recognizing if it was a proper, improper or mixed fraction.

And then we also had compare flash cards where two fractions were on the card and the student's job was to state which was bigger. And we had various types of comparisons. Some were easier that were the same denominator or same numerator. But as they got more fluid with quick retrieval of fractions that equaled one half we included some more of the difficult comparisons where they had to really think about one half as a benchmark fraction.

**[Slide 44 – Embedded Motivation System]**: We also had an embedded motivation system and we had fraction money. So that also supported what a quarter dollar, what a half dollar and what a whole dollar was and we were looking for on task behavior. And correct answers throughout the lessons could also earn additional money.

**[Slide 45 – Embedded Motivation System (cont.)]**: Students got to go to the store; our fractions store to spend their money at the end of every three days. So that was something that helped really keep students engaged in what we were doing.

**[Slide 46 – Results From Three Years of Research]**: And then here, is a slide about results over three different years of research. The top panel is the; was the year one. And then the bottom left was the year two. And then the bottom right is year three. And I'm going to talk about these results on the next slide so I may go a little bit back and forth as I go through that. So, I'm going to go on to the next slide and I may refer back to these effect sizes in just a moment.

**[Slide 47 – Implications for Intervention]**: So, what we learned is that students increase their ability to reason about fraction magnitude especially when you look at the number line results. Across the three years students got very good at being able to estimate and decide where the fraction should be placed on the number line. Also, we got great results on our procedural computations. So even though it was not a very large part of our intervention, the kids that had gone through the intervention with this large measurement and magnitude focus really increased their ability to add and subtract with fractions over those that didn't have that instruction.

And then we specifically addressed some of the misconceptions of whole number bias that Russell spoke about. In terms of getting students more acquainted with the infinite equivalencies the value differences with the numerator versus the denominator. You know like he mentioned how fourteen twenty firsts is the same as two thirds. So, we discussed that a lot and the NAEP results were really reflective of those larger, whole; big picture conceptual misunderstandings.

**[Slide 46 – Results From Three Years of Research]**: And so, I'm going to go back so that everyone can look just quickly at those effect sizes. So you can see that comparing was a magnitude test that was only included in the first year. But, you can see that our number line; the effect size is over one. NAEP was close to one. And then our calculations, we were really excited about that result because it was two and a half effect sizes over the control kids when we really didn't emphasize calculations very much. And then you can see also the results for years two and three with the number line, with the NAEP and then the calculations in terms of how our students continued to perform over their counterparts in the control conditions.

**[Slide 47 – Implications for Intervention]**: So, I think I am out of time and I will pass it to Sarah.

**[Slide 48 – Intensive Intervention With Fractions]**: **Sarah Powell:** Alright, thank you very much. Good afternoon everyone. The purpose of this Webinar today was to talk about making sense with fractions and special considerations with secondary intervention and intensive intervention. And Russ did an excellent job of setting up the difficulty with fractions. And Robin highlighted our wonderful evidence program um, for students who are struggling with fractions. And so now, I'm going to talk about how to intensify interventions for students who are having difficulty with those fraction skills.

**[Slide 49 – Response to Intervention (RTI) in Mathematics]**: So, when we're thinking about an RTI framework we typically have three Tiers although we know that some schools may have more than three Tiers. But, the typical model does include a three Tier model. Where students in Tier 1 are receiving an evidence based mathematics intervention in their general education classroom. And what we know in terms of mathematics is that we do need a lot of work here. As we look at the Work Works Clearinghouse which I'll show you on the next page and other sites. There are several math programs that are recommended but, many math programs that schools are using these days; including text books. Do not have an evidence base or do not have an adequate evidence base.

Now what Robin was showing you all today was a Tier 2 intervention that was focused on fraction skills. And we do know quite a bit here in this area. The National Center for Intensive Intervention which is hosting this Webinar has a wonderful webpage where you can go and look for intensive; Tier 2

interventions for students. And some others are listed on the What Works Clearinghouse and the Best Evidence Encyclopedia site as well.

