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Understanding the Neurodevelopmental Framework (NDF)

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Carlos Borges:

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Andrea Brothman:

Welcome to the Math for All podcast. In this series, you'll hear from teachers, instructional coaches and school leaders who are bringing the math for all approach into their classrooms, schools, and districts. I'm your host, Andrea Brothman. Math For All is a mathematics professional development program for elementary school teachers. The program helps teachers implement high quality, standards-based mathematics education for a wide range of students, including those with disabilities. This first episode examines a foundational component of Math for All, the neurodevelopmental framework or NDF. I'll back up and explain.

Anytime we learn something, like a new vocabulary word while reading on our own or completing a task like solving a math problem with a partner, multiple cognitive systems or functions are in play simultaneously. Math for All identifies eight systems that make up the neurodevelopmental framework, and those are: higher order thinking, language, spatial ordering, sequential ordering, memory, attention, psychosocial thinking, and motor coordination. Depending on the kind of learning or task at hand, the functions in play will be in varying degrees of demand. But any way a slice it, there is a lot going on. Kids have a lot going on when learning.

We can use the NDF as a tool to help us understand why students succeed or struggle in mathematics when we identify their strengths or challenges within particular functions. So for example, a learner can have a great memory but may be challenged by tasks that require significant interaction with a peer. Or maybe a child excels in activities that require higher order thinking, but due to challenges with motor functions or spatial functions, that child struggles to represent their ideas on paper.

In this episode, you'll listen to a group of Chicago educators discuss how the NDF framework has changed how they think about mathematics education. The conversation is facilitated by Nesta Marshall, a Math for All coach and a faculty member at Bank Street College of Education. I'll also jump in from time to time to highlight some important ideas. Okay. Let's get Adelicia, Shaquila, Carlos and Nesta.

My name is Alicia Brienzo. I am an education specialist with the Illinois Resource Center.

Shakeila:

My name is Shakeila Jones. I am a special education administrator for the Chicago Public Schools.

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Carlos:

My name's Carlos Borges. I am a CPS instructional support leader in mathematics.

Nesta:

Hi, I'm Nesta Marshall and I am so happy to be talking with you. Let's talk about the neurodevelopmental framework and what it is.

Adelicia:

I'm thinking back to when I was in a classroom, and I was working with a group of teachers to first introduce the neurodevelopmental framework. And I remember this being kind of like an a-ha moment for this group, because they had always thought about all of these different functions in isolation. So, they knew about their students' memory challenges that they might be having, or they knew about the attentional difficulty that they might be having in the classroom. They knew about their language strengths that they had in the classroom. But they weren't used to looking at it through a mathematical lens when they were planning. And so being able to think about, okay, let's take the things that you know about this child and all of these different areas and to be able to overlap that with your planning, that was the piece of the puzzle that I think the teachers never had before.

Shakeila:

To me, it magnifies the demands on the student, and I think a lot of times we create assignments, and we create activities without really looking into the depth of what is it that students need to bring to the table before they can even begin to delve into this assignment. So I think for me, when I was looking at this neurodevelopmental framework, I'm like, yes, I need to know what is it that I'm asking my students to do and what are these demands that I'm putting on them and are they able to meet those demands? And for my students that are not, then what am I putting in place to help them meet those demands?

Carlos:

I believe that the neurodevelopmental framework is the answer to "Why aren't the students getting it?" It is a way to answer that question. So a teacher will do the task and then they will use a neurodevelopmental framework to then go through the demands of the task.

Andrea:

During each Math for All workshop teachers pick an upcoming math lesson they plan on using in their classrooms and then do the activity in the same way it's presented for students to do. For example, let's say a teacher knows that after a workshop, they'll be facilitating an activity that asks pairs of students to find and measure classroom objects that are shorter than, equal to, and longer than a foot, and then to record that information on a worksheet. During workshop time, the teacher will find a partner and move around the room with the lesson's recording sheet and ruler in hand so that they can identify, measure, and note the objects that fit the size categories I just described. They'll also take note of all the cognitive demands of the activity. So in this example, a teacher would use the neurodevelopmental framework to take a deep dive into the psychosocial and language demands required for partner work, the motor demands needed to hold a ruler beside an object and measure it, and the various spatial demands that come into play when recording information into a table. Doing the student task helps teachers figure out the neurodevelopmental demands the activity will require of students. Teachers are then asked to think about a specific student in their class. They keep that focal child's strengths and needs in sharp focus as they then spend time adapting the lesson to better support their focal student.

