

Bethany Lockhart Johnson (00:00):

If I look at a sheet where students have filled in a page of answers, I may be able to put that neat score on the top and enter it into my grade book. But then, what do I actually know about what that student knows and how they're thinking about numbers?

Dan Meyer (00:14):

Welcome back to Math Teacher Lounge. I'm your host, Dan Meyer.

Bethany Lockhart Johnson (00:17):

And I'm your other host, Bethany Lockhart Johnson. Hello, and welcome.

Dan Meyer (00:22):

Hey, Bethany. It's wild where we've been right now. I think we have been exploring fluency over ... let me pull up my my hands and fingers and toes to count them up. <laugh> Ten! Ten whole episodes! That's been a lot of learning.

Bethany Lockhart Johnson (00:35):

Ten episodes. And I gotta tell you, I know you were hesitant about diving this deep into fluency, but, as I reflect on our time together, I feel like we've just scratched the surface. We could do another 50 episodes on fluency and it wouldn't be enough. Don't you agree, Dan?

Dan Meyer (00:53):

I think that's right. Every guest has answered a question that I've had, that you've had, that we've had, perhaps, about fluency ... and then also opened up entirely new areas of investigation for us. Whether that's thinking about community more deeply through fluency, or assessment, or classroom practices, how to develop it. Like, I wanna know more about how we create games with Dr. Jennifer Bay-Williams. All these different folks who offered us a glimpse into their expertise and then pointed at paths towards more learning. It was a really great time. I don't regret it at all. <laugh>

Bethany Lockhart Johnson (01:27):

And for folks listening, you know, this is the same as last season, when we talked about math anxiety as our focus for the season. You know, we did not go into this with the goal to answer all the questions. Like Dan's saying, this season brought up more questions, which I think is a good thing. The folks we're in conversation with gave us different perspectives, and I loved that we were able to talk about so many different aspects of fluency. And like you said, we're leaving with more questions. Hopefully our listeners have some things that they are curious about and they want to take into their classrooms or into their staff meetings. And hopefully this helps to further the conversation, and our definition and our understanding of fluency is bigger and better for having spent this time together.

Dan Meyer (02:17):

That's right, yeah. And the service we'd love to offer you folks — and for ourselves, at this moment — is to look back at those episodes and pull out some of the themes that felt most meaningful or impactful or interesting to us. Producer Martin Kessler will be pulling out some audio clips to help anchor us in those conversations. We'll also talk about the future of the podcast and what's next for us. But first, I think we'll have a really good time here, revisiting some of the biggest ideas of the season.

Bethany Lockhart Johnson (02:45):

For sure. And that is a perfect time to give a little shout-out to our producer, Martin Kessler. Y'all don't know, but behind the scenes, it takes a lot of work to make us sound this good. So—

Dan Meyer (02:57):

I'm getting emotional.

Bethany Lockhart Johnson (02:58):

Big kudos, Martin. You know what else? We won't be diving into each episode individually, but I also wanna give a shout-out that not only did we have another live episode from NCTM like we did last season, but we also had a special bonus episode with Dr. Nicole Joseph, author of Making Black Girls Count. And it was really special to have such a journey this season. So, let's dive in.

Dan Meyer (03:25):

Let's do it. So yeah, every guest we ask the same question, which I thought was really helpful. This was Bethany's suggestion, to ask them, "What's a way that you're developing fluency in your day-to-day life?" And why it's so helpful for me is that fluency in math class, I think, has a lot of ideological baggage attached to it. There's ideas about authority, for instance, that are attached to math class that aren't attached to other areas of life, where math class has this really, I think, outsized importance in the world. We define who gets to go to college and who experiences prosperity through math achievement. Which makes all of us a little bit nutty when it comes to ideas of fluency and ordering forces in math classroom. The same is not true of other areas of life. So it was really helpful to ask people, "So, where are you developing fluency in your day-to-day life?" and draw lessons out of that that weren't quite as inflected by all the social forces that are present in math class, I thought. So, let's run through a few of those answers right now. We have a question we love to get to know our guests by asking.

Bethany Lockhart Johnson (04:26):

One of the things that we're asking all of our guests...

Dan Meyer (04:29):

And we're curious...

Bethany Lockhart Johnson (04:30):

We're curious...

Dan Meyer (04:31):

Is there an area of your life....

Bethany Lockhart Johnson (04:33):

Outside of math...

Dan Meyer (04:34):

As personal as you wanna make it here...

Bethany Lockhart Johnson (04:35):

...where you've developed — or you are currently developing — fluency?

Fawn Nguyen (04:41):

It's baking. Bake a baguette.

Jennifer Bay Williams (04:43):

OK. So my favorite thing that I'm developing fluency in is horseback riding.

Lauren Carr (04:47):

Well, over the summer I started learning how to sew. I don't think I realized how much math goes into sewing. If you're one inch off, that throws off your whole outfit. And so—

Bethany Lockhart Johnson (04:58):

Wait, you started with clothing <laugh>?

Lauren Carr (05:02):

Yes, they—

Bethany Lockhart Johnson (05:02):

That's impressive.

Dan Meyer (05:04):

Straight for the final box.

Bethany Lockhart Johnson (05:04):

Yes!

Jason Zimba (05:05):

I roasted about 30, 40 chickens in the exact same way. To the point where now I prep the chicken without opening the book. And, you know, I know the temperatures and the times ... but of course, every chicken's a little different. So you can't just apply an algorithm for having a nice roast chicken.

Art Baroody (05:24):

At this point in my life, I'm trying to be a better husband, father, and grandfather <laugh>.

Bethany Lockhart Johnson (05:32):

Oh!

Art Baroody (05:33):

It's always a work in progress. But it's especially important to keep my wife happy. <laugh>

Myuriel von Aspen (05:39):

For the past six months I have been learning Italian. So as I'm going through this process, I'm noticing that what has helped me learn is that I practice it on a regular basis. I also like doing it in little chunks.