And then in Tier 3, we're also going to use evidence based interventions and that's what I'm going to focus on here. And we'll use an evidence based intervention but then intensify it for the student's individual needs.

**[Slide 50 – Tier One]**: And if you were wondering what I was talking about in terms of looking for information on the What Works Clearinghouse or the Best Evidence Encyclopedia. These are the links to those sites.

**[Slide 51 – Tier Two]**: And this is the Tier 2; if you're looking for academic interventions from the National Center, this is the site that you can look at on the intensive intervention webpage. And you'll notice that the program that Robin was talking about title "Fraction Face-Off" is recommended very highly. It meets all quality criteria for determining an evidence based practice.

**[Slide 52 – Tier Three]**: But, my focus here is on Tier 3. So when we're thinking about Tier 3, these are most likely students who are receiving special education services. Although, there may be some students who are not within the realm of special education but do require individual; individualized support. And the definition that the Center has been working with in terms of intensive intervention is; an intensive intervention addresses severe and persistent learning difficulties.

And this intervention should be driven by data. And it's different sets of intensity for the student. And it's all individualized based on the student's needs. Most of which is determined by data.

**[Slide 53 – What Is NCII's Approach to Intensive Intervention?]**: The approach to intensive intervention from the Center is based on data based individualization. You'll also see that as the acronym of DBI. And DBI is a method of using data to figure out when students require instructional changes and perhaps what those instructional changes might be. The origins of DBI have come from special education research conducted over the last thirty years. So, the research base in this area is very strong.

But, the Center does want to emphasize that DBI is not an intervention that you can purchase and you use. It's more of a process and a framework for providing individualized intensive instruction for students that require it who have maybe been non-responders to the Tier 2 programs. Perhaps the; perhaps the Tier 2 program that Robin was talking about.

**[Slide 54 – DBI Rests on Six Assumptions]**: Now, we have six assumptions um, for when we're using DBI and they are the following. It's that; like I just said, maybe some students are non-responders. So an evidence-based program; even if your school invests in it, it may not improve the fraction understanding of one hundred percent of the students. We typically see that about three to five percent of students need more intensive instruction above and beyond their Tier 2 intervention. And this may vary by school. It could be more in some schools and it could be less in some other schools.

Our second assumption is that based on some of the work that Russ and his research team has done, it is that students who require intensive interventions; is that they typically need ten, they tend to need ten to thirty times more exposure and more practice to new information than peers without disabilities. So, this is giving teachers a way to provide that practice in a meaningful way for these students. Students that need special education instruction and that probably goes without saying, we're all special educators here and we understand that.

Our fourth DBI assumption is that if we use this data, it's really going to help us make changes um, quickly for the students and make effective changes for the students. DBI is also different from Tire 1 general education instruction and Tier 2 secondary prevention like the program that Robin was talking about. This is going to be more intense and there are many ways that we can intensify the interventions and I'll talk about a few of those ways in just a minute.

And our sixth is that we know that DBI works. And that we've got research that shows that it supports students in terms of learning more in reading, learning more about writing and also learning more in mathematics.

**[Slide 55 – How Is NCII Addressing the National Need for Intensive Intervention?]**: Now, the NCII which is The National Center for Intensive Interventions. We are addressing the need for, the need for intensive intervention by putting together modules for teachers and school support staff to use. These are all located on the Website which is WWW.IntensiveIntervention.Org. And if you look under implementation support which is at the top of the page, you can click on that and there's a pull down menu that says DBI Training Series. And if you click on that, you can find all of the information about how to do data-based individualization in terms of academic behaviors, behavior; behaviors and thinking about progress monitoring within the RTI framework and all of that.

So, NCII has been putting together these materials and presentations. For not only teachers to use who are involved directly with the project but also schools to use across the United States. So, NCII is also providing a lot of technical assistance to schools to see how much support schools need in order to implement DBI as well. And there are some of the other things that the Center is doing in terms of, data-based individualization.

