

Dan Meyer (00:01):

Hey, folks. Welcome back to Math Teacher Lounge. I'm one of your hosts, Dan Meyer.

Bethany Lockhart Johnson (00:05):

And I am your other host. I'm Bethany Lockhart Johnson. Season five! Hello!

Dan Meyer (00:11):

Bethany, how are you doing? How have you been spending the long break between our recording sessions?

Bethany Lockhart Johnson (00:16):

As much as I loved sharing content from previous seasons, I am so thrilled that we're back for season five. I have been, you know, chasing a toddler. I think he's already tired of me saying, "Ooh, can we count that?" He's like [sighs] "One two, one two." Like, he's done already.

Dan Meyer (00:36):

Too much counting. Yeah, I worry about that so much, that my love of mathematics might be perceived by my kids as smothering. Yeah, I worry about the same. We shared with you folks some bangers of reruns, in my humble opinion. Some great guests. But, we've been excited—me and Bethany—to hop back on the mics, on the ones and twos, and explore some new ideas together.

Bethany Lockhart Johnson (01:01):

Well, I loved our season talking about joy in mathematics. And personally I could...like, we could turn this whole podcast into joy in mathematics. However, we're kind of going a different route. Because if you ask folks why they don't feel joy in mathematics, a lot of times at the root of that is some really intense math anxiety. So this whole season, we're going to be delving into math anxiety. Exploring what it is, who has it, why do we think it happens, what do we think we can do about it, and how can we navigate through it, so that we can experience that joy in math? These are questions that we're gonna explore over the course of the season. Dan Meyer, how do you feel about that?

Dan Meyer (01:49):

It feels big and it feels personal. I mean, as we shared in our math stories back from season...whatever it was, math anxiety was a huge part.

Bethany Lockhart Johnson (01:59):

It was last season, Dan.

Dan Meyer (02:00):

Last...? I mean, who can remember? Big part of your journey. I've had some very punctuated but intense moments of anxiety in math class. And socially, we have built math up to be this incredibly powerful thing. You know, restricting movement on economic ladders, preventing people from getting into careers they want. Whether or not they have much to do with math class, math anxiety is a really large part of educational but also social life. And yeah, I'm really excited to explore it with you. We're bringing on some really excellent guests. Some researchers, yes. But not just researchers! Also people who practice in the field and know firsthand what it looks like to resolve issues of anxiety with students.

Bethany Lockhart Johnson (02:45):

Yeah, you're right, Dan. My math story contained quite a bit of math anxiety, so I am particularly invested in this season. I mean, I still navigate math anxiety. And, you know, many of us do, and let's talk about it. And let's—I love that you reminded me. We're gonna have a lot of great researchers all throughout the season, and a lot of times folks feel like the research happening, there's sometimes a gap between researchers and what's actually happening in the classroom. Not in all cases, but a lot of times. Right? And I remember a lot of conversation about the latest research when I was in grad school, but unless you're actively studying something, sometimes we don't know what's happening. Right? We're really focused on what's happening right in front of us in our classroom. So let's take some of that research; let's break it down; let's talk to some of the folks who are thinking about this for the bulk of their day, right? <laugh>

Dan Meyer (03:41):

Yep. So we got our first guest coming up in a moment here.

Bethany Lockhart Johnson (03:45):

So to kick off this season, we're starting episode one by talking to Dr. Gerardo Ramirez, Associate Professor of Educational Psychology at Ball State University. And he's been researching math anxiety for more than a decade. He's worked with so many amazing folks in the field. He's worked with students, he's worked with teachers, with educators...I'm just so excited to talk to him. If you look up math anxiety, you see his name as one of the folks who is really thinking about this at so many different angles, and we get to talk to him. So enjoy our conversation with Dr. Gerardo Ramirez.

Dan Meyer (04:29):

We are so excited to have Dr. Gerardo Ramirez on the show with us. Dr. Ramirez is an Associate Professor of Educational Psychology at Ball State University. Thanks so much for joining us.

