

Dr. Erin Maloney (00:00):

It's the anxiety itself in many ways that can cause people to underperform.

Bethany Lockhart Johnson (00:06):

Welcome back to Math Teacher Lounge. I'm Bethany Lockhart Johnson.

Dan Meyer (00:10):

And I'm Dan Meyer.

Bethany Lockhart Johnson (00:11):

This is episode two of our new season, all about math anxiety. Who has it? What is it? What do we do about it?

Dan Meyer (00:20):

I'm learning so much, learning a ton.

Bethany Lockhart Johnson (00:22):

I loved our first conversation with Dr. Gerardo Ramirez, episode one, our first episode of the season. Really, our goal with that conversation was just to—we need to talk about the basics of it, for reals. Like, what is math anxiety?

Dan Meyer (00:36):

What is it? How do you measure it? How's it defined? Super-helpful stuff.

Bethany Lockhart Johnson (00:40):

There's not only one way that it's measured. But it's like, in active research right now, how are folks making sense of it? And I think Dr. Ramirez did such a fantastic job of sharing that with our listeners. And I learned a lot. You learned a lot, Dan?

Dan Meyer (00:56):

I did. And I'm also super-excited to take that knowledge that we have developed together and go and build on top of it and keep on climbing up up the mountain here, and learn more about math anxiety. Which is why we're super-excited to have a guest on, Dr. Maloney, who is going to help us learn more—especially about what happens to the brain when it's experiencing math anxiety. There's some really complex stuff that happens there, including the role of parents and educators in creating and resolving math anxiety. And I think we'll also learn that the whole situation is a bit of a hot mess. And we'll try to make it a little bit less messy together.

Bethany Lockhart Johnson (01:34):

Little bit less messy. Dan, if we do nothing else, can we make it a little less messy?

Dan Meyer (01:41):

I sometimes prefer more mess, but in this case I prefer less. So.

Bethany Lockhart Johnson (01:45):

I have a two-year-old, so everything is a mess.

Dan Meyer (01:47):

Your life is mess. Yes. <laugh> Right. Well, I'm excited for you folks to hear this. It was a delightful conversation, so yeah, tune in. We are joined by Dr. Erin Maloney.

Bethany Lockhart Johnson (01:56):

Let's go. We are joined by Dr. Erin Maloney, associate professor in the School of Psychology at the University of Ottawa, where she directs the Cognition and Emotion Laboratory, as well as serving as the Canada Research Chair in Academic Achievement and Well-being. Welcome to the show, Dr. Maloney. We're so excited to have you in the Lounge.

Dr. Erin Maloney (02:20):

Yeah, thank you so much for having me. This is fantastic.

Bethany Lockhart Johnson (02:24):

So our last season was all about math and joy. And even when I read your title, I felt more joyful. Like, somebody is thinking about academic achievement, but with well-being in mind. I love it.

Dr. Erin Maloney (02:39):

Aw, thank you.

Dan Meyer (02:40):

Cognition and emotion!

Bethany Lockhart Johnson (02:42):

E-mo-tion!

Dr. Erin Maloney (02:43):

I don't think they can be separate. I think that you have to think about them together, 'cause they're so intricately connected.

Dan Meyer (02:49):

Love that. People try, but we love that. Yeah. That's our vibe here, too.

Bethany Lockhart Johnson (02:52):

People try. That was a big problem with my math anxiety. They just wanted...there was no room for my emotion. They're like, stop weeping at your desk—

Dan Meyer (03:00):

It's rearranging neurons....

Bethany Lockhart Johnson (03:01):

—you're distracting the other children. So would you mind telling us the story of how you even got interested in this topic? You know, when you tell people that you study math anxiety—or, actually, I don't know how you describe it to them; I'm hopeful you bring in that well-being part—but how did you get here? What do you, what do you, what do you...yeah, tell us! We love it!

Dr. Erin Maloney (03:23):

<laugh> I feel like what you're actually asking is, "How did you make life choices that got you to here?"
<Laugh>

Bethany Lockhart Johnson (03:29):

Justify your life choices! Ready? Go!

Dr. Erin Maloney (03:32):

<laugh> Whoo. OK. So, all right. So we often, in psychology, we joke that instead of doing research, we do "me-search." And that's, that's admittedly true in my case. I was a student who absolutely loved math up until about eighth grade, and then something changed, and all of a sudden I was terrified of math and I had absolutely no sense of self-efficacy in it. Despite trying really hard, I was extremely anxious about it. And so I initially, I set out...my parents were completely convinced that I was absolutely capable of doing mathematics and that I was getting in my own way. And when I went to university, I decided to prove them wrong. So I set out to prove that some people just can't do math, and that's the end of it. And, you know, 20 plus years later, my parents were right. And it turns out that many people—well, I would argue virtually everyone—can do math. And that if you are really anxious about it, it can get in the way. And interestingly, you know, in, in the years that we've been doing this research, there's really good strategies that can be used—that hopefully we get a chance to chat about—that can really help reduce the amount of anxiety that students are experiencing. But I really did set out, like the bold teenager that I was, to prove my parents wrong. And that backfired <laugh>. So I know it's kind of a strange answer, but it's the truth. So I was really interested in understanding why it was some people just could not do math.