**[Slide 56 – Intensive Intervention With Fractions]**: Now, when we're thinking about fractions,

**[Slide 57]**: we are going to look at some of the materials that the Center has put together to help teachers to intensify interventions for students. So, on the left hand side is a screen shot of a packet that the Center has put together on different fraction concepts. And you can find this material on the NCII website if you look under the tab at the top that says instructional support. And then there is a pull down menu and it says sample lessons and activities. Then it comes up with a table and there are some that are forthcoming but the fraction materials are already up so that is why we're talking about those today.

So, these screen shots show some of the materials that are available from the Center. Now, these are materials that the teachers can use to help students who maybe are having difficulties with fraction magnitude. And Robin was talking about that earlier. There is information about putting fractions on a number line and there is information about comparing fractions with like denominators and unlike denominators.

And so these are materials that if you know a student is struggling with a skill; for example, finding common denominators. You can pull the worksheets from this packet and use those to help and intensify the intervention. Now, there's more to intensive intervention than just using these materials. Which is what I will talk to you about on the next few slides; but I do want to show you that over here, on the left hand side we've included Common Core Standards that we are addressing; in terms of the specific skill that the students may work on. We have the different principles for intensive intervention and I'm going to go over some of those in just a minute. And then possible materials that you will want to use.

Now, here in the middle; these are sample worksheets that the teachers can ask with a very good step by step breakdown on how to compare fractions with different denominators. Have students showing their work using inequality symbols like Robin was talking about and then checking their work with

manipulatives. And we've also included printouts for; if you don't have manipulatives on hand. We've included printouts and you can print those out, cut it apart and students can use these printouts. The fraction tiles instead of you having to invest in a lot of fraction tiles.

Now, we have these materials to help intensify interventions but, there are several ways that teachers can modify delivery of instruction that will help when you are using those materials for students.

**[Slide 58 – Explicit Instruction]**: So, we've got seven that we're going to talk about here today. If you do want more information these are under the DBI training series that is on; on the website. So one of the ways to help intensify interventions for students is to use explicit instruction. If there's any trend that has come out of the mathematics research for kids with disabilities over the last thirty years, is that; it is that explicit instruction improves mathematics understanding for almost all students. Now, explicit instruction might be using explicit instruction, systematic instruction, direct instruction or capital "D" capital "I" instruction.

But, it is teachers providing instruction to students. It's a learning process with the students and then the teachers providing feedback to students. So with explicit instruction, teachers are always modeling how to solve different fraction problems. Teaching the steps involved in solving problems. Robin talked through on many of her cards when they were talking about putting fractions on a number line. It is broken into steps and so as a teacher, you're going to explicitly break that down into those steps and teach the students, how to do that.

When you're using an explicit instruction, you might be teaching procedures. You might be using graphic organizers. You might be using manipulatives but the entire time, the teacher is directing the lesson. Working alongside the student and making sure that the students understand what they are working on. So, that's one way to intensify interventions.

**[Slide 59 – Teaching Vocabulary and Symbols]**: Another way is to explicitly teach vocabulary and symbols. Just in fractions um, when Robin was talking; we were talking about all of the different fractions. One half, four twelfths and so students have to understand all of those terms. Denominator, number line, numerator, equal parts, whole units, proper, improper, mixed fractions; there are so many terms that students have to be taught. And many times we do see on standardized assessments especially, that students have to understand these terms.

You know it will say "what is the greatest common factor with these set; this set of fractions?" And if they don't understand what that term means, then they are going to have a lot of difficulty solving the problem. So we know that students with strong math vocabulary typically perform well in mathematics. And on the flip side, students with weak math vocabulary, they struggle with mathematics. So the more vocabulary support and also symbol support that teachers can bring to the table um, the better off students are going to be.

**[Slide 60 – Graphic Organizers]**: Another way that students can intensify the intervention is to use a graphic organizer. Graphic organizers are really helpful for learning vocabulary. You can have the vocabulary word on a graphic organizer and then examples, non-examples and the definition of the vocabulary word. Graphic organizers are also helpful with helping to organize word problem information. I don't think that Robin talked a lot about it but, I know that within their program, they did teach students how to solve word problems with fractions.