Dr. Gerardo Ramirez (04:40):

Yeah, thank you for inviting me to talk about math anxiety.

Bethany Lockhart Johnson (04:43):

So with your interview, Dr. Ramirez, we are actually launching the season. We're gonna be talking about all different aspects of math anxiety, and it feels pretty perfect that you are first guest of the season, because of the sheer breadth of research and conversations you've had about math anxiety. Could you start us off kind of telling us a story of how did you get interested in studying math anxiety? Or why, you know, why did you dive into this topic that, you know, I think a lot of folks might...like, if you're on a plane, and you say, "Oh, I study math anxiety," what kind of reaction are you gonna get? <laugh>

Dr. Gerardo Ramirez (05:24):

Oh, sure. Yeah. I think most people are actually very interested because they all have their own story about feeling anxious about math, or just being anxious about evaluation situations that involve math. And, yeah, they wanna share those stories. People feel quite comfortable talking about their anxiety about math, for some reason. But for me, I started off, when I was in undergrad, I was studying to take the GRE quiz. I was hoping to go into a psych program. But I wasn't exactly sure what direction yet. As I took some of the practice tests, there's some situations in which I was very nervous about taking the

practice test. And I just noticed that I did really poorly on some of these exams. And so I became very interested in issues like choking under pressure, which means when you underperform relative to what you expected to perform. And so, as I was researching these issues, I started to come across this whole field of math anxiety. And I saw that while there are some people who choke under pressure during tests, there are other people who just have a strong general fear of mathematics.

Dan Meyer (06:29):

That's really helpful. I can imagine you're doing a lot of free psychology sessions, free therapy for people on airplanes when they bring to you their own stories of math. So let's thank you for your service in that sense. <laugh> I'm super-curious. So Bethany and I have both taught math. We both have seen firsthand what it looks like when a student is anxious in math class, though maybe we don't have kind of the clinical language to describe it. And I'm curious, from a clinical sense, how do we define math anxiety?

Dr. Gerardo Ramirez (06:57):

Sure. So first off, math anxiety is not something that you would find in the DSM, for instance. But we generally define that as a fear or apprehension to situations that involve math. So it doesn't have to necessarily be educational situations. It could be someone asks you a math-related question during a party, or you have to calculate the tip at a restaurant, for instance. It doesn't have to be about schooling situations, although that's obviously where it seems to matter a lot for many people. So it is basically a fear or apprehension to situations that involve math. And I think distinguishing the term "fear" from "anxiety" is really important here. A lot of times people use those terms interchangeably, and the term "fear" is obviously within our definition of math anxiety. But oftentimes what differentiates anxiety from fear is that, anxiety is—think of it like a recipe. Anxiety is fear plus a little bit of unknown. OK? So if, for instance, if you hated snakes, and they threw a snake at you, you'd be in intense fear. Whereas if you hated snakes and they said, "There is a snake in the room, but I'm not gonna tell you where," that's gonna cause anxiety. And so the reason why we call it math anxiety is because a lot of times people experience this fear for a possible unknown future that involves math or possible unknown evaluations that people might have about your competence, because of math. And so for a lot of kids, they feel anxious about how they're gonna do on a test or whether they're gonna be able to pass a class or whether they'll be able to understand what you're saying in your lessons, for instance. And so the anxiety component really gets at fear of something that's unknown, but related to mathematics situations.

Dan Meyer (08:47):

Math is somewhere in the ceiling right now. Perhaps I might be surprised with a math situation!

Dr. Gerardo Ramirez (08:52):

Yeah. yep.

Dan Meyer (08:52):

So I have this tendency to assume that every other subject that we teach has it better and easier than math does. It's not true. I know this is not true. But I'm kind of curious here. Is math anxiety, like, part of a general just set of anxiety around schooling itself? Like, is there a reading anxiety, a writing anxiety, and does that all just flow from the same kind of fount of anxiety around schooling or situations about learning? And what makes math special in this regard? If it is its own special anxiety, for instance?