Dan Meyer (05:10):

That makes two for two so far, on guests for this season who did a version of me-search. And I feel like this is pretty common for a lot of researchers. Like, I wanna figure out...my experience as a teacher, the part where you, I think, diverge from a lot of people I knew in grad school, myself included, is that you actually let counter evidence change your perspective on things. Whereas I feel like a lot of us go in: "I know this is true and I'm gonna gather data!" and lo and behold, I'm true! But only now, with the research TM, you know, trademarked research, attached to it. So that's, really exciting. Thanks for sharing that.

Dr. Erin Maloney (05:43):

No, you're welcome.

Bethany Lockhart Johnson (05:44):

But don't people say that the more personal you get, the more universal it is? Right? So if you go and get your doctorate about something that you think is just your experience or in your brain, then people are gonna be gonna be like, "Wait a second; you think that too?" "Wait, that math anxiety isn't just you?" I don't know, it sounds like a pretty great path to me. When you tell folks that you study math anxiety or

when you're speaking to folks about your research, do you find that there is a lot of folks who relate to what you're studying? Or how does that conversation typically go?

Dr. Erin Maloney (06:20):

Yeah, so it is I think an extremely relatable topic. Not in the sense that everyone experiences anxiety about math, but everyone seems to know somebody who's really anxious about math. Or everyone's at least aware of the stereotype that like some people are math people and some people aren't, and that's just the way it is. So it feels like everyone has feelings about math and everyone seems very happy to share those feelings. So one thing I've always found really interesting, and actually, so I, I know you mentioned that you had Gerardo on recently. Gerardo and I have had really interesting conversations about how people are really quick to tell you that they hate math and they can't do math, and they're anxious about math. And I've yet to have anyone ever tell me they hate reading, they can't read, they're really anxious about reading as an adult. So for some reason math seems really different. And in that sense people always seem to be pretty excited to talk about their feelings towards math.

Dan Meyer (07:23):

Yeah, definitely. Been on an airplane or two myself and had those conversations. You know, people asking to be reseated because they found out that I do math for a living or whatever. Or just unburdening themselves, for sure. I'm super-curious: I think that the fact that you are doing the research is reason enough to want to dedicate your life to this study. But I am curious: If you were gonna justify to someone else, why is math anxiety important to study? What are its consequences, even outside of math education? What would you say to that?

Dr. Erin Maloney (07:57):

So I think it's probably not hard to convince people that success in math is important, right? So we know that children who start elementary school behind in mathematics tend to stay behind in mathematics, unless they have any kind of very targeted intervention. We know that children who do worse in mathematics throughout K to 12 education in general get lower-paying jobs when they're older. We also know that when they do worse than mathematics relative to their peers, there's fewer jobs that are open to them, relative to if they excelled in math. Right? And so I think in many ways there are really clear consequences for students who are not comfortable with math and who avoid it. But I think one of the really, really interesting things about math anxiety, and maybe part of why I've fallen in love with it as a research topic is that it's the anxiety itself in many ways that can cause people to underperform. So 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 career-wise. And I think that is really empowering.

Dan Meyer (09:18):

Hmm. Yeah, definitely. And I'd love for you to explore — your laboratory is the cognition and emotion laboratory, which I love, how you're creating those linkages between how you feel about a thing and what your opportunities or your aptitude for learning it. I'm really curious, can you say more about the, the relationship there? How does feeling anxiety impair your ability to do mathematics?

Dr. Erin Maloney (09:41):

Yeah, so feeling anxiety, typically what you tend to experience is these negative thoughts and ruminations. So you can imagine, you're somebody who doesn't really love math, you're pretty anxious about it; you know, Bethany, maybe you've had this kind of experience before. I'm gonna call you out on it. I've had it many times, where you sit down to do a math test and all of a sudden you're not focusing on the actual math test in front of you. You're focusing on things like the consequences of not doing well on this. Right? Or "my parents are gonna be really disappointed if I don't pass this test," or "my teacher is gonna think negatively negative of me," or sometimes we see things like, "I'm a girl, girls don't do math." These types of stereotypes. And what happens is that those thoughts actually tie up really important cognitive resources, like, really important memory resources, that you need to do the math test. And so if you are trying to essentially do two things at once, right? You're trying to deal with all these negative thoughts that are distracting you and you're trying to do the math test, then you're not going to do as well as someone who's sitting down and doesn't have all of these distracting thoughts to deal with. And we actually know that from research that we have in our lab right now, where we just ask people like, "Hey, when you did this math test, what kind of stuff are you thinking about?" what we find is that the people who are really anxious about math report a whole bunch of thoughts that are unrelated really to the math test, per se. It's more about the consequences of doing poorly. And as a result of those thoughts, they actually end up doing worse.