And you can use a graphic organizer to help the students understand is this um; a part of the fraction or is this the whole of the fraction and those types of things. And also, graphic organizers help students with

note taking and breaking complex skills into smaller steps. They can list those steps and then use those checklists to work through those.

**[Slide 61 – Concrete-Representational-Abstract Model]**: Our fourth way to; to intensify an intervention is to use a concrete representational abstract framework. And like we said; like I said a little bit earlier, over the last thirty years, there has been a few trends that have emerged from the research on students with math difficulties. And explicit instruction is always like yes, this works. I mean time and time again, we know that this works for students having difficulty with math. But we also know that a great representational abstract model or framework is a very, very strong way to help students connect the conceptual piece of mathematics to the procedural piece of mathematics.

And with this, there are three phases and hopefully most of you are familiar with this. But the concrete is touching and using manipulatives. So, here's an example of fraction tiles where students can move those around. The representational phase is pictures of those tiles. And I showed you an example of that a few slides back and here's a picture on the right hand side of that also helps you see that. And then working in the abstract is always solving problems that involve the numbers and symbols. So one over two is the fraction one half and to be able to understand what that represents.

And Robin and her team; they did a lot of work with the fraction circles and the fraction tiles and incorporating the CRA [Concrete-Representational-Abstract] along with explicit instruction in their fractions program. And just one more thing; is that in intensifying interventions, I know in Robin's program sometimes they only used fraction tiles for maybe one or two examples. But for students who are really struggling, they may need more opportunities to work with the fraction tiles. Or perhaps the fraction tiles don't make sense to student so, maybe you'll use fraction circles or a geo board or Cuisenaire Rods which is another way to represent fractions and giving students the opportunity to see what it is to have a whole and split that whole into equal parts. Or have more than one whole and things like that.

**[Slide 62 – Fluency Building]**: Another way to intensify intervention which is so important for students who are struggling with math is to build their fluency. Robin was giving some examples about finding one half, then using the doubling rule. If you don't automatically understand that four plus four is eight, then it's going to be very difficult for you to use the doubling rule. And then in the say way, if I; I mean like the; common denominator. If the students are taught to multiply to find the common denominator they should quickly be able to tell you that five times four is twenty.

So there have been these suggested activities for building fluency and it's really a personal thing. I think that one of the best things that you can give your students is strong fluency with their facts in addition and subtraction, multiplication and division because, it makes everything in mathematics easier from here on out.

Here are some activities. And just remember that fluency practices; just working through a set of one hundred flashcards. That is not as meaningful as working with a small set of selected known and unknown facts. Providing corrective feedback and also having the students graph their scores and set some goals; like I'm going to try to do two more this time and two more the next time and so on and so forth.

**[Slide 63 – Effective Questioning and Feedback]**: And then there are two other things; that we've been talking about in terms of intensifying interventions. And that is asking effective questions. Those can be low level questions and high level questions. But when teachers ask those, teachers should be providing appropriate feedback to students; especially when the feedback needs to be corrective.

**[Slide 64 – EBI Network Sample Intervention Brief]**: So, thinking about that and also conducting error analysis on students work. This can be done formally or informally. Having students tell me what you were thinking when you were solving that problem? How did you place that fraction on the number line? And those types of things and that really gives you an idea for things that maybe need to be re-taught or perhaps some of the next steps that may be necessary in terms of developing students fractions skills or just developing their mathematical skills overall.

**[Slide 65 – What Is Happening in Other States?]**: So, that's all I'm going highlight about intensive interventions. And that was a very quick go through. Typically, we work with teachers for three to six hours on a lot of those skills and developing them in depth. But again, if you do visit the intensive intervention website you can see and download all of the materials about intensive interventions that we have been working on with some of our schools in some of the other states. So, I'm not going to spend much time on this.

**[Slide 66 – Colorado]**: But, what's happening with us in other states if you're interested you can see what some other states around the country have been doing in terms of RTI implementation.