Dr. Gerardo Ramirez (09:27):

There are different...so some people obviously suffer from generalized anxiety. Right? And so they would, you know, feel anxious both for evaluative and non-evaluative situations. But in the research that we've done and that other people have done, there are differences between things like reading anxiety, math anxiety; I've also studied spatial and creativity anxiety. A lot of times what we're trying to do in these studies is we measure all of the above, and we try to show that, look, math anxiety predicts math situations above and beyond these other things. So yeah, we definitely distinguish those things. And so what's special about math is that, well, I think the symbolic nature is a big part of it. The abstract symbolic nature is just not as tangible to students. They can't touch it. And so it doesn't allow 'em to use their full cognitive faculties to play with it, as you might see, for instance, in science. Or it doesn't allow people to relate math to their own interests the way you might see, for instance, in English. So maybe I hate reading novels, but I'm interested in zombies and you give me a book on zombies, well, ok, great, you've connected my personal assets to the topic. Whereas with math, either that's harder to do or instructors don't do such a good job of setting that connection up.

Bethany Lockhart Johnson (10:46):

Also, I think, you know, I've heard of students being really anxious, let's say, during a reading session, when teachers used to do—hopefully they're still not doing it—the popcorn reading, where you just randomly call on a student to read out a sentence. Right? But you don't really hear students or adults talking about, "Oh, no, no, no, I don't read; I don't mess with reading." You know? Whereas with math, you do hear, "Oh, I'm not a math person. Oh no, no, no, don't ask me any math questions." And that is such a distinction.

Dr. Gerardo Ramirez (11:18):

Yeah. And I think a lot of that's because it's just so common. As an adult, to be nervous about reading is kind of an uncommon thing. So people feel a stigma around admitting that. But math is something that everyone feels like they're inadequate in. And so there's a lot of comfort in telling you how they're just one of the many people who don't like math. And that, you know, can have a lot of different consequences and outcomes. I think on the one hand, I think for a lot of kids it becomes a normalized message that if you fear math, that's OK, join the club. Right? But we have to be careful about that, 'cause a lot of math anxiety researchers will oftentimes say, part of what leads to math anxiety is adults normalizing that it's OK to be scared of math. So I think a lot of times adults, teachers, for instance, math teachers, they'll tell kids, "You know, if you're scared, that's OK." And so a lot of the math anxiety community says, "No, no, no, you're not supposed to do that." But my recent view is different. I view that as a form of validation. Because math is hard. And so telling kids, "Hey, look, it's actually easy if you just try," I don't think that's true. It's actually just hard. And I think even if it was easy, to the kid, it feels hard! And I think something that's not really well-studied right now in our field is the value of validating people's math negative math experiences. We don't want to validate that, 'cause we think that we're gonna reinforce that. But actually, I think the opposite. I think when you validate people's negative math experiences, it helps 'em to feel that they can handle it. They can start to take control over their own emotions.

Bethany Lockhart Johnson (12:52):

I love that. And I, I actually, I think that's so powerful, what you're talking about, that validation. I taught kindergarten, and I vividly remember being in a parent-teacher conference and that parent saying, "Oh, I wasn't a math person either," right? Or, you know, their language and their experience with their own

math schooling, their anxiety about math was actually impacting their students' experience of math. Or the conversation that, when I would go to talk about a math assessment, let's say, you could see the parent actually tensing up. And there was this moment of validation, that I felt like we needed to make space for that in the conversation with the parents, right?

Dr. Gerardo Ramirez (13:38):

Yeah.

Bethany Lockhart Johnson (13:38):

Like, this is a real thing. And we are working on teaching students that math is something that gets to—your experience with math gets to look all sorts of different ways. And it's OK if we, you know, make a mistake, or if we kind of only get this part, but we've really got that part. Or let's talk about it; let's write about it. So I really feel like that that validation is something that's so missing. And instead of the validation, like you said, you see folks being like, "Oh yeah, me neither. I'm not a math person either." Right?