Dan Meyer (11:14):

This has been really helpful to figure out, how the emotional state of doing math affects the ability to do math. And it's really interesting how you're saying that the direction of the causality can go from the emotions to the cognition. And I'm just curious then, what is the source of the bad emotions about math? Where does that come from? Is it nature? Is it nurture? Some combination? How do you see it?

Dr. Erin Maloney (11:39):

Yeah, so one, that's a fantastic question. And there's been a whole bunch of people all around the world that have been spending a lot of time really trying to pinpoint that down. And I think the answer is that it's, you know, it's complex. So most of what it's looking like right now is that it is a combination of both. So essentially what we find is that kids who start elementary school who are a little bit behind in math—and for the question of why they're behind, that's also complex; it could be genetics, it could be just environmental input, before the child ever entered formal schooling kind of thing—but in essence, what we find is that kids that start school behind in mathematics, those are the children who are most likely to develop anxiety about math by the time they're finished first grade. OK? But we also know that once they've developed the anxiety about math, then that's when they get these thoughts and ruminations that kind of tie up those memory resources, that then is gonna make it harder for them to succeed in math tests. So you get into this sort of vicious cycle, right? Where maybe you start behind a little bit and then you develop the anxiety, the anxiety causes you to underperform relative to what you should be able to, so now you're even further behind, you get more anxious because you're not doing as well as you'd like to...but again, kind of coming back to the "Why are the children starting behind in the first place?" Some of that seems to be the role that parents are playing in the household. So some kids come from a household where parents are playing a lot more math games with them, talking about mathematical concepts on a regular basis. Maybe they have older siblings who are, you know, practicing arithmetic and, and mathematical processing in front of them. And so those kids are exposed to more math before they ever even start formal schooling. Those kids seem to do better. And then we also know that the parents' attitudes matter a lot too. So what we find is that when parents are high in math anxiety themselves, especially when they help their children a lot with their math homework in really early ages, we find that those kids end up being more anxious about math by the end of the school year,

and they also end up doing worse in mathematics. So it really does seem to be, you know, kind of a complex set of factors that have something to do with both maybe genetic predisposition to success in math and genetic predisposition to anxiety, but then also the social attitudes and stereotypes about math to which you're exposed at home that really seem to be coming together to create this anxiety in young children.

Bethany Lockhart Johnson (14:24):

I feel like everything you're saying is <laugh>...it makes so much sense and yet it's so often not talked about, right? Because it's just more like, it gets boiled down to, "Oh, they're just not a math person," instead of all these other factors that are at play. And I completely remember the anxiety I felt, whether it was a test or not, walking into my math classroom when I was in ninth grade. And there's no way I was set up and ready to learn. Right? <Laugh>. And something with—we mentioned Dr. Ramirez, he was talking about validating that anxiety. If teachers validate that like, "Oh, you know what, sometimes you might feel stumped, or this might feel overwhelming." Even the power in creating space for that in the classroom, right? And acknowledging that it doesn't—math doesn't have to "come easy" to you in order for you to have access or make sense, is such a powerful concept. And I love the way that you are looking at all these different factors and saying, "Hey, it's both simple and also a lot more complicated than we're we're making it." Right?

Dr. Erin Maloney (15:36):

No, and I agree with that sentiment so much. Like, I think, though—one thing I will sort of caution is that I think when teachers are validating the anxiety, or when parents are validating the anxiety, I think there's a very fine line that needs to be walked where we need to be able to say, you know, "It's OK to struggle with something. That's, that is completely OK." And as we're, you know, as we're working towards something that's really valuable, right? We can, we can work hard at something and by working hard at it, we're going to get better. And I think that type of validating is really, really important and valuable. I think what we wanna be careful of is not to say things like, "Oh, it's OK. I also never loved math." And, you know, "Oh, I was never a math person either." And so even though we might be bringing comfort to the the child, I think that that's sending the wrong message. And so sometimes it's really well intentioned and really not great—

Bethany Lockhart Johnson (16:37):

A hundred percent.

Dr. Erin Maloney (16:38):

—in terms of the messaging. So that's the only...so just for people listening, the only sort of caution that I would give there is that I think there's nuances to the validating of the feelings that are important.