**[Slide 67 – Michigan Integrated Behavior and Learning and Support Initiative (MiBLSi)]**: data-based intervention and those types of things.

**[Slide 68 – Rhode Island]**: We've got Colorado, Michigan and Rhode Island.

**[Slide 69 – Washington (state)]**: The NCII has done a lot of work in the state of Rhode Island, Washington state.

**[Slide 70 – Wisconsin]**: As well as Wisconsin.

**[Slide 71 – Questions]**: So, I'll go ahead and turn it over to Neo. I appreciate all of you for participating today and hope that you learned a little bit more about intensive intervention especially with regard to fractions. And Neo will take it from here and we will go ahead and answer questions.

**Moderator:** Great, thank you Sarah and thank you to Russell and Robin as well for a great presentation. Now, we'll take some time for a Q and A discussion with our presenters. As a reminder, please type your questions into the Q and A box. Due to a large number of participants, it is likely that we won't get to answer all of your questions during this Q and A portion. If we don't get to your questions, please look for a Q and A document that we'll post under the webinar section of our website in the coming weeks. You can also e-mail your questions to the Center at NCII at AIR.Org.

And the first question, I'm going to direct to Russell. Could you please discuss methods or strategies on how to best meet the needs of learners who are on the lower level that are still struggling with basic number concepts when trying to teach more complex skills such as fractions? Russell?

**Sarah Powell:** Is he there?

**Moderator:** Robin or Sarah do you guys want to tackle that until we get him back?

**Sarah Powell:** Robin, you can go ahead.

**Robin Schumacher:** Well, that's a very, very big question. Is there a way that I can see the question Neo; just because there were so many different parts to that?

**Moderator:** Sure, I'll send it to you in this chat.

**Robin Schumacher:** Okay, I apologize.

**Moderator:** No problem.

**Sarah Powell:** I think it was about how when kids have a very, weak sense of number sense?

**Robin Schumacher:** Yeah

**Sarah Powell:** And I'm assuming.

**Moderator:** I can.

**Sarah Powell:** The number meant whole number.

**Moderator:** Bring that up.

**Robin Schumacher:** Okay

**Sarah Powell:** Yeah

**Moderator:** I have it right here. It's to discuss strategies on how to best meet the needs of learners who are on the level; on the lower level, who are struggling with basic number sense concepts when trying to teach such; complex skills such as fractions.

**Robin Schumacher:** Well one thing that I will say is I think that's where the representations and showing fractions being represented in different ways. In a concrete way and getting away from just the abstract number and presenting it that way with students who are really struggling. Maybe for a longer period of time and Sarah mentioned that as well.

**Sarah Powell:** Yes

**Robin Schumacher:** In her presentation. Students might need to stay in that concrete or representational phase a little bit longer than some other students to really get the visual along with seeing the number. That's one approach that I can think of.

**Sarah Powell:** And I; that's excellent Robin. I would also say providing students to see fractions in more than one way. So, if you're working with fraction circles not that that's not a good representation of fractions. But, giving them larger circles or smaller circles or using a geo board that is also getting at that area model of Fractions.

**Robin Schumacher:** Yes

**Sarah Powell:** Because, many times students seem to be like "oh, well that's the pink one." And having really no meaning attached with what that actually represents in terms of the manipulatives. And I also think that helping students with basic number concepts um, we have done; I've worked with Robin at Vanderbilt and at several other universities. And every time, we always include fluency building activities. And it can be as quick as a one minute flash card warm up or something like that.

I know in Robin's fractions program they had students look at fractions very quickly and compare them, to one half or something like that. But, those are very basic foundational skills that then are going to allow students to understand that one half is the same as four eighths which is the same as six twelfths and those types of things. But, in terms of building students' fluency or just fluency with facts; what's four plus five or what's four times five. Those are the things that are going to help students with these more complex skills down the line.

And from my point of view, we just don't see that schools emphasize fluency as much as students need it. And so typically, I'm in middle school classrooms or even high school classrooms where teachers will say my students don't know their multiplication and division facts. Well then how am I going to be expected to find the common denominator using a multiplication strategy? So, really working on those very basic fluency skills will help everything; help everything down the line. And also as Robin was talking about, using more manipulatives and those types of representations are going to be helpful as well.