Dr. Gerardo Ramirez (14:10):

Yeah. I think...part of the reason why people are comfortable sharing this because they're looking for validation also. When they say, "Oh, I'm not a math person," you know, I think they're hoping that, you'll say like, "Yeah, me neither," or "Of course not, 'cause math is terrible." Right? They're looking for validation, not to reinforce their perspective, but to feel that it's OK not to be a math person. And I think that's one of the techniques that I'm trying to work on in my research right now, is to provide evidence that actually people will work harder when you validate their math experience. You don't have to tell them a positive story per se. If your current story is "Math is hard and I'm very, very anxious; I'm scared," then we can just validate that and help you work through that. And it actually will strengthen our relationships. Because if you're a student and you're struggling with math and I tell you, "Yeah, it's hard; it's OK to struggle with math," that makes you feel seen. And that's gonna lead you to want to ask me more for help, because I'm someone who understands you. And that's a great, you know, remediation opportunity.

Dan Meyer (15:14):

A common thread that I think I'm seeing here in several answers is that math sometimes asks students to disassociate part of themselves. Where success in math oftentimes means working from an a level of abstraction with symbols, like you said, that can feel alien. Like, who am I here? And in the same way, I love that you're proposing we validate and reassociate people with a very deeply felt part of themselves that is anxious about mathematics.

Dr. Gerardo Ramirez (15:44):

Yeah. I mean, I think that's what validation's supposed to do, right? So a lot of us, when we feel these strong emotions, we wonder, "Is this even a real thing? Are other people feeling this? Is there something wrong with me?" So we feel the emotions, but we can't actually deal with them, because we wonder if they're legitimate. And so when someone says, like, "Yeah, this is hard," it crystallizes that emotion. And once something is made real, you can actually choose how you want to deal with it. Some kids are gonna deal with it by staying anxious. But some people are gonna choose to deal with it by saying, "Well, there's nothing I can do about it now; I have to take this math test, so I'm just gonna think positive." And that's great. If the kid can end up saying that to themselves, that's much more effective

than me telling the kid, "Hey, you just gotta think positive. You're gonna start the test anyway." And so we want the kid to make meaning of their experience, and the way we do that is by crystallizing their emotions through validation.

Dan Meyer (16:36):

Yeah. I love that. And so what you're proposing there, I think, sounds like, a solution, like a post-talk solution after students are feeling anxiety.

Dr. Gerardo Ramirez (16:43):

Yes.

Dan Meyer (16:43):

To validate and empathize.

Dr. Gerardo Ramirez (16:45):

Yes.

Dan Meyer (16:45):

And over the course of our season, we hope to explore a lot about solutions to math anxiety that are preventative, that reduce the odds of anxiety arising, through instruction and curriculum, before it arises. And I'm just wondering if you've seen anything that would hint at either specific or general words of wisdom you wanna share with the educators, about not just addressing it after the fact, but preventing math anxiety before it arises?

Dr. Gerardo Ramirez (17:14):

To be honest, at this point, I haven't seen enough evidence for me to recommend anything concretely as an intervention for math anxiety, or an intervention to prevent its development. All I can really do here is rely a lot on the more broad cognitive-behavioral research on anxiety, which says that one of the ways we prevent people from developing anxiety is by helping them to make more positive appraisals of challenge situations. So a lot of times, when kids are challenged, they don't know how to interpret that. "What does it mean that I'm struggling with this thing?" And so that's where I think a lot of teachers can help students' interpretations of that. 'Cause if you leave kids to their own devices, they're gonna think, "I'm struggling because I'm stupid. I'm struggling because I'm not good enough. I'm struggling because my dad is right; I'm gonna be a failure." You know? They're going to impose an interpretation to a challenge situation regardless. And so, as teachers, one thing we can do is we can help shape that interpretation and say, "What does it mean to struggle with math? People will say it means you're stupid. That's one interpretation. What's another one? It means that your brain is working really hard to think through something. That's another interpretation. What's better? What do you think is more helpful?" And then, helping students to see how interpretations matter to how you ultimately feel about something. And that's a very metacognitive way of thinking about things. So yeah, I would say that one way to prevent it is to help students to take more positive interpretations of their experience. But another way, and I think a more successful way, I think, is to give students early experiences where they feel efficacious dealing with math. One of the ways you do that, for instance, is by obviously making sure that the students understand the material—but that's obvious; people are trying to do that. One of my favorite recommendations is to keep reassigning assignments, the same exact assignment, for, say, three weeks, back-to-back. So if in week one you do the homework assignment, you do OK, you don't do