Bethany Lockhart Johnson (16:50):

I am so glad you said that because as a kindergarten teacher, I vividly remember—and this is as early as, you know, the kids are five years old, right?—and I remember in a parent-teacher conference, a parent saying, "Oh, I wasn't a math person either," or, "Oh, no, ugh." And they were so quick, like you said, they wouldn't say that about reading, but they were so quick to talk about their lack of natural math aptitude, right? And, and it was really interesting because you know that even if they're not saying that specific thing at home, those attitudes are absolutely carrying over at home. And they're absolutely carrying over to, to how they interact with their kiddo around math and around what's happening in the

conversations about math. And I felt like a lot of times my work as a teacher was also to help support parents through their own math anxiety, and help give them some new language for how they can talk about math. And that math is more than just getting to an answer quickly. Like, let's talk about, let's go on math walks, let's go on number walks, what numbers are around the home? Or oh, is that bigger than this? Do you have more of this? And even those little things, I, my hope was that it was starting to shift the conversation around what math was possible in the home, particularly when you saw that it was the parents who had palpable math anxiety. Right? And how much you know that that's gonna impact what's happening when you sit down to do homework together.

Dr. Erin Maloney (18:22):

Yeah. And I love that you have worked to encourage parents to do that. So we do similarly. Like even from a research perspective, where I will often give talks to parents and teachers and we talk about the idea of trying to mathematize everything, right? So just the idea that math is absolutely everywhere, and you know, whether it's a matter of playing games in the car with your kids where you're thinking of a number and it's "My number is higher than 42, but lower than 80, and what number do you think I might be thinking of?" And, and gradually trying to get the child to that number. Or, you know, asking questions like, "What's your favorite even number and why?" And just little things like that that, that I think can make math fun for kids, that help—I don't even know how to explain it, but just that idea of bringing joy into it, so it's not always this heavy subject that kids have to come to. So we definitely try to talk to parents about the idea of, like I said, mathematizing everything. And usually it's well-received, 'cause often parents find it empowering, right? They're like, "Oh, well, I could do that! But like, that's not math!" And you're like, "No, but it is."

Dan Meyer (19:33):

Yep.

Dr. Erin Maloney (19:34):

Like, it is! And sometimes parents will say like, "Well, I don't know how to do fractions." And you're like, "OK, but how do you bake?" "Well, I don't know! I just, like, I know how to do those fractions!" And you're like, "OK, but that's the starting point. Let's work with that." Like, let's, you know. And I think a lot of times, it's reminding the parents that they're actually far more capable than what they think they are, despite the fact that maybe they struggled with math when they were younger.

Dan Meyer (19:58):

Yeah. This is so interesting. And I feel like part of the challenge around conversations about anxiety and math and how to, how to resolve it and where it comes from, is that it, like, it presupposes a single definition of math. And so, you know, we're talking about like how to be more mindful about math. But you know, like if kids were walking every day through a treacherous street, you know, the solution might not be become more mindful about that street. It's just like, we gotta fix the treacherous nature of the street, really. You know, I love that we're talking also about redefining what math is, making it more playful. That feels like a super-important component here. I'd love to know more about what you know about the role of gender in all of this. Are there differences in the way boys and girls experience math anxiety and how it relates to achievement in math?

Dr. Erin Maloney (20:48):

Yeah, so, there's really, really interesting research on gender in math anxiety. So in general, we find that girls tend to experience more anxiety about math than boys do. So one hypothesis is that it has to do with just social stereotypes that, you know, girls are, are good at reading; boys are good at math, kind of thing. So there's some evidence to suggest that that might be playing a role. There's other evidence to suggest as well that maybe boys actually do experience as much anxiety, they just don't really own up to it.

Dan Meyer (21:20):

Ooh, yikes.

Dr. Erin Maloney (21:21):

So thoughts are, you know, there's a bit of an apprehension for males to admit experiencing the anxiety. But I think one of the things that is extremely interesting about it—at least to me—is that we don't tend to see gender differences in young children. So in early elementary school, even though we'll see that kids as young as six years old will experience anxiety about math, and that that anxiety is related to how well they do in math and how much they enjoy math, it doesn't seem to vary as a function of gender at that young age. It doesn't seem to be related to gender until kids are at about sixth, seventh grade that we really start to see this gender difference coming online. And so that, to me, suggests that it's probably something more social than biological at play. It probably has something more to do with these stereotypes and stuff. But another really interesting—or at least, I'm biased, but to me—another really interesting line of research that comes into play—and some of this is stuff out of my own lab—so we know that boys in general tend to do better at spatial processing than girls. And we know that spatial processing is really important for math, right? So math and space are pretty connected. And by spatial processing, I mean things like being able to picture something rotating in your mind or, you know, envisioning how these puzzle pieces might fit together. And so we know that boys tend to do better at that type of processing. And the gender difference there seems to be related to gender differences in math anxiety. So there's some speculation, too, that it might be that as the math starts to become more reliant on spatial processing, that that's when we see this separation between boys and girls with respect to how much anxiety they feel about math. So a lot of this is to say, I think the answer to the gender question right now is what I think what we would officially call a bit of a hot mess, <laugh> where I think there's probably more questions than answers. But I think that there's definitely something going on. And it really seems to be coming on later in elementary school.