John W. Staley (05:52):

So let's go personal: My quiet time with God. There are days when I think I'm doing well with it. There's days when I'm light. And the consistency across the days is something that I continue to myself step back and look at. I've got multiple strategies that I can bring into it. So as I think about "building that fluency," I'm thinking about which strategies do I need? Which ones do I want to use that day?

Jody Guarino (06:15):

I started doing Pilates a few years ago, and at the time I was like learning vocabulary. And I would listen to the instructor cues and interpret them and attempt to do them. Often my attempts would be followed up with some immediate feedback from the instructor. And now having practiced a few years, I wouldn't say I'm fluent, but my form has certainly improved.

Bethany Lockhart Johnson (06:36):

Dan, I think we could be done. That sums it up. That's fluency.

Dan Meyer (06:39):

We did it. We did it, folks! Right there in that montage. <laugh> I'll be real. I have thought about some of those for a long time after the interview. I think like Jason Zimba was our first interviewee, and his comments about roast chicken, I felt like they mapped so cleanly onto fluency that I've continued to think about them when I'm helping my own kids in mathematics or helping other kids. I've been doing some Zoom tutoring recently with a family friend. Anyway, just to name a couple of things that we love about what we learned from those people: one for me was the idea that fluency has a purpose that that extends past the immediate task. Where, as Jason has roasted so many chickens, he now can do it more easily. He mentioned also in that interview — I recall this — "I don't need to like, you know, bear down and clear my schedule from one o'clock to five o'clock before a dinner with friends. I can kind of whip that up ASAP." I bet his first chicken, he's like, "Don't talk to me. Everyone, quiet. Gimme peace." And now he can carry on a conversation with somebody. That's one element of a lot of these different testimonials about fluency that I thought was really powerful.

Bethany Lockhart Johnson (07:49):

Absolutely. I remember some of your misgivings about this topic were about, "Fluency? Where's the excitement in that? Where's the newness in that?" And what I think you are pointing out and what I think we've seen from our guests, it's like fluency can have richness in itself as students develop these strategies and really build this deep foundation. And also, we don't become fluent in our basic math facts, and then we're done with math. That's just one piece of the puzzle. And this question, it helped us get to know our guests better, and two, it was just so fun to see the connections between what they're gaining fluency in and the topic for the season. However, Dan Meyer, I don't know if we have recently ... maybe in like our first episode about fluency, we talked about what we are gaining fluency in. But I would love to know, Dan Meyer. Can I ask you the question?

Dan Meyer (08:51):

Yes. And vice versa.

Bethany Lockhart Johnson (08:52):

What are you gaining fluency in?

Dan Meyer (08:56):

Yeah. I'll just say, kind of duplicative of Jason Zimba, cooking in a general sense. This 2023 was the year where I tried to make something new to me every week. I'm trying to share the household labor a little bit more equitably around here. And cooking has not been my domain. Cleaning the dishes, that's how we kind of split it up. This is gonna sound embarrassing to anyone who's ever cooked anything, but like, dicing an onion is a thing I've done maybe 25 times over the last year, across 25 dishes or so. And just to be able to do that, to know how to dice it a certain way, has just been ... yeah, to not think about that, to involve my kids in that. 'Cause at first I'm like, "No, stay far away. Sharp knives. I don't know how to use these things. People could get hurt." And I was like, "Yeah, let's do this together. And you can toss 'em in and stir 'em in oil." Just noticing this, I think, noticing the structure of what I'm making, how, "Oh, like lots of these things have oil, onion, garlic, and that's how we're gonna start things off, and that's kind of a foundation of flavor." The fluency, I'm like, "Well, these are all just special snowflake dishes," basically. And my fluency in certain kinds of staples or stock-ingredient combinations has let me learn a little bit more about how these flavors are playing together. So that's a little plus one on cooking and baking as a metaphor for math learning. I'm still processing a lot of that.

Bethany Lockhart Johnson (10:14):

I love that. And I would like to say I'll sample dishes that you make any time, Dan.

Dan Meyer (10:19):

Come on by. Come on by <laugh>.

Bethany Lockhart Johnson (10:22):

So for me, I've shared this before that I'm learning to play piano. And I think it has been very humbling. Because my friend loves to send me these videos of these five-year-olds playing like Mozart and Bach. And I'm like, "Hey, listen! Learning! I'm a lifelong learner, OK?" <Laugh> But I realized that when I practice consistently, when I take the time to actually pay attention to the patterns in the music and the structure, I'm able to make more sense of it. And I think for me, the joy has been those few times when I haven't overthought what the note is, but when my fingers just know where to go. It's just so joyful. And my husband plays violin. My kiddo loves music. So I have this vision, Dan — you'll be invited — I have this vision that we're standing around the Christmas tree and I'm playing carols on the piano and we're singing ... can you picture it? Can you picture it?

Dan Meyer (11:31):

I can. I'll bring over my sauteed onion and garlic mixture that everyone loves.

Bethany Lockhart Johnson (11:35):

<Laugh> You'll build the flavor. You'll build the flavor.

Dan Meyer (11:38):

We'll enjoy together.

Bethany Lockhart Johnson (11:39):

But this is a lot of fun, to ask our guests this question, and we encourage you listeners to share and to think about what's something that you're building fluency in or what's something you'd like to build fluency in.

Dan Meyer (11:49):

So one point of all of this whole season has been, what is fluency anyway? And there are lots of different academic definitions one might use here. I'm just curious for you, Bethany, what has concretely stuck to you throughout this season? What does it mean to be fluent? Do you have a sentence at this point that you might help someone else learn what it is we're talking about when we talk about fluency?