so great, when week two you do it, you give the exact same assignment, and now the student can see like, "Wow, OK, this was much easier." And then, week three, you give the exact same assignment; now the kid's feeling really confident. And the reason why that's great is because it helps kids to see that they're growing in confidence. A lot of times kids don't get to see that because we're constantly throwing new assessments at them. And so they're never seeing that growth. All they're seeing is a new challenge, a new challenge, a new challenge. So I think we need to set up situations where they can feel that they're growing, when we keep the assessment static. That can be a formative assessment, for instance—doesn't have to be a summative assessment.

Bethany Lockhart Johnson (19:55):

That feels so powerful and it feels like it really connects to that validation piece, right? We are actually helping to create a culture in our math classroom where we might struggle with something, but we keep revisiting it. And it's not so much to reach mastery, but as Dr. Megan Franke — we talked to her about this partial understanding and about pulling on those threads of things that you do understand, so that you can build your confidence...build, not just confidence, but build your...I guess, kind of get your footing, right? You're saying, "Well, I do understand this. I see how this works." And if I'm revisiting an assignment, I feel like that would give me permission to like, "Hey, I don't have to have this figured out on the first pass. You know?"

Dr. Gerardo Ramirez (20:44):

Yes, yes. Yeah. I mean, I'm gonna give you a silly analogy, but I think it works. You know, a lot of times people will have nightmares, right? And they'll keep having the same nightmare over and over again, right? And so one reason that we suspect this happens is because they haven't worked through whatever that nightmare's supposed to be about. So if, say, I'm scared of driving, I may be having the same dream about driving and crashing over and over. And we keep having these nightmares. And I think math anxiety is kind of like a waking nightmare, where you keep rehashing something because you haven't had the chance to finally address that dragon. You know? And so if someone was having a lot of fear over driving, then one behavioral approach would be, you know, to work with a therapist to actually get behind the wheel and maybe drive around the same track over and over until you feel comfortable at that, and then the nightmares stop. Well, the same thing is true, I think, about math, math and math anxiety, is that you wanna give people these opportunities to feel confident by going back to that original experience that caused them to feel anxious, and saying, "This one assignment that we did in week three that really freaked you out, let's try it again now in week five. How was that?" "Yeah, it wasn't so bad. It was still kind of annoying." "OK, we'll we'll come back to it." "Now it's week seven. Now let's go back to that assignment. How is it now?" "That's actually...it wasn't that terrible." And that gives people the opportunity to reflect on how they've grown past that nightmare.

Bethany Lockhart Johnson (22:05):

I have to say, Dan talked about you being like a therapist. I'm like, wait, "How did you know, Dr. Ramirez? I did have this recurring dream! I did! And I had to face it. No, but I had such intense math anxiety in high school and it was debilitating. And the biggest thing for me, I thought I was the only one. I thought there was something wrong with me. I thought, "Why can't I figure this out?" There wasn't a conversation about "Here are some tools," or "Here are some, some, <laugh> some...". Like, "This is OK, for you to feel scared about this or overwhelmed!"