**Robin Schumacher:** And the number line.

**Sarah Powell:** And the number line.

**Robin Schumacher:** You forgot to mention the number line.

**Sarah Powell:** I feel like the number line is always there and you just can't forget it.

**Robin Schumacher:** Well, you can ignore it I guess.

**Sarah Powell:** I guess you could. You're right. But, it can include; I guess I just meant including representations.

**Robin Schumacher:** Um hum

**Sarah Powell:** Since the number line isn't really concrete, it should still um, be included. There is actually an activity in one of our lessons where we look at the fraction tiles along with the number lines since they both can show how Fractions grow.

**Robin Schumacher:** From zero to one.

**Sarah Powell:** Yes.

**Robin Schumacher:** Yeah, that's great.

**Sarah Powell:** What other questions might there be?

**Moderator:** Great, and this is for Sarah. If you could discuss how many lessons or days would you use to work with a student on a concept or vocab work like denominator equivalence?

**Sarah Powell:** Oh, okay. Well it should be introduced one day and then practiced again and again. So for an example like denominator which we would rather you use than bottom number. Bottom number doesn't say anything mathematically but denominator does. The teacher should use explicit instruction like today we're going to use a new word, denominator. And write that word out so that the student's see it. Maybe the students also write that word out.

When we're talking about the denominator, we're talking about a whole and a fraction that's divided into equal parts. That number of equal parts represents the denominator. So, providing a student friendly definition that the students maybe write out or the teacher writes out and puts on a vocabulary word wall. And then the next day when students come, we learned about a new word yesterday. Does anybody know what that new word is? That word was denominator.

Let's say it together. What is the denominator? And then maybe the teacher would show some different fractions in the abstract and say; you know here's the fraction three sixths, what's the denominator in this fraction? What does that mean if the denominator is six? And then the third day, maybe you're going to introduce another vocabulary word. But then; you're going to eventually fade the focus on denominator and perhaps focus on; you know a common denominator. That would be another term that students would need to know.

But reviewing vocabulary pretty consistently and that's one of the things with Robin's program. It's that throughout; probably even in the thirtieth day, the teacher asked questions like okay, what's a proper fraction? And then the students respond. What's an improper fraction? How are those different? Because we know that students on a standardized assessment will; may be asked, which of these is an example of improper fraction? Or turn this improper fraction into a mixed number.

So I mean; Robin probably introduced into their program proper fraction and improper fraction on the first day. Yet thirty days later they're still reviewing those. Now, there may have been days where they didn't review those explicitly. Am I correct Robin?

**Robin Schumacher:** That's true.

**Sarah Powell:** But for the most part, you're reviewing those all the time. .

**Robin Schumacher:** And another way to work on vocabulary.

**Sarah Powell:** Yes

**Robin Schumacher:** I'm sorry to just to.

**Sarah Powell:** No, go for it.

**Robin Schumacher:** But in your talk about denominator, one thing that we did say is to "remember the "D" nominator is to remember that the unit is how much the unit is "D" vided." So, we did some discussion with pneumonic; with denominator. With how the unit is "D" vided.

**Sarah Powell:** "D" vide.

**Robin Schumacher:** And so, just to get kids to understand the difference between the numerator and the denominator and really think about okay, the "D" nominator is how many parts the unit was "D" vided in to. And then that.

**Sarah Powell:** About how many days would you spend talking about that? I mean you probably spent a minute talking about it but, over how many days?

**Robin Schumacher:** We always referred to the numbers as numerator and denominator.

**Sarah Powell:** Yeah

**Robin Schumacher:** We never called them top number and bottom number. So, as soon as we introduced it, we talked about what it was and then always referred to those numbers that way. And then we would review it especially if a student was getting, stuck on something. We would say, "Remember "D" nominator was how the unit was "D" vided."