Dan Meyer (23:32):

That's a refreshingly honest admission from a social scientist, that it's a hot mess and not perfectly clear, <laugh> so I appreciate that. It's interesting what you said about the spatial reasoning. In our work creating curriculum at Amplify, I find we lean a lot on trying to tie abstract math towards spatial topics. Like, can you estimate a quantity before you calculate it? Can you identify a pattern and where it breaks before you prove it abstractly? And, I dunno, it's just interesting to me. I'm just thinking out loud about how I feel like math becomes more abstract rather than more spatial. The farther you venture into secondary math...I'm wondering if I misunderstand what you're meaning by spatial, and the progression of math from K–12.

Dr. Erin Maloney (24:20):

Yeah, so I think you can still have—you can have math be abstract, but still really relying on spatial processing. Right? And I think part of that is maybe a bit of us having different definitions of when we

say "spatial." So in cognitive science, when we talk about spatial representations or spatial reasoning, it's really like anything you're picturing in your mind, any time you're really picturing these things in your mind and manipulating those images at all. So if you imagine, even like at a simple level, but it's gonna hold when you're going more complex as well. So doing like equivalence problems, for example, where you have to balance the equations.

Dan Meyer (24:58):

Yeah.

Dr. Erin Maloney (24:59):

Even just being able to envision things kind of moving around that equal sign and bringing one piece of the equation from this side to the other is actually an extremely spatial kind of reasoning. Right? Or when you're expanding, that's actually extremely extremely spatial, despite the fact that it might not feel like it initially. Obviously anything in geometry is going to be very spatial. So I think, in that sense, we would argue that the spatial processing is still playing a pretty important role. But it's maybe a different type of spatial processing than what we're seeing at a very early level in elementary school. That said, you can completely disagree with me too. 'Cause I could also just be wrong, and that's fair. My kids tell me I'm wrong all the time. So I'm used to <laugh> being told that I'm wrong.

Dan Meyer (25:47):

Well, we're a bit more deferential on this here show, with our guests. So I would not do that. But it makes sense, what you're saying about how these are things that you manipulate in your mind, whether they are Xs and Ys or numbers and fractions. These are all things that we manipulate. That ties into differences in this spacial reasoning category, it sounds like, which then contributes to math anxiety. And it does start to feel like there's a lot going on here, is what it feels like.

Bethany Lockhart Johnson (26:14):

You mean hot mess?

Dan Meyer (26:16):

I meant hot mess.

Dr. Erin Maloney (26:17):

Yeah. <laugh>, I think that's the technical term, right? I'm pretty sure that's the technical term for it.

Dan Meyer (26:21):

I didn't know the citation for it. So I didn't say it. But I knew who in literature named that. But yeah.

Dr. Erin Maloney (26:28):

I'll write something at some point.

Dan Meyer (26:30):

We'll cite Maloney, 2022. Yeah. Yes.

Bethany Lockhart Johnson (26:34):

So I will say that one of my dreams in thinking about this season and last season, but particularly this season, since we're really getting to talk to some researchers who get to think about this, and have really interesting conversations about it all the time...one of my dreams is that we're bringing—'cause we do have some folks who are researchers that are listening, right? But then we also have teachers and folks who are in the classroom every day, and parents and caregivers listening. And so I think one of the beautiful things about the way that I hear you talking about it is you're thinking about the research, but it's so applicable. Right? And I wonder if there's anything else you can say around it. I wanna reduce that divide, that gap, between the research that's happening and then what's happening with the kiddos and in the classroom and at home. And I don't know if it's like a magic wand thing where like <laugh> if there were changes you'd wanna see at a societal level, to try to combat math anxiety, but you see where I'm going. You know, it's like <laugh>....

Dr. Erin Maloney (27:39):

OK. So I'm gonna answer maybe in two ways. So I think the first thing that I'm hearing from you is that idea of diminishing this divide, right? And so one thing I try to keep in mind, as someone who's a researcher and working in the lab, I will often be called in to talk to teachers and give professional development sessions. And they often want the sage-on-the-stage academic, that stands up there and tells you the answers to things. And one of the first things that I'm gonna admit when I get up there is, "I am not on the front lines." So what I do in the lab, for me to tell you that that's gonna work in a classroom of 30 kids who may or may not have eaten dinner that day, and may or may not have snow pants, and may or not...like it's--

Bethany Lockhart Johnson (28:23):

Mmm, yes.