Dr. Gerardo Ramirez (22:41):

Mm-hmm. Mm-hmm. <affirmative>

Bethany Lockhart Johnson (22:42):

You know, I think often when we talk about how widespread math anxiety is, I think a lot of folks automatically jump to high schoolers or college students avoiding math courses. But we see this in really young kids.

Dr. Gerardo Ramirez (22:56):

Yeah. So people are...people are just constantly making meaning of themselves, regardless of the age range. And that's true even with young kids; they are trying to figure out who they are. Right? And so one of the things you see oftentimes with young kids is you ask 'em, "What are you good at?" And they say, "Everything!" And that's their attempt to, you know, make meaning of themselves. But sometimes they're not good at everything. Sometimes they actually struggle in math. And I think even early on, they have to make meaning of that. They say, "Well, I'm good at everything except math." And how do you make sense of that? Well, why not math? "Oh, because math is terrible. It's not for everybody. You know, it's not something that I like." And so, yeah, in a lot of the studies that we did early on, we basically went into these first-grade classrooms with the purpose of trying to assess whether we can actually show variability in kids' math anxiety, even early on. In other other words, do kids even report feeling anxious about math situations? Or do they tell us that they're great at everything? And what we found was that in fact, a good chunk of kids are, again, perfectly willing to tell you that "No, certain situations involving math make me very anxious." Counting or addition, or doing a problem on the board. And the way we do that is by—I think there are probably more sophisticated ways that can be done, but this is the best we have at this point—is we go in there and we ask them, we show them a bunch of smiley faces and anxious faces. And we say, "I want you to tell me how you feel about these different situations that involve math." And so we say, "If you feel kind of nervous, I want you to point to this face. If you feel very nervous, point to this face." And we basically will read to them situations. We'll say, "How would you feel if your teacher asked you to open up your new math textbook and you saw all the numbers inside of it?" And they'll point to the really nervous face. So right now, those are some of the more reliable assessments for math anxiety among young kids. And that work showed us that even young kids are self-reporting math anxiety.

Dan Meyer (24:51):

Obviously this is worth our study, because we would hope people would not feel anxious in general, and especially if we have a mandated...kids are mandated to be in math classes for their entire childhood. So I see the need for this study, these studies. I'm curious: What are the consequences, though? Like what, what correlates with math anxiety? What are other reasons why we should care about math anxiety and work to remediate it?

Dr. Gerardo Ramirez (25:16):

Oh, sure. So it correlates with their actual math performance. It can correlate when they choose to do homework. Right? So a lot of times, the parents report having to fight with their kids over math homework a lot. And you also oftentimes see a lot of frustration over mathematics specifically. And so it can, you know, not only affect their academic ongoing outcomes, like math tests and math assignments, but it can also affect their relationship with their parents. So if every time you come home, your dad's screaming at you because you haven't done your math homework, and when he asks you to solve the problem in front of them, you don't remember, 'cause you were checked out, 'cause you're so stressed



out, that's gonna cause a really negative experience. You know, a lot of times people grow up and they still remember their dad screaming at them over the math homework. You know, it'll affect your relationship with your teacher. So if you're making me feel incompetent, if you're stressing me out, you're not the kind of person I wanna come to for help. So it can predict relational outcomes as well as academic outcomes. And down the line, of course, when it affects students' opportunities to get into things like AP classes, it affects students' standardized test performance and their choice of colleges, as well as scholarship opportunities.

Dan Meyer (26:29):

Once you show that it correlates to performance, then that opens up a whole range of other correlations that are pretty important, it sounds like. Whether that's career options or, you know, post-secondary education and the like.

Dr. Gerardo Ramirez (26:40):

Yeah. And a lot of times, when people are choosing a career at college, a lot of times students will make a decision specifically based on what career has less math requirements or less math courses. So I think this finding needs to be verified further. But, there's some studies showing that, for instance, elementary ed teachers, one factor that feeds into the decision to go into elementary ed is the math requirements are very low in elementary ed. So that can...obviously it's not what we wanna hear, because these are our first formal math teachers, right? For our kids.