Bethany Lockhart Johnson (12:14):

Sure. I feel like it has grown over the course of this season. But when I think about math-fact fluency, I am thinking about ... students are accurate. The answer is correct. They're flexible in their strategy. They're using strategies appropriately. They're using a known fact to help them solve or using a strategy that fits the problem. And, you know, honestly, I know this is a little controversial, but fluency for me also incorporates speed. And I don't mean speed in terms of timed tests. I mean it's there, it's at your fingertips, I'm not hunting around for middle C — I just know where middle C is, right when I'm playing the piano. And so for a student, they can be a really fast skip-counter — 5, 10, 15, 20, 25. Oh, five times five is 25. But when they just know it, it's just there.

Dan Meyer (13:11):

Yeah. I think I would add ... or maybe, I don't know if I'm saying modify the ideas about speed, but I think automaticity ... "automatic" and "efficient" are words that speak to me very strongly when it comes to math. Maybe that's the same as fast or speedy. Regardless, I do think it's interesting to think about, for all the different disciplines our guests talked about developing fluency in, which of those requires speed? For which of them is like speed and actual attribute or virtue? When Art Baroody talks about trying to get better at being a spouse, or John Staley talks about his spiritual practices, I'm thinking about those. Speed really doesn't have a place in those, trying to more automatically and quickly treat your spouse with kindness or, you know, really burn through those prayers in faster and faster reps every time. So I'm walking away with a lot of closed questions — or more closed questions than we started — but I still am wondering: to what extent is speed versus automaticity versus efficiency an element of math class? Just an open question, and I'm still thinking about it.

Bethany Lockhart Johnson (14:21):

Yeah, no, thanks for flagging that. I like efficiency a lot better than speed. 'Cause I think too often "speed," that word in the wrong hands, can cause a lot of math anxiety. And we don't want our kids to think that's what math is about, that the person who's fastest at math is the true mathematician. So if we can think about it in terms of efficiency, that feels a lot more to the core of what we, what our guests, highlighted and flagged.

Dan Meyer (14:49):

Yeah. Yeah. I think so. Can I share my favorite quote about fluency? I've not shared it with you or on the pod, certainly so far.

Bethany Lockhart Johnson (15:01):

I would love that.

Dan Meyer (15:03):

A quote that a lot of people who I think disagree with me, and I disagree with on other matters, around engagement and the role of direct instruction, we all like this quote. Which puts it near and dear to my heart for that reason. And I think it's a smart quote. It's from someone named Alfred North Whitehead. Someone who is, I think, a mathematician a very long time ago. Says this: "It is a profoundly erroneous truism" — so, a wrong thing — "repeated by all kinds of copy-books and by eminent people when they are making speeches, that we should cultivate the habit of thinking of what we are doing. The precise opposite is the case. Civilization advances by extending the number of important operations which we can perform without thinking about them. Operations of thought are like cavalry charges in a battle — they are strictly limited in number, they require fresh horses, and must only be made at decisive moments." And that imagery, I think, has stuck with me for a while. About the skip-counting to 25, for instance. That's like a cavalry charge. You've only got a little bit there. You've only got a few of those. And you're actually better off when you can do these things without thinking about them. I think that oftentimes we say that has certain implications for teaching that I think go a little bit awry. Where if we'd like people to be automatic, the thing to do is to put them under these kind of contrived conditions of time and stress. But I do like this idea that, yeah, all things being equal, I would love to not have to think about where middle C is or which spices on my list I should get for roast chicken or what five times five is. So that's a just a little parting, season-ending offering for the potluck here.

Bethany Lockhart Johnson (16:42):

I love it. And actually, lest you forget, you have shared that quote. I can't forget Mr. Whitehead.

Dan Meyer (16:48):

What? What, really?

Bethany Lockhart Johnson (16:49):

Yeah. In fact, I think you shared it in the episode with Val. But it's still true though. It's still true. It is still true.

Dan Meyer (16:59):

It's true a few months later. It's true. All right. There it is.

Bethany Lockhart Johnson (17:01):

<Laugh> That was a couple years ago. It's OK. And it did stick with me. That's the thing. It stuck with me. You have these limited resources, right? Our working memory is limited.

Dan Meyer (17:10):

Yep.

Bethany Lockhart Johnson (17:10):

And so we, we talked about this last season. If we can not expend all of our working memory on trying to figure out six times seven, you know, by the time we're done with that, we don't have resources left for the juicy problem ahead of us. Actually, let me give you an example. Yesterday, I'm sitting on the

couch with my kid and we were talking about something, and I don't know where it came from, but all of a sudden I said, Do you wanna make some cookies? And what do you think his answer was, Dan?

Dan Meyer (17:47):

"No, thank you. Carrots, please."

Bethany Lockhart Johnson (17:49):

Exactly. So of course he said, absolutely. No, he did not. He said, "Yes, I do." And I said, "Oh, let's make snickerdoodle cookies!" And so I said, "I have a recipe for snickerdoodles. The best snickerdoodles I've ever had. My friend gave it to me 10 years ago. I know just where it is." I went to my recipe area to look for the snickerdoodle recipe for 15 minutes. I looked for this recipe, and at the end of that 15 minutes, I still hadn't found it. And guess what? I was all done with the idea of making cookies. I had used up all of my energy <laugh> trying to look for this recipe. Now, some may say, "Why didn't you just google a snickerdoodle recipe? That would've been faster. Why didn't you look at a cookbook?" You know, though, listen. I had a vision <laugh>. I wanted to make these cookies with my kid. And I was so frustrated that I couldn't find it. I went, you know what? Let's go play outside. <Laugh> Which is probably ... anyway, that's what I think of when I think of Mr. Whitehead. I think of this idea that I had this much energy and I'm holding my fingers not very far apart. I had this much energy and I used it all up on the hunt and muck instead of on the juicy part.

Dan Meyer (19:06):

Your fresh horses were no longer so fresh.

Bethany Lockhart Johnson (19:09):

OK. So we had 10 episodes. Dan, for our listeners, we wanna help kids develop fluency. What do we do, based on what we've learned so far this season? I'm curious if there are some specific takeaways we could, share and we could even share some clips from some of our guests.