Carlos:

So then as they are going through the demands of the task, they get to analyze, oh, you know what? The way that's worded is a little tricky, or there's a lot to remember in this question. So when you think about the demands of the task, then you're able to think about the student and what you know about the student. And teachers become experts of their students, and so this just encourages them to look at their students in a more specific manner.

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Carlos:

Yeah. I had an amazing experience as a coach with a teacher not too long ago, a couple days ago. So we were Math for All, neurodevelopmental framework, went through the learning, went through the planning, teachers excited to teach the lesson and pick the focal child, awesome work. But what happened was this conversation where the teacher spoke to everyone and said, I believe that this type of thinking, this neurodevelopmental framework, I can use this thinking in all my subjects. That I can see this idea of math for all becoming every subject for all, and I just thought that it was great to see the inspiration that it caused. That the neurodevelopmental framework caused that planning around that while also doing the rest. That combination is a recipe for success in our classrooms and not just in math, but for other subjects.

Shakeila:

Carlos, you nailed it. I love that.

Carlos:

Well, thank you.

Shakeila:

It is a way for teachers to reflect on how they can perfect their implementation of the lesson. So it takes the pressure off of the students not knowing what to do, and instead the framework answers the question that you put out: "Why aren't the students grasping the concept?" And it does put more ownership on the teacher to really look at the lesson, to kind of break that lesson apart, to look at those demands. So man, that was amazing. I love that.

Nesta:

I like also how the neurodevelopmental framework provides this language that is respectful of who the students are as learners. That it's not about them, the students, it's not about me, the teacher, but it's about understanding the brain through this brain-based approach, which helps to illuminate for us the areas in which students might be strong in and areas in which they might be challenged in. And then gives us something concrete that we can be working on, such as this child is experiencing some difficulty with active working memory. Maybe chunking the task might be a way for them to be able to achieve success with it.

Shakeila:

Absolutely, Nesta, and I can speak on from a special education perspective. So when we have students who have an IEP or any student with disability, and they are included into the general education classroom, a lot of times our general education teachers are a little hesitant because they don't understand how to support the student. So utilizing the neurodevelopmental framework, we can identify the areas where the student may need more adaptations to a lesson. So it really guides that support and then by focusing on that student, we're seeing, the general education teachers are seeing, oh my gosh, this is an impact that's going to be advantageous for all of my students. No one has the perfect classroom where all the students are on the same levels, where all the students learn the same. So being able to really recognize through the neurodevelopmental framework exactly what demands are going to be placed on a student, and then to really intentionally plan those adaptations for the student has really been helpful in bridging the gap and lessening the anxiety that our general education teachers have with students with disabilities in their classrooms.

Nesta:

So is there an experience that you've had with a colleague, with a student, where you have employed the neurodevelopmental framework and watch it in action?

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Shakeila:

I can remember that we had a teacher that was a little hesitant through the training, and it was very difficult to encourage them to really embrace their neurodevelopmental framework. So he had a student and he was like, "He just won't listen, he's just not doing what I want him to do. He just sits in class, and he won't do anything." So we kept saying, "Okay, okay, let's go back to the neurodevelopmental framework and let's see where is the area that he's struggling in? What is it that he really needs?" So when we looked, it was simply just attention. Like the student just could not sit and pay attention for that length of time.

Andrea:

In this instance, Shakeila used the NDF to help a teacher identify where the student's struggles may have been coming from. Once they identified that there were attentional challenges at play, they could make a plan to adapt the lesson to better fit the student. That's an example of using the NDF to adjust teaching practice.

Shakeila:

So what the teacher did was he started incorporating more hands-on activities in the math class. He started pulling out those manipulatives that were just collecting dust on the shelves. When he started making his lessons more engaging, the student perked up. He was attentive. But what was even greater was that we finally had teacher buy-in and he came back to one of our sessions and he was like, "You won't believe it. I finally listened to what you all were saying. I incorporated more hands-on activities. I really engaged with the student and my focal student is now one of my best math students." So definitely utilizing that neurodevelopmental framework as a guide to see why are your students struggling? What is the area that they may need additional support in? It has just been a wonderful resource for our teachers.

Adelicia:

I remember having that conversation with the teacher thinking about how does fine motor work in math? They had been using at that time interlocking cubes that are, really even for myself, they're really hard to get in and out. And they went and they switched them to, I believe, Unifix cubes and not just for this one student that was having trouble, and they've started seeing like, wow, something simple as taking away this fine motor barrier has caused us to be able to have more time for instruction and less time fiddling around with things. It's caused more ability for keeping on task and staying focused because the students would get so focused on getting these pieces together that they would lose track of where they were mathematically.