Bethany Lockhart Johnson (27:16):

It feels so powerful, the impact that math anxiety can have, not only while you're in, let's say, elementary school, high middle school, high school, but then the impacts beyond that in terms of your career. And I shared this last season, when we talked about our personal math story, but I know when I was navigating the deepest part of my math anxiety, I really felt like, maybe this is a reason I can't be an elementary school teacher. Because I was so worried that I wouldn't be able...not that I wouldn't understand the math for fourth grade, fifth grade, but that there was something about my ability to teach it or understand it or develop a love and passion for it that I wouldn't be able to do. And I really had to reclaim it <laugh> in my own way. But, you know, something that I think is so powerful about your research is just the applicability — not only to the field of mathematics, but folks' everyday lives. And the way that you have talked in the past about math being a gatekeeper...I have a family member who, brilliant American Sign Language interpreter. I mean, amazing. Like a dance with her fingers. I could just watch it all day. And she actually didn't complete the program because she couldn't complete the math requirements. And I remember talking to her about like, "Well, have you gone to the free tutoring? Have you gone to, you know, this or that?" But it was a paralyzing fear, you know? So Dr. Ramirez, what do you wish educators understood about math anxiety? Or the research about math anxiety? Or maybe even the general public at large, what do you wish folks understood about math anxiety?

Dr. Gerardo Ramirez (28:58):

Oh, I think that a lot of students, they struggle with math. And I think we wanna normalize that struggle as much as possible. We want to create a culture where it's OK to do math slow; it's ok to take your time. And I know that's not possible with a lot of these requirements that a lot of math teachers have to do. But I think if we want to prevent math anxiety, we have to create opportunities to tell better stories. So that's ultimately what I tell people is, why do people develop math anxiety? Because they had

experiences that challenged their competency and they told a negative story. And so making space to reflect in math classrooms about what does it mean to go slow in math, or what does it mean to make mistakes, and then helping kids to tell better stories, I think it's really the best thing we can do as math educators. 'Cause you know, your job is not to be a therapist ultimately. You know, there's only so much math teachers can do. But I think one of the most powerful things we can create is setting up students' experiences where they feel confident, and they can tell better stories, so they can have better dreams about math.

Dan Meyer (30:06):

Really appreciate this introduction to math anxiety. It's been a fantastic kickoff to our season. Dr. Ramirez, thank you so much for joining us.

Dr. Gerardo Ramirez (30:14):

Sure. Thank you.

Dan Meyer (30:16):

Thank you folks so much for listening to that conversation with Dr. Gerardo Ramirez, Associate Professor of Educational Psychology at Ball State University.

Bethany Lockhart Johnson (30:25):

Dan, OK, if not for your frantic signaling, I would've probably asked another 20 questions. I need to know what you thought <laugh>.

Dan Meyer (30:34):

I found it interesting at all points. And especially I think I started to understand a little bit better where the anxiety comes from for some students. I got a little bit here, which is that I think math, more than other disciplines, involves alienation. Check that word. You like that? Alienation? I'm into it. I'm feeling it. It's like...to get good at math, to be successful in math, you gotta, as a kid, lose your attachment to the world you understand. And I mean, "got to" as in like, "you are asked to" — many times, unfortunately, by curriculum and instruction. Which is to say, you're turning things you can hold onto into numerals. Right? You're turning the world and its patterns that you can see and touch into Xs and Ys. And I just don't know that other disciplines deal with that as much. Maybe I'm wrong and just guilty of, you know, "grass is always greener" syndrome here. But I think that's an experience that kids have in math. And I thought that Dr. Ramirez got at that when he's talking about the need to validate a student's experience of anxiety. Like, in treating anxiety, sometimes we alienate people further by just like saying, "Oh, no, no, no, it's just like, you need to, you know, drill yourself more, practice more," and kind of invalidate that. So this feeling of alienation, I think permeates a lot of math instruction. I'm looking forward to learning more about that with our future episodes