Dan Meyer (19:28):

Yes. Let's roll on it. I got maybe three that come to mind immediately. OK. One, uncontroversially: Repetition of a certain sort. Repetition being helpful to develop fluency. Let's attach tons of caveats to what kinds, and what amounts, and what experiences are repeated. The second, that I've been thinking about throughout our season, is how students are often repeating and developing fluency in more than just the mathematical operation at hand. They're developing fluency in certain ways of thinking about themselves mathematically. And ideas about what math is more generally. So it's easy to think about, "Well, when I give kids this kind of worksheet with all these problems, they're getting fluent in this operation, but also they're getting fluent in either this sense of "math has purpose," or "math doesn't have purpose, beyond getting a grade on my worksheet." They're practicing: who am I as a mathematician? I'm someone who takes orders and executes them faithfully without creativity, let's say. So I've been keeping that in mind through some of the guests that we had on. And then, you know me, I love the technical aspects of creating a math experience. Think about that constantly, working in curriculum right now. And so I pulled a lot, I think, from Dr. Jenny Bay Williams in thinking about fluency and conceptual growth not as a strict binary, not as a light switch — it's either in fluency mode or concept-building mode — but is a dial that can be turned part way. And so I loved the way the games that we played at the NCTM live session with Dr. Jenny Bay Williams, I loved how those involved fluency and subtracting two-digit numbers, but also through some of the strategy of the game. We were

thinking conceptually about place value, for instance. About the tens and the units and how they interact with each other. So that's a couple off the top there that just really got me lit up. I think maybe you can hear my tone of voice that I'm very much more engaged and excited about ideas of fluency than I was in episode one of this season. That, for me, has been a real, real joy. What about you? Any thoughts on those thoughts? Or thoughts of your own about what you pulled out of this season? How to develop fluency?

Bethany Lockhart Johnson (21:45):

I love that connection between math identity, thinking about math, identity and fluency. I think that's really powerful. These repeated experience in mathematics are building our math identity. That's so great. Yeah, I mean, there's so many takeaways. But I think a few that I really appreciated were the ideas around not going this alone. I think both Myuriel and Jody Guarino, Dr. John Staley, I feel like so many talked about "how do you do this work with others"? And there's so many people who have been thinking about fluency. So for our listeners who are like, "I have this bigger idea of what fluency could look like — how do I start this work? Or how do I shift the work I'm already doing?" There's so many different resources out there. Our guests alone have myriad resources that they offer. And how can you find, for example, an accountability buddy? Maybe your whole school doesn't wanna do a yearlong fluency study, like Dr. Guarino talked about. That's kind of a rarity. But can you find a buddy in your school, or via X, or at a conference, that you can dive into the work together and you can together share resources or learn what's out there or what your school or grade level's already doing? Take a look and see, what are we doing and what little shifts could we make that will lead to big shifts? And I wanna share a clip from Dr. Guarino talking about that.

Jody Guarino (23:15):

In that situation, I think there was a lot of leaning into each other. So I think if people are interested in working on fluency, finding a friend — even if that friend isn't at your school or at your grade level — who can sort of be that accountability partner or thought partner, that can lean on each other as you're doing this.

Dan Meyer (23:33):

Great advice for any kind of learning in a community like a school. It's great when everyone's pulling in the same direction. But at minimum, find someone who's interested in what you're interested in and learn together.

Bethany Lockhart Johnson (23:45):

Absolutely. A couple other things that stuck out to me. One was the strategy of it. I wasn't at NCTM, sadly, so I didn't get to experience this game in real time. But while I think that there was power in a game like the one that you all played, I also think about, "how are we incorporating strategy?" The way that Dr. Val Henry teaches. Or Myuriel von Aspen talks about. To make sure that the facts that the students are practicing are going to be supporting their fluency development and supporting those known facts that they're going to be able to pull from. So, for example, flipping those cards over, you don't know what you're gonna get. So if you're already fluent, you're practicing, and you are building fluency. But for those students who aren't fluent, how do those students have access to that game? And we talked a little about maybe you have a hundred charts there, or maybe there's other games that you can incorporate. But I don't wanna forget about that power of, for example, the tens, the fives that students can use to then help them build all the other facts that are gonna come from there. And one of

the most important things that I got from Myuriel: No matter how students learned facts, she remembered going in and talking to these students, and she asked them a question that was beyond 12 times 12. So, the students maybe knew their facts up to what was on the multiplication chart. But then, when she asked them 13 times something, they were like, "Well, we didn't learn those. We stopped at 12. We didn't learn this." And that to me was so powerful. 'Cause she said, "Well, when we know how to use strategy, we know how to use known facts to figure out unknown facts. We know how to compose and decompose. We are able to be strategic in our solving." One other thing I wanna flag: I really wanna talk about assessments for a second. And I wanna talk about what Dr. Val Henry brought to the episode in talking about one-on-one assessments. And for so many teachers, I feel like they think that one-on-one assessments is out of reach. But she talked about the power of sitting with a student and asking, "How did you get that answer?" Or, "Tell me about your thinking." And then Dr. Guarino talked about how that can happen in a real formative-assessment context, when you're walking around and noticing the way a student is solving a problem when they're playing a game, for example. And I wanna play a clip from Dr. Henry's interview. But Dan, can you weigh in on this for a second? Because I wanna remind listeners, last season we interviewed Dr. Erin Maloney, who we adored and who I totally think we'd be friends with her in real life. Dr. Maloney talked about some potential benefits that she sees from time to practice. So let's play a quick clip from Dr. Maloney's interview last season, where she flagged timed work.

Erin Maloney (26:50):

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, I know that this part can be a little bit controversial because we don't wanna necessarily demotivate children and kind of 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 (27:48):

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.

Erin Maloney (27:57):

Yes. A hundred percent right. And so, I don't hate time 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 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 again, it can be done in a fun way.

