

Jason Zimba (00:00):

The dials are all mixed up on fluency. On the one hand, I worry that word problems and applications get proceduralized. And if so, then we're aiming for fluency with something that's not a procedure in the first place.

Bethany Lockhart Johnson (00:13):

Hi, I'm Bethany Lockhart Johnson.

Dan Meyer (00:15):

And I'm Dan Meyer.

Bethany Lockhart Johnson (00:16):

Welcome to our new season of Math Teacher Lounge. Dan! New season, new music!

Dan Meyer (00:24):

New lounge, too! I'm loving this new spot. What's in our new Lounge here right now? You know, posters on the wall of famous mathematicians from movies and whatnot. <Laughter> Movies and TV. Better accommodations, slightly less grungy. Beanbag chair.

Bethany Lockhart Johnson (00:37):

The couches have been steam-cleaned. There's donuts on the table. I don't know, it feels like a fresh start. Anything is possible...including defining fluency, Dan Meyer.

Dan Meyer (00:48):

Defining fluency. New season for us here. Last season, we really got to the bottom, and I would like to say we solved entirely, the issue of math anxiety. <Laughter> Good work to our guests, but especially to you and to me, Bethany, on that last season's deep dive into math anxiety. And we're excited to bring a new deep dive to you folks, on fluency. We've done an episode on fluency. Yeah? A couple of them? Dr. Val Henry, Tracy and Graham. Very popular episodes. That that gave us the sense that fluency was an area that we ought to dive deeper into. So, Bethany, what's your vibe on fluency? Like, how do you feel about it? Are you looking forward to this? What are you looking forward to?

Bethany Lockhart Johnson (01:30):

Well, should I pretend I don't know how you feel about it, Dan? In my defense, I will say that when we were thinking about how we want to spend our collective time in the Lounge and what we were hoping to share with the audiences, I think I was more pushing/gung-ho for the joy in mathematics season. Math anxiety, I think you were onboard. Fluency ... you seemed onboard, but not with the level of enthusiasm that I was hoping. And so I'm thinking that over the course of this season, your enthusiasm will just continue to grow. How you feel about that? You think?

Dan Meyer (02:11):

<laugh> I think it could ONLY grow. That's the only direction. <laugh> Now this is an area, gentle listener ... this is one of the rare areas of difference between Bethany and I. And I wanna say it's a very loosely held difference for me. Like, I'm here wanting to believe. And I'm so excited to have Bethany on this season with me, 'cause Bethany isn't ... I would call you enthusiastic about fluency and what it can offer

students, and fluency as a lever for more equitable education for all kinds of kids. You're positive about it in ways that I admit that I am not. And I want to learn more. I assume when someone I respect, like you, likes a thing that I'm not instantly drawn to, that there's something there for me to learn. So if I could just offer to the listener ... I get really excited by introducing new stuff. Like, I get excited by, "So you've learned this old thing, and here's like a way into the new thing — a connection you haven't thought of or something surprising about it." And I find myself not super-opinionated about how the old thing becomes fluent or even really solidly known. I do think this is a liability of mine, a place of growth for me. And I'm also aware of a lot of the ways we develop fluency in the old stuff. And the thing that was known can cause some damage to kids. Like, when adults reflect on moments in their childhood where they decided that math was not for them, it is often on some worksheet or some drill or some moment where they could not see the forest for the tree in front of them. They lost sight of what a lot of us cherish about mathematics.

Bethany Lockhart Johnson (03:52):

I applaud you in your open mind, that you know that the new IS exciting. And I guess where I come from, living in K–5 land — the land that I love — I see what a barrier fluency can be. And I see the way that kiddos who don't own their addition, subtraction, multiplication, division facts, the way they don't own those — and I'm speaking about fluency, again, with the basic facts here — that can be such a barrier. And I think so often the way it's taught or not taught at all is the real issue, and can be a cause of math anxiety. So you have these kiddos who don't have access to these facts, or they don't own them. They don't know 'em. And it keeps them from diving into the juicy parts of math, right? Math is so much bigger than addition facts, but because they don't know those addition facts, it becomes all math is. And all you can think about. And when you think about math, that's what you think about. So there's two things: There's the kiddos who don't have them yet and who are then stymied from enjoying all the things you can do once you have those in your repertoire, and then you have schools and teachers who, a lot of them don't know enough about fluency. So they are going to Teachers Pay Teachers and downloading timed tests with just cooler font or whatever, right? And thinking, "Look, this is themed! This is a Halloween timed test! So they've gotta get it now, right?" And fortunately, I was at a school where my principal sent every single teacher, K through 5, to training. And we did the training with Dr. Val Henry, who we've talked to; we'll talk to her again. And she has a program called FactsWise. And my favorite part about it was just how much I learned about how facts are learned, right? Like, I learned, how do we learn them. And learned about long-term memory, working memory. And it just really helped me to have a better, like, joy and sense of what's possible. And too often I have seen teachers, when you ask them, "Well, how do your kiddos learn their facts?" Or "What do you do in your classroom?" a lot of them don't have any plan at all. Or they're like, "Oh, well, they'll just get it." Or, "Oh, yeah, at the end of every week, we do a timed test." And we know that's not how kiddos learn it.