Dr. Erin Maloney (28:24):

You know, I think we also need to be a little bit reasonable. So I try really hard in my own program of research to make sure that I'm always talking to teachers and to principals and to curriculum designers to make sure that the ideas that I have make sense. In fact, one of the most recent book chapters that I wrote, I wrote in collaboration with a really good friend of mine who's a principal, an elementary school principal, and a former math consultant. And we wrote it together, to really say like, "Hey, here's how we can help each other inform how research can inform practice and how practice can also inform research." 'Cause he can come to me and say, "I'm doing this. I can't find anything in the literature to support this, but I'm sure it works!" And we can design something in the lab to test whether or not it seems like it's gonna work.

Bethany Lockhart Johnson (29:11):

That's huge. Yeah.

Dr. Erin Maloney (29:12):

Empirically. And so I think that open communication is massive. One thing that we're doing in my own lab to try to keep that open communication available. So to anyone listening who's ever tried to get access to a journal article, they're held behind paywalls, right? So one, the way it works, my understanding of this anyway, is that the journal owns the formatted version of the paper. So what we do is we put up audio recordings of all of the research papers that we ever publish. So I'm pretty sure I own the words as the author, and the journal owns the prettified version that you can buy. So we audio-

record all of our papers, so that if teachers or parents ever want to hear the actual science that's going into some of these decisions, they have access to at least the stuff that we do in our lab. And we also put up an infographic for every paper, just highlighting kind of the main questions and main findings. And we do that because I think that the only way for the information to actually be useful is if it gets into the hands of the stakeholders that actually need that information.

Bethany Lockhart Johnson (30:21):

And is accessible. That's huge. That's huge!

Dr. Erin Maloney (30:24):

Yeah. Yeah. So that's one way that we try to do it. And like I said, the other thing, we try to always be working with principals and with teachers. I joke that the way that I remedied this in my own life...so my husband's a teacher; it's like, I just married one! It's fine! <laugh> I can grill him on a regular basis, and be like, "I wanna try this experiment. Do you think it's gonna work?" And he can say, like, "It's not going to. Here's why."

Dan Meyer (30:47):

That's awesome. Marrying a participant—you know, a research participant—is unethical, of course. Would not clear IRB. But turning your partner into a participant? Like, what are you gonna do? That's great.

Dr. Erin Maloney (30:57):

Yeah, no, that's fair game.

Dan Meyer (30:58):

Yep.

Dr. Erin Maloney (30:59):

Yeah. So that's—I think we we compensate each other <laugh>. So, no...so I do joke a little bit about that. He was a teacher simply 'cause he wanted to be one. Not 'cause I needed him to be one. But, I think that communication part is, is really key. That's one thing. Then the other part of the question or the other sort of piece of the question that I was hearing is that idea of, how do we fix math anxiety. Right? Like, what's the great, "I'm glad that there's a whole bunch of time and effort and energy going into trying to understand this, but what, where are we at?" And I think with that, it's really, really promising. So there's been a lot of research coming out looking at how best to help children or even adults manage their own anxiety about math. And there's a few really interesting strategies that seem to be quite effective. So one, and I don't know if—um, it feels weird calling him Dr. Ramirez, just 'cause I know him well!—but I don't know if Dr. Ramirez would've talked about this when he chatted with you, but he has some really interesting work on expressive writing. Did he chat about that at all?

Bethany Lockhart Johnson (32:07):

He didn't, but I've read some of his work about it and I think it's so fascinating.

Dr. Erin Maloney (32:11):

Yeah! So, OK, well, I'll tell you about his work on it.

Bethany Lockhart Johnson (32:13):

Yes, please. Please.

Dr. Erin Maloney (32:14):