Dan Meyer (28:38):

That was, I think, a really interesting moment in our anxiety discussion and certainly the kind of the wormhole that tunnels between last season and this one. And yeah, I find that really compelling — and

obviously, based in evidence that when people are anxious, their working memory is just getting soaked trying to deal with that anxiety and they're not able to create fresh charges of their horses in the cavalry. And then my question to follow that is, to what degree is timing, then, the best way to create that automaticity and efficiency for students. Total agreement that being able to know seven times eight automatically is much better than having to skip-count. Certainly easier for lots of higher-order tasks. But to what degree is having students doing a mad minute worksheet with eight times seven somewhere on it, to what degree is that gonna be helpful at developing that? Versus other activities of the sort that we've been working on? Is the idea that we would expose students to anxiety-producing experiences for many of them, and that would inoculate them against experiencing anxiety? That to me feels like a path that just doesn't seem ... to me, it mostly seems like it's giving up, to some degree. I'm not saying I would never want to involve time. But we've just learned over this season how many creative ways there are to help students generate automaticity. I'm not sure why I would use timing. Except if I didn't have access to those other ideas.

Bethany Lockhart Johnson (30:07):

So let's hear from Val. In her episode, she talked about one-on-one assessment.

Val Henry (30:11):

When I first started reading the literature about fluency, one of the things I realized was that the psychologists who actually specialize in studying the challenges of fluency in mathematics do one-on-one assessments, so that they can really hear students not only say the answer correctly or incorrectly and they get a sense of how long it took them to come up with their answer, but they also get to ask them this really important question. Which is, "How did you get that answer?" And so, one-on-one assessments are so different than timed tests in a couple of different ways. The first one is that you actually find out how fluent ... I'm gonna move away from whether or not they're fluent, but sort of how fluent they are with the fact, with the math problem. As opposed to on a timed test, which typically has, you know, 20 or 50 or a hundred problems, and students complete it, and you have no understanding of how they completed it. Whether they were skip-counting on their fingers, whether they were jumping around and kind of going, "OK, five times seven is 35, so now I'm gonna look for seven times five because now it's in my short-term memory, and then I'm gonna do 35 divided by seven and 35 divided by five," all without really having been fluent with any of those, but just capitalizing on skip-counting and short-term memory. So one-on-one assessment taught me a lot about how to really understand what's happening with students.

Dan Meyer (32:05):

So Bethany, you taught elementary. I'm really curious how you would balance the different kinds of imperatives here. The value that Val saw in interviewing students one-on-one; the more efficient experience, in terms of having kids all doing a thing simultaneously, of a timed math worksheet. How do you think about those two different experiences and their advantages and disadvantages?

Bethany Lockhart Johnson (32:30):

For me, it came down to "what's the point of the assessment?" For me, the point of the assessment was to find out what my students knew, what they were thinking, and how they were thinking about it. And then, for me to be able to use that information to direct my instruction. So if I look at a sheet where students have filled in a page of answers, I may be able to put that neat score on the top and enter it into my grade book, but then what do I actually know about what that student knows and how they're

thinking about numbers? So for me, the key that I learned from Dr. Henry is that you're not doing one-on-one assessments every day. Dr. Guarino talked about this as well. The power of formative assessment as you're walking around and the students are playing games, as you're bringing the students back and doing a share-out of how they were thinking about the numbers when they were playing the games. You're taking notes on those. And then you are sitting down with students a few times a year, or certain students that you are curious about, like how they're thinking about those numbers. You can any time just ask them, "Hey, how did you solve this?" Or, "how did you get that answer?" Or, "Show me, show me what you're thinking," or "Can you show me, with these blocks, what you're thinking?" And then sitting down and asking students, one-on-one, the different facts I think was for me, really, really powerful. And the key for me was that it was low-pressure, it was conversational. It was, "Hey, this is a chance to show what you know, and let's talk about your thinking." And that for me gave me so much more to work with as a teacher than just a page of answers.

Dan Meyer (34:13):

I love that. And I feel like it just speaks to the idea that the most powerful form of inquiry-based learning is not necessarily when students are inquiring into an area about which they know nothing, but when their teacher is inquiring into the ways that they think about mathematics — equipping themselves with all kinds of resources for their instruction.

Bethany Lockhart Johnson (34:32):

Absolutely. Absolutely. If given the chance, I could go through a thousand more points, which I know, Dan, I can tell from your expression that you would like me to. But I want to point out one more thing that I would hope to leave listeners with, and that was for teachers to build meaningful ways to regularly and strategically practice fluency and not expecting students just to absorb these facts or expecting it to happen at home. And I wanna include one more clip from one of our guests, Myuriel von Aspen, on why it's so important to develop fluency in the classroom rather than relying on caregivers to do it.

Myuriel von Aspen (35:10):

For some children, we, the teachers might be the only ones that can support them with the work of fluency, of learning their math facts, because maybe they have parents at home that are working two jobs, three jobs. They may not have those opportunities that other children have at home. And so taking away those opportunities from our students, we're taking away the chance for them to learn higher math later on, because we are what they have, to learn those foundational skills.

Bethany Lockhart Johnson (35:41):

I loved that clip so much. And I feel like with the math anxiety that often caregivers can bring into their parenting, <laugh> whether they mean to or not — we talked about this last season — if there's a way, for example, for a teacher to show caregivers a game that would be building fluency that they could do at home with their kiddos. So they're still practicing fluency at home, but they're having a fun interaction around math. Fun conversations around math. I think that would be more powerful than just drilling, drilling, drilling. So how do we make sure, as teachers, we're doing the work in the classroom and finding ways that are positive and community-building at home for students to practice?