**Sarah Powell:** Right

**Robin Schumacher:** And so, like in Vermont, reminders were brought up. And, we introduced that vocabulary and I want to say even the first half of the program; which would have been eighteen lessons. We did a vocabulary review at the beginning say, you know which number is the numerator? Which number is the denominator? What does the numerator tell us? What does the denominator tell us?

**Sarah Powell:** You really can't overdo it.

**Robin Schumacher:** But, it had to be; yeah. They had to be very fluent in providing answers about what each answer meant in the fraction.

**Russell Gersten:** This is Russell and I just wanted to add in; with my University of Oregon training. All of these things resonate and they're excellent and they go well beyond what most books will do. Because, the idea of the cumulative review and recycling through things like this you know; for often a minute or so is critical. But, the idea when things are likely to be confusing; this is one of, Carnine and Engelmann's big ideas in the theories of instruction book.

You want to separate them when possible. So, you might teach denominator and make sure that kids grasp it before entering numerator. Because, it's so easy to confuse when two; somewhat similar things are introduced together. And that is a nice little trick. Cumulative review is essential.

And the other thing and I think its fine to share with the kids. Is that you're really; with math vocabulary, you're invariably teaching concepts. And some of these concepts to really grasp; I mean it, sometimes it takes years to really grasp what equivalence means and all these different contexts.

So, mentioning that to kids and mentioning that to others that involved training others or working with others. That because you're teaching a nuance; a brilliant concept but, one that it amounts; a lot of time on them is great. But, brief and consistent and; I love what you're saying. Is always use the mathematical language is correct.

**Robin Schumacher:** Yeah

**Sarah Powell:** Yes

**Russell Gersten:** So, it shapes kids and it fully shapes their thinking.

**Moderator:** Great, thank you all for you input. Another question; and this may be for Robin more so. It is; one person asked. Why you chose to use circle rather than rectangular models or both to start fraction understanding?

**Robin Schumacher:** Well so we used the fraction circles that were 3-D. And we used those and tiles. So, tiles are sort of more of the; I guess it could be considered a rectangle but, it is more linear. But then when we had pictures on some of the other materials we integrated different shapes. some were circles, some were squares and some were rectangles.

So we did not limit it just to circles. Bur fraction circles and fraction tiles are a really common type of 3-D manipulative that can be purchased and that's what we used for the 3-D part.

**Moderator:** Great, thank you. So from now; for the rest of the questions, I think I'm just going to throw it out there and whoever wants to tackle it can go ahead. So the; one of the question is if you have limited 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?

**Robin Schumacher:** Yes

**Sarah Powell:** This is Sarah. It should always be linked to the algorithm or maybe not the algorithm but to the abstract. So if you were; are working on conceptual understanding with perhaps manipulatives of pictorial representations of manipulatives. That's really important for students to understand how a whole is divided into equal parts and that type of thing.

But, it should always be connected to "well what fraction is this representing?" Okay, this is a numeral three Fraction bar over four. Okay, we have our four equal parts that represents the denominator and we're going to highlight three of those parts to show our numerator. So, always making that connection for students and making it explicit. Because, for some students they get it and they're like yeah, I see how that works.

But for many students with math difficulty we know that they need those explicit connections. And that's where the teacher really needs to provide that intensified support for the student.

**Robin Schumacher:** And to build on what Sarah said, in the program, that I spoke of. When we did move to the procedural calculations we would demonstrate first off an addition problem with different denominators. And show it with either the fraction circles or the fraction tiles and how you can't add two fractions together with different denominators. And then why conceptually you need to find and equivalent fraction that has the same denominator as the other one before you can compute. And so we demonstrated that with addition and subtraction.

And a lot of students were like oh or okay, I get it now. So, showing why you can't do something, in terms of; like students tendency to add across the denominator. And showing why that doesn't work was also really beneficial for increasing that conceptual understanding.

**Sarah Powell:** And you all also did; when you were solving word problems. You would also sometimes demonstrate with manipulatives to like.

**Robin Schumacher:** We did.

**Sarah Powell:** You know with breaking things a part or putting things together. And so I feel like it's; like a very combined approach instead of one or the other.