Bethany Lockhart Johnson (32:00):

Alienation. That's interesting. I definitely felt, I definitely felt isolated <laugh> and alone many times in my math journey, when I was having my...you know, in high school, when I was feeling like, "Clearly everyone can look at tan, sign, cosign, and that means something to them." Right? I think it's really interesting, because I'm thinking about the other disciplines; I'm running through them, and I'm like, even in science, which can seem abstract, so oftentimes there's these experiments that accompany

these concepts, where you're like, "Look at this concept made real in front of you." Right? <laugh>. And so yeah, that's really interesting.

Dan Meyer (32:39):

You're always one step away from blowing something up! <Laugh> Or, you know, dissecting something that's tangible to you.

Bethany Lockhart Johnson (32:46):

Yeah. That's really interesting. I did really love how he brought up the abstract. And how, I think, even validating it...he talked so much about validation. Which to me was like, YES. If somebody just said, "Hey, it's not only possible to have math anxiety, but it also doesn't mean that you don't belong here." If somebody had said that, it would've literally changed the trajectory, you know? And I wonder what those conversations could look like in our classrooms, where teachers celebrate that. Like, WHOA, this is a new way to think of this. This is a new way. Asking how many, or what do you notice for this image, through a mathematical lens, or looking...we talked to Alison Hintz and Antony Smith, like mathematizing books, like looking through these lenses — it's an invitation to step into this other world, right? But there's not only one way to do it. And I think oftentimes it's like that anxiety of "Am I gonna say the right thing?" or "Am I gonna notice the right thing?" Right? How do we create that space more, where there's so many possibilities and we want kiddos to notice what they notice, right?

Dan Meyer (33:54):

You gotta become a certain kind of person to be successful in math class. I feel like is part of the implied deal. Where you've gotta—like how you said—say a certain thing or think about a certain thing a certain kind of way. You're trying to become someone who is not necessarily you. Which I think is fundamentally an experience of alienation, separating you from important parts of yourself.

Bethany Lockhart Johnson (34:19):

I will never, ever dive into mathematics on the scale and level that you have with your PhD. You understand math in a way that my brain just...I won't get there, right? And yet I'm allowed to call myself a mathematician, with all of my deep dives in elementary math and my love of early numeracy and thinking about how we start thinking about counting and numbers. Right? It's like, if we make more space for what mathematicians can look like, and what is your personal relationship with math...I mean, that to me feels really exciting. 'Cause I think we both have something to offer each other.

Dan Meyer (35:03):

I think I have never found early math more interesting than when I talk to early math educators. And learn just like all the different ways that students come to understand a concept that I had thought was simple. Like addition of whole numbers. Whoa! There's a lot of ways kids do that work, and their brains think those thoughts. And, yeah. That's a good word there you're offering us and our listeners.

Bethany Lockhart Johnson (35:27):

Yeah. Yeah. I'm really excited about this season. I think there's — again, there's no way we're gonna cover all facets of math anxiety. But I think having the chance to explore it over the course of a season is going to be really fascinating. And really, I hope, destigmatize it and open up the conversation for our listeners. And, you know, if you listeners...we wanna know what you thought of this episode. Do you have any particular questions? Do you have questions related to math anxiety? Questions related to this

episode? We are in development for this season, so we're gonna do our best to get those questions answered. You can keep in touch with us in our Facebook discussion group, Math Teacher Lounge Community, and on Twitter at MTLshow.

Dan Meyer (36:14):

Next time, we're gonna go deeper into the causes and consequences of math anxiety.

Dr. Erin Maloney (36:20):

It's not just the case that people who are bad at math are anxious about it. It's actually that the anxiety itself can cause you to do worse in math. And that for me is really exciting, 'cause it means that if we can change your mindset, then we can really set you on a path with several more options available to you.

Dan Meyer (36:41):

Til next time folks,

Bethany Lockhart Johnson (36:41):

Bye.