Dan Meyer (36:28):

I love that. As a parent of elementary kids, I don't want to be in a coercive relationship at the end of the school day with my kids about, you know, working through these particular exercises they don't have a

strong connection to. But it's been wonderful to do the kinds of games that we learned about from Dr. Bay Williams and that you've alerted me to, Bethany, throughout the run of this season. And I think maybe the biggest takeaway for me — the outcome of this whole season for me — has been a desire to participate in a family math night at my kids' elementary school. To partner up with other parents, and hopefully just equip parents to whatever degree I can, with resources to help them have these kinds of moments with their kids at home, where they might not feel equipped otherwise, or to have the time or energy to do really intensive kinds of fluency-building. Like, let's do some low-key fluency building.

Bethany Lockhart Johnson (37:16):

That's awesome. That's awesome. And we know that students not knowing their math facts can be a reason that they can continue to struggle in mathematics, develop math anxiety, and ultimately feel like maybe math isn't for them, or they're not capable mathematicians. And it's just not the case, right? This is something that students can make sense of. They can make sense of it in meaningful ways that are fun and that are competence-building. And it's something that I hope that our listeners feel excited to dive into more and excited to explore.

Dan Meyer (37:58):

So, Bethany, just to close this up, I'm super-curious, after all the learning we've done. You've been a very helpful guide for me through the work of fluency with our guests. Of course. I'm curious if there's any questions that still seem most provocative to you after all this learning. Where are you at?

Bethany Lockhart Johnson (38:16):

You know, Dan, I'll admit I'm a little sad that this season is over. I feel like I have a ton of questions. But more than anything, I'm just so excited to see how you have kind of evolved, should we say, around your thinking about fluency. And I'll take it <laugh>. And deep-diving into math-fact fluency is what I envisioned our season would be about. And it was, for the most part. But I also appreciated when Jason Zimba talked about fluency with the count sequence, for example. What does fluency look like beyond math facts? What does it look like in secondary, in your world, Dan? I feel like there's so many different directions that we could take the conversation. And I wanna keep learning and reading about what's happening, figuring out how to talk about math-fact fluency. So many teachers have opinions on it, which is great, but how do we keep having conversations about what is actually happening in the classrooms? And then how do we keep building on that work? And, especially, how do we talk about fluency work and practice in a way that is affirming to our students? And make sure that the work we're doing, like you said, is continuing to build a positive relationship with mathematics. What about you?

Dan Meyer (39:39):

I love that. Yeah. I wanted more examples of everything, really. You know, it's one thing to get an example of a really exciting policy about fluency, or a definition, or a game. I just want more of all the above, as I get my own lay of the land of fluency. All in all, a very exciting season.

Bethany Lockhart Johnson (39:57):

Thanks for being willing to dive in, Dan.

Dan Meyer (40:00):

Anytime. So now we're gonna move on to some life updates from me and from Bethany. Here's the deal. This is the final season. It's not just the last episode of fluency; it's the final episode of the run of our podcast, Math Teacher Lounge.

Bethany Lockhart Johnson (40:16):

I mean, we've said it all. We've covered every math topic imaginable. Right, Dan? So what else could we talk about?

Dan Meyer (40:21):

We solved it. We solved it. We're done, folks, you know.

Bethany Lockhart Johnson (40:24):

<Laugh> We did it.

Dan Meyer (40:25):

We answered all the questions. What more do you want from us? Any question you have, any moment throughout history, next century, whatever, just listen to the archives. It's in there, folks! We got it for you!

Bethany Lockhart Johnson (40:33):

Dan. Do you know that we first launched -- OK, my kiddo is about to turn three. We launched in December of 2020. This is before the birth of my child. In fact, you were one of the first people I told that I was pregnant. I was like, "Hey, by the way, Dan, you know this big project we're planning? We're gonna need to schedule some. ..." <Laugh> I mean, this is big, Dan. We've been in each other's lives for three years. Three years. Dan, how do you feel about that?

Dan Meyer (41:06):

Yeah, I'm excited to not just have a bonkers, fun podcast out of this, but also to be a godparent to someone's child. I did not expect that when we took on this. I'm gonna keep on speaking, trying to speak that into existence. Bethany.

Bethany Lockhart Johnson (41:19):

Oh, you know, my kid loves him some Dan.

Dan Meyer (41:22):

Yeah, we have some fun.

Bethany Lockhart Johnson (41:22):

In just a little bit, we're gonna tell you about some of what's next for us, but first we wanna pause to reflect.

Dan Meyer (41:28):

Yeah, I mean, it's been a really intellectual and fun ride. What's it been, since 2020...it's been six seasons. We had a couple of video seasons, four podcast seasons, 40 episodes. I got the stats right here. How many countries you think we reach with this thing, Bethany?

Bethany Lockhart Johnson (41:46):

At least two!

Dan Meyer (41:47):

Seventy countries and territories, is what I'm told by producer Martin. "Territories" might be doing some heavy lifting there; I'm not sure what we're counting as a territory these days. <Laugh> But that's great. A hundred thousand podcast downloads, 20K video views. It's been really exciting, knowing that folks are out there listening and sharing things. And it's given us a lot of incentive to do our best in thinking through these issues. And it's been exciting to think through them with you folks out there in in podcast land, hearing your comments, reading your emails, your tweets, your posts, and all of that.

Bethany Lockhart Johnson (42:22):

When we first started this ... I just love how it's evolved. I loved doing the video seasons, but when we dived into the podcast seasons, those were my favorite, in the sense that we got to have such more in-depth conversations with the guests. It's been really fun to see how it's evolved.

Dan Meyer (42:38):

It's been great to be a part of your drive time. Instead of just your your video-watching time.

Bethany Lockhart Johnson (42:43):

Let's include a clip from our very first episode. Dan.

Dan Meyer (42:48):

Hey folks, my name is Dan Meyer from Desmos.

Bethany Lockhart Johnson (42:51):

And I'm Bethany Lockhart Johnson.

Dan Meyer (42:53):

We're very excited to bring to you folks an ongoing video series called Math Teacher Lounge. And we wanna acknowledge right off the jump that people have very different experiences with teacher lounges in the past.