Because it's super-useful. So when we talked about that idea of how anxiety causes these thoughts and ruminations, and they tie up the memory resources that you need, what Gerardo has found is that when you get students to write about their anxiety for about 10 minutes before they do a test, what ends up happening is they end up doing better on the test, relative to if they would not have written about their anxiety at all. And this is particularly true for students who are really high in anxiety. OK? And the idea is that all of those thoughts that they were going to have about the test or the consequences of the test, et cetera, you just kind of get 'em...it's like a mind dump where you get 'em all onto the page at first before you even go to do the test. And now when you go to do the test, you're not having to do two things at once. You're no longer dealing with these thoughts 'cause you got 'em all out on the paper beforehand. And so Gerardo has some really interesting work showing that that works for math anxiety. And then it also works for just testing anxiety in general. And so that's a strategy that I love. I also—part of what I really love about it is it's so low-cost, right? You need a paper and a pencil and it's great. So those are always my favorite strategies, the ones that don't really cost us anything. So that's one way of dealing with like the cognitive part of the anxiety. The other thing you can do is try to deal with the anxiety part of the anxiety. So for that, what we find is that the typical strategies that you're gonna see for anxiety tend to work for math anxiety. So things like focused breathing. Right? Making sure you're doing deep inhales and exhales. That really diaphragmatic breathing seems to be quite helpful. We know that what we call progressive desensitization is really key. That's the idea of doing things, you know, starting with the questions that you know how to handle. And then gradually working up to the more difficult questions. So you're sort of gradually exposing yourself to the more complex stuff. And how that can play out on an actual test at school is, you sit down, and instead of just starting with question number one, you actually read the whole test, see which questions you feel like you know the best, start with those questions, and that helps build your confidence so that you're better able to tackle the questions that are maybe a little bit outside of where you're currently at. So that seems to be really helpful. The other part that I will say, too, that's extremely helpful: So we know that anxiety really ties up those memory resources. And so the more you can make the math automatic, the more immune it's going to be to anxiety in the moment. And so I know that this part can be a little bit controversial, because we don't wanna necessarily demotivate children, and kill the enthusiasm for math that we're trying to cultivate...but really, you know, really committing your arithmetic facts to memory can be extremely helpful. So really learning those times tables, really learning your addition and subtraction facts. 'Cause what happens is, then when you're in a situation where you need that information, even if you're anxious and you're working with fewer cognitive resources than what you would normally have, you actually don't need that many cognitive resources to be able to pull something from memory that you've memorized. So it really helps to kind of protect you against some of the negative impacts of the anxiety while you're doing that test.

Bethany Lockhart Johnson (35:37):

And you're not using all your cognitive resources to figure out seven times eight, because you can really focus on what you're trying to do with that. Oh, that's fascinating. Yeah. Yeah.

Dr. Erin Maloney (35:47):

Yes. No, a hundred percent right. And so I know that's one that, like I said, I know it can be somewhat controversial because it's...you know, we've talked about—or we haven't talked about in this conversation, but we often talk about—the idea of drilling and killing. Right? So you drill the facts, you kill the, the enthusiasm. But I think that there are ways that we can drill arithmetic facts, or help make them automatic, but still fun, right? It doesn't have to always be in a high-pressure kind of way.

Bethany Lockhart Johnson (36:16):

Totally. And we've talked about fluency, and I'm sure we'll talk about it more in the Lounge. And that is interesting, that link between anxiety when the fluency isn't there, that—or, of course we hear about anxiety with timed tests, but the idea of that IS something you can do to reduce it, because you have those facts just at your ready. Right?

Dr. Erin Maloney (36:37):

Yeah. So I actually, again, I'm gonna be a little bit controversial. So I don't hate timed tests in the way that a lot of people do. But I love time to practice. So I think once we've got to a point where children have a fairly decent understanding of skills, of a skill, once they've got a fairly decent grasp on it, then I love the idea of the timed practice. So it can be still in a low-pressure situation, where in many ways it doesn't matter if you get the answer to the question correct. But we're practicing doing it in a situation in which you might be feeling a little bit of pressure, but it's not real pressure, if that makes sense. And I think that can be really, really useful for students. And again, it can be done in a fun way, right? It doesn't have to be these super-intense ways. It can be fun. But I think that in life there are situations in which the time that it takes you to complete a problem matter. And I think that we have to make sure that we don't get too far away from that.

Dan Meyer (37:40):

Yeah. It feels like we should do an entire other episode thinking about ways to develop that fluency and automaticity that don't contribute to anxiety, or create further disparities between people who are high math anxiety and low math anxiety. Not a small question, I'm sure. And I appreciate you alluding to all of that. You know, this whole thing, as you said, is quite the hot mess. And I feel like you, Dr. Maloney, have helped us make this a little less messy, in our heads, and hopefully the listeners' heads. I really appreciate that. I just love...you've mentioned lots of resources that you have. You've alluded to them: audiobook-style readings of your research, which I need 'cause I just finished, you know, Harry Potter, the seventh book, so I need a new thing to listen to like that. Also infographics. Can you tell our listeners where they can find this work of yours, and if there are any other kinds of resources that you wanna plug for our listeners here?

Dr. Erin Maloney (38:32):

Yeah, for sure. So all of our resources can be found on my lab website. So the address for that is www.ErinMaloney.ca. So there we have, like you said, the infographics and the audio articles and all that stuff. And then we also have a link to a new kids' book out, actually, that a colleague of mine and I have published recently, that really walks through some of these strategies on combating math anxiety. The book is written as a children's book, so it's Peyton & Charlie Challenge Math. But it secretly is a book that would also work for adults. So if you are a parent that's a little bit anxious about math, or a teacher that maybe is a little bit anxious, and you wanna see how some of these strategies can play out, in that book—we linked to it on the website, but it is available for purchase on Amazon. And the one thing I will say about the book, 'cause this is something that we were pretty proud of, so Sheri-Lynn Skwarchuk,

who is a school psychologist, and I wrote the book. And it's available for purchase at our cost price, so we don't actually make any money on the book. It was literally just a way of getting some of the science out to people who might be able to benefit from it.