**Robin Schumacher:** Yes

**Sarah Powell:** Yeah

**Moderator:** Great, thank you. And one last question. Do you advocate for the use of interactive journals to supplement interventions? So for example, having students record their thinking to the best of their ability than using the journal as a study source? And examples and if you have if you could, mention

various examples of graphic organizers that you found helpful in organizing word problems. I know that's a long question.

**Robin Schumacher:** Well, I'll start. I can't really; what was I saying. I just lost my train of thought. About the question and I apologize.

**Sarah Powell:** About journaling.

**Robin Schumacher:** Oh journaling. I was going to say that I can't speak to journaling. But I will say that all students when we work with them are encouraged to talk pretty fluently about Math. So, what we do; want them to be able to explain their thinking verbally and that is actually a big part of the program. Especially as we start to move through the magnitude activities and tell me why they knew one fraction was smaller or larger than the other one and why the changed a fraction. And so, they were also taught to use the mathematical language like we spoke about.

Like, I rewrote this as an equivalent fraction with the denominator of ten. So, I changed one half to five tenths so that I could add five tenths to three tenths. So, journaling I guess would be another way. I found with our students in the time constraint that we had that that probably would have been time that I didn't have to spend to have them be journaling. And then also, so many of our students also have reading and writing difficulties. That being able to speak to me happened quicker and was an easier check for us.

**Sarah Powell:** I just want to make a.

**Sarah Powell:** Okay

**Robin Schumacher:** I completely agree with you Robin. I'm sorry to interrupt you. I've been conducting another study completely separate of this. But it is where we were working on students mathematics writing. And what we learned is that students are pretty poor at mathematics writing. And so you would have to do some explicit instruction if you were doing journaling like; especially for students who have Math difficulty.

So, what's your topic sentence going to be? Or how are you going to organize your work? So, just asking the students to write I think that would be a pretty cumbersome task. And how Robin was saying, it's easier for students to talk about it. But if you were going to have them do something, that is a nice idea. But just make sure that explicit instruction accompanies it.

**Russell Gersten:** And just to chime in and add a couple of things. I think that very often; it sounds like what we're hearing is journaling may be what's used in the core instruction. And in that case, intervention time can almost invariably start with a variable. But sometimes, visual representations where kids talk through how they solve the problem or how they set up the problem and it would be equally fine. But intervention probably would almost always; would be support for the writing that they'll do in their math class. As opposed to for kids; like of average and above average ability. Where most often, they write first and then discuss with people.

**Sarah Powell**: Yes

**Russell Gersten**: This pre-step almost always needs to be done.

**Sarah Powell**: And I will say that I know that a lot of assessments require students now to either draw with a picture or explain with words how they got their answers. So, it certainly seems like I; like what

Russell was saying. It's a good exercise but maybe intervention should be; you know it should be more in the core instruction. And then intervention could be a support for that.

**Moderator:** Great, thank you. And that concludes our webinar today. Thank you to Doctor Gersten, Doctor Schumacher and Doctor Powell.

**[Slide 72 – Connect to NCII and NCSI]**: This concludes; as a reminder, this webinar will be achieved on our website and the power point will be posted along with a Q and A document along with the questions; along with all of the other questions that we didn't get a chance to answer during this Webinar. If you have any other questions that you didn't get a chance to ask, feel free to e-mail us at NCII@.org. Here is some contact information for the two centers which brought you today's webinar; NCII and NCSI. You can follow us on You Tube and Twitter at @TheNCII.

We encourage you to visit our websites and sign up for our newsletter. We also strongly encourage you to take the survey about your experience with today's webinar. Your browser will be re-routed to our survey page after this webinar concludes. By completing the survey, you will be helping us. You will be helping NCII improve future webinars and document the work, quality, relevance and the usefulness of the tools that we are providing. Thank you all in advance for your feedback.

**Robin Schumacher**: Thanks Neo.

**Sarah Powell**: Thank

**Moderator:** Thank you.