Bethany Lockhart Johnson (43:05):

The teacher lounge in school spaces is not always a space where conversations are safe, where conversations are welcome. And I've experienced both: I've experienced teacher lounges where it didn't leave me feeling recharged. It left me feeling like, "Oh, I actually just feel kind of crummy." <Laugh> And then I've experienced other teacher lounges, where people brought emotion, brought exhaustion, brought funny stories, and you kind of just decompressed.

Dan Meyer (43:32):

Yeah. I hope that we in this video series live up to the highest potential, the highest ideals, of a teacher lounge as you have described it.

Bethany Lockhart Johnson (43:39):

Listen to us! Just starting out!

Dan Meyer (43:42):

We did it, Bethany! We cooked it! <Laugh> I think that we have been a credit to teacher lounges and elevated the highest aspirations. Can you imagine having all the people that we've had as guests, as listeners, all in the same teacher lounge? That'd be amazing!

Bethany Lockhart Johnson (43:57):

Oh, man, let me tell you. We explored topics like joy in math, math anxiety, technology, data science. You did some episodes on AI! I mean, we interviewed guests like classroom teachers, TikTok stars, university professors, and hello, we interviewed a friend of Big Bird, Rosemarie Truglio from Sesame Workshop. Two episodes in front of a live audience. I mean, listeners, thank you. Thank you for sharing this journey with us. Dan, how has this podcast shaped your thinking? That's not a big question, right? What <laugh> would you say? What's your reflection you have on this journey?

Dan Meyer (44:38):

Ooh, yeah. I think, just generally since 2020, I feel like my appreciation for the sophistication of kids' thinking, especially early-kid thinking, has only grown. And, at the same time, I've learned so many strategies for drawing out of kids that sophistication. I've always known that kids don't come to classrooms as a blank slate for teachers to write onto. But I think through your participation here, hosting with me and the guests that we've brought on, and the season themes, and of course my own life with a couple of roommates who are six and under, it's been just marvelous for thinking about how sophisticated kids think about these ideas in mathematics. And I'd also say that some of our guests have just really alerted me, more and more, to how doing math is not just an operational skill, but it involves aspects of your personhood and your community. And, it's social, in ways that are deeply felt. Even though they are sometimes invisible, and not obvious on a piece of paper or a Scantron sheet or an exam. So those are, I think, probably a couple of the biggest aspects, the biggest learnings and developments, for me. And I've been so grateful for both of those. What do you think, Bethany? What's been new or newly developed for you over these last few years?

Bethany Lockhart Johnson (45:59):

For me, you know, my personal relationship with math has absolutely evolved since I was a student in an elementary classroom. And it continues to evolve. So, I think my time on this podcast has really allowed it to evolve even more. Like you said, seeing math in communities, folks' connection to mathematics outside of the classroom, seeing math everywhere ... just the deep respect I have for teachers, for educators, for researchers, in really attending to students' thinking and really letting their own thinking shift as they get new evidence, and as we try to make this subject come to life for students. And I think the other thing, too, is the power of these ideas to also change teachers' relationships with mathematics. Because there are so many teachers out there for whom math is a very scary subject. And I hope that in our work, we have helped to make it a little bit more accessible. And I guess the other thing, too, is how accessible folks are. People are excited to talk about these ideas. And so, if there's questions or ideas that you're curious about, it's a reminder that we don't have to do this in a silo, in

isolation, in our classroom. There are so many folks out there who are doing work and wanna connect. And it's a great reminder. And I think every episode has reminded me of that.

Dan Meyer (47:29):

Love that. I definitely agree with the generosity of our guests and eagerness to share ideas they're passionate about.

Bethany Lockhart Johnson (47:37):

I wanna shout out a couple favorite moments. One of my favorite things about this has been talking to authors. You know, we did a Facebook Live series with the authors of Hands Down, Speak Out. And I love a good book study. So, I'm excited. How can we keep that going beyond the podcast? Are there books that other folks wanna keep talking about? And, I just thank our authors for being interested in coming on and sharing their work, I loved our NCTM Lives. I loved talking with Dr. Rosemarie Truglio about early mathematics, as a mama of a toddler. And you know, Dan, I gotta say, I loved working with you.

Dan Meyer (48:16):

Making a heart emoji right back.

Bethany Lockhart Johnson (48:18):

And there were some special moments. Dan, I'd like to share a special moment, actually.

Dan Meyer (48:23):

I love the spirit that Bethany brings. And yeah, it's been great to check in with you, Bethany. <Overlapping edited snippets> I love talking about this with you. Yeah, I love that. I'm learning here. Thank you for that, Bethany. Thank you for that. Bethany. Thank you. Thank you. Thank you for that, Bethany. <Dan laughs>

Bethany Lockhart Johnson (48:36):

Dan, it's been a pleasure. <Dan keeps laughing> You are welcome.

Dan Meyer (48:41):

That was special for me, too.

Bethany Lockhart Johnson (48:42):

You're welcome, Dan. That's what I have to say. You're welcome. <Laugh> Do you have any favorite moments you wanna share?

Dan Meyer (48:49):

Definitely working with you has been really special, too, Bethany. Thank you for all of all of this. <Bethany laughs> You really couldn't do a podcast with two of me, though. 'Cause it's just too dry. And you have really brought out the humanity in me ... which has been important, I think, to make this a listenable podcast for mass consumption.

Bethany Lockhart Johnson (49:10):

That beating heart of yours.

Dan Meyer (49:12):

Yeah. You are the heart and I am the bile duct of the body we call Math Teacher Lounge. <Bethany laughs> Yeah. Rock on. <Dan laughs> Look, folks, that is who we are.

Bethany Lockhart Johnson (49:21):

You need 'em both, though. You need 'em both.

Dan Meyer (49:23):

How could you live without a bile duct? Yeah. I really enjoyed <laugh> a video episode where I got to hang with students and do a slow-reveal graph.