Bethany Lockhart Johnson (39:45):

Reducing that divide!

Dr. Erin Maloney (39:46):

Yeah, well that's what we're trying to do! Right? So I think in the U.S., I think it's like \$6 on Amazon. And then in terms of other resources, we're in the process right now of creating some informational videos and and stuff like that that hopefully will be useful for parents and for teachers, just in terms of understanding a little bit more about the anxiety and understanding how to deal with the anxiety in the classroom more, at home or wherever it might be coming up.

Dan Meyer (40:15):

Well, thanks so much. I really appreciate—we appreciate!—you coming on, and hearing about how you're trying to bridge so many different barriers from research to practice, and school to home. It's just really inspiring. And we'd love to have you back on sometime. So thank you so much for joining us.

Bethany Lockhart Johnson (40:29):

I feel like we've just hung out! Don't you, Dan?

Dan Meyer (40:31):

Are we rolling here? Oh my gosh, we're rolling. I just thought we're just hanging. Yeah,

Bethany Lockhart Johnson (40:34):

I thought we were just hanging!

Dr. Erin Maloney (40:36):

I know, I do, I really appreciate that it has a very kind of chill vibe to it.

Dan Meyer (40:41):

Chill vibe. Like a lounge.

Bethany Lockhart Johnson (40:42):

It's the lounge!

Dan Meyer (40:43):

Thank you. You get us; you get us. <laugh>

Bethany Lockhart Johnson (40:45):

Dan Meyer. I was shopping for children's books, and there was this book, and it was talking about being at home with Mom. And it's going through all the things that the child did that day with Mom. It's like, "We played outside, we ran through the sprinklers, we even did some homework." And it shows them

sitting at the table with the homework, that's clearly math homework, in front of them. And the mom is like, "Harrumph!" Like a very perplexed, anxious face. And there's all these question marks above her. And it's just like,

Dan Meyer (41:24):

"There should not be numbers on that paper!"

Bethany Lockhart Johnson (41:25):

Exactly. And the child is like, "Ohhhh," you know. And I mean, I have to give credit to the illustrator, because they really did capture the clear message of this interaction, which was sitting down to do math homework or think about math together is a source of angst. Right? According to this author and according to too many people. And so I think what's really important is that we recognize those images when we see them out there and speak back to them, and say, "Hey, wait a second." Yeah, it can feel like that, and it doesn't have to. And what's going on that that's just the assumed way that it's gonna feel, to sit down and math together. You know?

Dan Meyer (42:11):

Yeah. It feels like we all have a lot of work to do on the whole math-anxiety front. Dr. Maloney helped us see how parents play a part, educators play a part, society and how they create people plays its own part in how we all define math as a thing where we evaluate student thought or where students play it with their thoughts, has its own huge part as well. So yeah, it was a really fantastic conversation with Dr. Maloney. I hope you folks will check out the show notes, where you will find links to Dr. Maloney's website. A lot of her work, which as you heard, is very geared towards practitioners and parents and even directly at kids, especially the new children's book she co-authored, Peyton & Charlie Challenge Math.

Bethany Lockhart Johnson (42:55):

Next time we're gonna dive even more into the nitty gritty of combating math anxiety. To do that, we're actually gonna be joined—I am so excited about this—by Dr. Rosemarie Truglio from Sesame Workshop.

Rosemarie Truglio (43:09):

Our core audience are two- to four-year-olds, and they love math. And what's not to love? Children don't come with this math anxiety. Math anxiety is learned.

Dan Meyer (43:23):

So excited.

Dr. Erin Maloney (43:24):

Sesame Street was a huge part of my childhood and my toddler doesn't know it yet, but Sesame Street is coming. It's coming. Like, we're we're gonna introduce Sesame Street to him. We just haven't yet.

Dan Meyer (43:37):

Sesame Street straight raised me.

Bethany Lockhart Johnson (43:38):

Right?

Dan Meyer (43:39):

Yeah. Don't tell my parents. But that's, yeah, that's true. I'm excited, too. It's gonna be a blast.

Bethany Lockhart Johnson (43:45):

I'm really excited. I think that the more we dive into this topic—which, again, we're gonna look at math anxiety from a lot of different angles—and I'm excited to talk to Dr. Truglio about how we can take this research and these conversations that are happening about math and how it can actually impact what's happening in homes. 'Cause we wanna help create positive relationships with mathematics, with kids in math. I'm so excited. And I hope you folks keep listening. We love having you here in the Lounge. And if you haven't already, please subscribe to Math Teacher Lounge, wherever you get podcasts. And if you like what you're hearing, please leave us a rating and a review. It helps more listeners to find the show, and let other folks know about this show. Recommendations are great. Thanks so much for listening.