Andrea:

We sometimes make assumptions, in definitive ways, about what a student's challenges are. A history of teacher assumptions can follow a student from one grade to the next and can create a false narrative about whether or not that student is "good at math". But what if that student was never taught in a way that aligned with their strengths? If we don't take the time to delve deeper into the strengths a student is bringing to the classroom, then we are missing an opportunity to help them grow as a learner. The NDF helps teachers consider multiple aspects of cognition when they are in the planning process. It gives them a structure for thinking about the different types of ways they can engage their students, leading to better lesson planning.

Shakeila:

So many times when we're working with students with disabilities, one of the questions that we ask are, "Tell me your student's strengths." And many times we hear "They don't have any strengths." or "I don't know what their strengths are." So being able to refer them to the neurodevelopmental framework gives them a way to identify not just the deficits of a child, but really the strengths of the child. And then where we see deficit, it gives us information on how to provide the support, and that's really what we do with our students with disabilities. We build this individualized educational plan for them that should really hone in on what they can do and how they can do it. It's not just a plan that addresses all of their deficits, but we really want to look at the holistic child. So giving our teachers a point of reference through the neurodevelopmental framework helps them to really see the student in a new light.

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Nesta:

Yeah, I'm thinking how it debunks this idea that some children are predisposed, genetically speaking, to being mathematicians, but on this neurodevelopmental approach, we really are able to demonstrate that not only all children can learn, but also all children can learn mathematics.

Shakeila:

For me, the neurodevelopmental framework was eye-opening because when we really paired it with lesson planning, I just was overwhelmed. I was like, oh my gosh, this is more than just "Solve this math problem", but we're asking them to do so much more. There are so many demands that we're placing on the students that we need to make sure that we're providing those adaptations to them so that they can meet those demands. The first time we went through this, Nesta was our guide, and Nessa is amazing. She asked these probing questions and she kept going back to, "Okay, so what do you think that demands will be for the student?" And she'd say, "Go back to your neurodevelopmental framework and let's go step by step. Let's start at attention. Now, what cognition will they need to know? Let's look at the language in this task. What about memory? What should they come knowing or what do you want them to remember during the task?" So really looking at it through that lens on every lesson that we were planning was my takeaway from here. And when I really looked at it, I was like, "Oh my gosh. The demands that we're placing on these students." Now I understand while math is just more than just solving basic computations, it's also incorporating everything that they've learned and then building upon it in a mathematical manner.

Adelicia:

I think I just want to really say how much I love the neurodevelopmental framework for English learners and multilingual students because it really takes the pressure off the language piece and really helps teachers to think about other ways that children can express what they know. Because if you aren't able to proficiently explain it in the teacher's language, there are so many other strengths that our multilingual learners have that can really be used and incorporated into math lessons.

Carlos:

When I think about the neurodevelopmental framework as well, I think it also gives some levels of hope. So for example, you can say something like, this student or these students have issues. Well, using the neurodevelopmental framework, then we could say, this student actually has these strengths and this is the issue. And that makes me a teacher that feels like, "Hey, I can work with that." Right? So I think it's a hopeful tool that we will look at it and say, it is not that they don't like math or they're not a math person. It is a lot of what we're doing in math, and this lesson, it has a lot to do with short-term memory, and this is what they're struggling with. And once we give them some adaptation to help with that, we have hope. We will be able to see them do it.

Andrea:

At the end of the day, Math for All is about equity. The program aims to increase access to rich mathematics to students with diverse strengths and needs, including those with disabilities. There's a blog post on our Math for All website called Three Act Tasks and a Neurodevelopmental Mystery. In it, our colleague, Arjun CSA wrote, and I'm paraphrasing here, that rich math tasks, alongside planning with neurodevelopmental learning profiles in mind, have the potential to reach all students in the elementary classroom. He also wonders if perhaps neurodevelopmental lenses can help us solve the mysteries of fine teaching.

We hope this podcast has got you wondering about that too.

Tune in to episode two of our podcast where we will discuss another key feature of Math for All, and that is the idea of planning lessons and lesson adaptations with a focal student in mind. Thank you to Nesta Marshall for facilitating today's conversation. Thanks goes out to our guests at Adelicia, Carlos and Shakeila. Thank you to our producer and editor, Burt Granofsky and the entire math for all team for their dedication to equitable math instruction.

Thank you for listening. And I invite you to learn more about Math for All by visiting our website mathforall.edc.org.