Bethany Lockhart Johnson (49:34):

Ooh, yes.

Bethany Lockhart Johnson (49:35):

When we interviewed Jenna Laib about what this kind of thing was, this activity structure. Not just to talk about it, but do. It was a pile of fun. And also, yeah, meeting our community through live shows and chatting with people at live conferences was a great reminder of how social and national and international the work of math education is. How we're all in this giant boat called math education together, trying to chart a course together. So yeah, that's what I loved. It was all a blast. And I'm gonna queue up a clip right now, where Bethany sings a compilation of my — I'm sorry, I'm hearing from our producer, who knows such clip exists, but you folks all heard it. You know. Well, talk to me, Bethany: If we had a few more seasons here, let's drop some breadcrumbs for the folks who might be picking up the podcast torch behind us here. What would you want us to cover, or to take up, in a future season of Math Teacher Lounge, if there was one?

Bethany Lockhart Johnson (50:36):

Ooh. Well, I, too, loved your classroom episode. And so I'd love to have more classroom footage. And I think it would be cool to follow a classroom teacher for a season, or for a quarter.

Dan Meyer (50:51):

Yes.

Bethany Lockhart Johnson (50:51):

And see how they take up a certain idea or work with students and just see it evolve. For me, that would be really exciting. And I think the other thing I'd love to do ... again, I loved our videos, the video seasons, but they were, understandably, they needed to be short. Shorter consumption for the videos. I would love to go back to episodes we did with Megan Franke, Jenna Laib, Omo Moses. I would love to go back and have longer conversations, be able to dive into those topics that they just kinda whet our appetites in the video form. So I'd love to go back in and have episodes with them and talk more about their work. What about you? We have 10 more seasons, Dan! What are we talking about?

Dan Meyer (51:41):

I think that classroom teaching is some of the most sophisticated work I've ever participated in or observed. And I also think that that sophistication is not obvious, sometimes, to external observers. And so I love your idea about following classroom teachers. I love how knowledgeable experts can watch something that seems chaotic or not super-sophisticated, perhaps — I'm thinking about sports or the scrum of a football game — and it's all incomprehensible in some ways to me, not having ever played. But the announcers up in the booth, they have ways of making that chaos seem orderly. Like, they'll predict what happens next, and they'll wait in anticipation to see if their predictions were correct. And I would love for someone to give the same treatment to classroom teaching. To take video of a classroom where it might not seem like much is going on, or it might not seem like anything spectacular is there. And for two people to say, "Oh, check that out! Did you see that move right there? Did you see that? Run that tape back. I'm gonna draw in yellow marker on the screen." And you can see what that teacher's doing. That's so interesting. I'd love that.

Bethany Lockhart Johnson (52:53):

Yeah. Deborah Ball has an amazing ... she talks about all of these moves, within a minute, in a classroom. The idea that we could sit there and, you know, you don't even realize as a teacher, you don't even realize all the things that are happening. Or some of those moves, you get so fluent with some of those teacher moves, that you don't even realize you know what you're doing. And so, that opportunity to step back and have somebody else observe ... I love observing that. And yeah, that'd be awesome. You know, not to mention 10 more seasons with you, buddy.

Dan Meyer (53:25):

Yeah, that'd be a blast. Check out Deborah Ball's — I think it's her 2018 AERA talk, if I'm hearing you right, her ideas of discretionary moments, these micro moments where teachers make these decisions that seem almost invisible, or not even with a lot of thought, 'cause they're fluent in it, right? <laugh> And it just has such a huge impact on kiddos.

Bethany Lockhart Johnson (53:48):

Exactly. Thank you for the proper citation. Thanks, buddy. But hey, guess what, listeners? Even though our time in the Math Teacher Lounge is coming to an end, we want to again thank you for being a part of this community. For your listening, for your ideas, for your thoughts. And there are still plenty of opportunities to hear us talking about something we love, which is math. So we are gonna be hosting a whole series of webinars about the future of math, in our — Dan and I — our home state of California.

Dan Meyer (54:19):

Yeah, those sessions are gonna be hot and fun and they're gonna include, like, what's the big idea about big ideas, which is a key part of the math framework developed here in California. That'll feature Jason Zimba. We'll have sessions on building equity and engagement in California's math classrooms, which is for sure gonna be useful for every math classroom. And how to address students with authentic tasks. And also thinking about problem-based learning with you, in your K–12 classroom. There's several sessions that will be full of meat and spice, and really useful for everybody, for sure. Find out more and register for those at amplify.com/CAMathWebinars, all one word. And there's other projects on the horizon, too.

Bethany Lockhart Johnson (55:07):

Dan, you are gonna be part of March's math symposium. March Madness! The March Math Symposium, from Amplify Desmos Math, is coming. It's a free, virtual professional development symposium, and it's gonna focus on curiosity-driven instruction, bolstering student agency, and building math proficiency for life. That's all gonna be on March 12th. You can find out more info about the symposium at amplify.com/2024MathSymposium, all one word. And we'll make sure to have links to all these upcoming events in the show notes.

Dan Meyer (55:45):

And we'll also post updates in our Facebook group, Math Teacher Lounge: The Community. Make sure you folks keep an eye on the Amplify podcast hub and on Science of Reading: The Podcast. We'll be showing up there for future math-related content. You can follow all of that at amplify.com/hub.

Bethany Lockhart Johnson (56:02):

You can also keep up with both of us personally on X, formerly known as Twitter. Dan is @DDMeyer and I'm @LockhartEdu. And we hope to see you all at future conferences, at these upcoming events and webinars. We so appreciate you. Thank you so much for listening and joining us in the Lounge.

Dan Meyer (56:25):

Don't be a stranger, folks. Take care. Bye.

Bethany Lockhart Johnson (56:27):

Wait, let's cheers!

Dan Meyer (56:29):

Cheers, folks!