Dan Meyer (06:27):

I think that speaks to what I'm excited about for this season with you, Bethany, is to come to an appreciation of the sophistication of developing fluency for kids, with kids. Like I know the sophistication of introducing new material, like ideas of cognitive disequilibrium or intellectual need or worked examples. It feels so rich to me. And I think that I can agree fluency is important, but in my head, what's conjured up are these very direct routes from not being fluent to being fluent. They just kind of charge in a direct line, by way of these worksheets, these downloadables. Whereas you have seen, I think, through folks that we'll interview, I hope, the sophistication there. And how there are different paths possible from not being fluent to being fluent, that can actually lead through mathematical joy and conceptual richness and the stuff that I more innately gravitate towards. So I'm excited about it. We got

a great set of guests lined up here. And I'd just love to intro our first guest of the new season. Happens to be Jason Zimba, Amplify's Chief Academic Officer of STEM. He's been thinking about math fluency in depth for years. We hope this will be a great introduction into a season-long exploration of this topic.

Bethany Lockhart Johnson (07:44):

We hope you enjoy our conversation with Jason Zimba.

Dan Meyer (07:50):

Welcome, Jason Zimba, to the show. We're happy to have you here.

Jason Zimba (07:54):

Thank you. I'm glad to be here.

Dan Meyer (07:55):

We know that fluency is one of many buckets of mathematical ideas and competencies you care a lot about. So we're really happy to get your time here to help us break some initial ground on the area of what is fluency and why should we care so much about it.

Bethany Lockhart Johnson (08:10):

But before we get into that, I mean, we need to get to know you a little bit more, Jason Zimba! <Laugh> So we're curious: What's something outside of math where you've developed, or you are currently developing, fluency? I figure you're pretty fluent with the math facts.

Jason Zimba (08:29):

Well, you know, a lot of fluencies I think we develop as kids. Shoe-tying, the combination lock on your locker in the high school hallway. But there is something I have made a concerted effort to become fluent in over the last 10 years, which is roasting a chicken. I was following food blogs and other things. I grew up in a diner, and making food was always a part of life. And I noticed that people were always on a quest for the perfect roast chicken recipe. And they were like, "Oh, this recipe will finally help you get it right." And, "This is the ideal recipe for roasting a chicken." And I decided to go another way. I got a cookbook for Christmas. It was Anthony Bourdain's Appetites book. And he had a recipe for roasting a chicken that looked pretty good, looked legitimate, you know? Legitimate chef. And I said, I'm just gonna get good at this one. I'm gonna stop hunting for the perfect chicken recipe. I'm just gonna learn how to roast the crap out of this recipe for chicken. And so I started doing that and I've roasted about 30, 40 chickens in the exact same way to the point where now, if I'm walking past the grocery store, I don't need an ingredient list. I can just walk in. I know what I need. I prep the chicken without opening the book. And 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. The weights are different, you know, the way the legs go is a little different. The lemon you have might be a different size. And I have found that a much more rewarding way to go about it than to constantly be hoping that I would find the ideal roast chicken recipe.

Dan Meyer (10:10):

It feels like we might return to this anecdote over and over again. <Laugh> This conversation. There's a lot going on here. I, myself, am wondering, like, that 30th chicken versus the first — you've mentioned

that you don't have the things you don't have to do anymore. But are there things that you now can do because your mind is no longer occupied by the steps of the recipe? Ways that you're more flexible with the chicken?

Jason Zimba (10:35):

Well, one thing is, I no longer need it to be a weekend where I have five hours to futz around and mess up the kitchen. There are more windows of time available to me now, when we can have that. Or if I'm staying over at someone else's house and poking around, I could do it. I don't need home-field advantage to roast the chicken.

Dan Meyer (10:56):

As Bethany and I talked about before our interview began, I'm in the process of trying to awaken my own enthusiasm for fluency. I mean, I have some, but it's not my first-round draft pick of areas of math that excite me. And what you're describing here, how it enables you to do more things or better or differently for how you're fluent with chicken preparation <laugh> is pretty exciting. But we're kind of talking around the issue here. I'd love to hear from you. If you're on a train with a stranger, and they get to know you a little bit in that way you do sometimes on a train, and were to ask you, "So what is fluency, anyway?" how would you offer them a definition?

Jason Zimba (11:39):

Well, so there was a reference book, a National Academies report that came out a little over 20 years ago called Adding It Up. And it has, I think, a definition of fluency in math — procedural fluency — that is still useful. It covers a lot of the diverse cases that are covered under fluency. But as a general concept, the definition there is "skill in carrying out procedures flexibly, accurately, efficiently, and appropriately." And that's a careful, committee-style definition. I think in a very informal way, maybe you could say it's getting the right answer to a routine sort of problem without struggling over it. And I might even say there's even a more informal ... maybe it means similar to when we say someone's fluent in a foreign language. It's not halting. To be fluent is to flow. I think it even comes from a Latin word that means fluid.

Bethany Lockhart Johnson (12:34):

So Dan loves to say how much I love talking about fluency. And it's true, because I have seen the power when somebody is really fluent and when they are not. And I'm speaking right now in, like, math facts. I'm K–5, but it feels like whenever I've heard you talk about fluency, your definition of fluency, it stretches beyond basic arithmetic facts. And for me, I so often stay there in that land, in that bucket. What are some other big buckets of math fluency you think about that maybe us in the K–5 world are not thinking about? Or just don't see right away?

Jason Zimba (13:23):

There are a lot of places where this plays out. Starting in kindergarten, there are some important kindergarten fluencies. Reciting the number word list in order. Physically executing the cardinal counting procedure takes practice in coordination. Writing the numerals from 0 to 9. Subitizing and conceptual subitizing. You might think of those as forms of fluency and kind of a capstone at that level of comfortably finding sums and differences within 5. So there's a lot of foundational fluency work there on the entry into this discipline. And then over the next few years, fluency with multi-digit calculation grows. And then, growing into middle school, fluency with rational-number arithmetic becomes a focus

in grades 6 and 7. And in rational-number arithmetic, that is, like doing algebra with numbers, the calculation in elementary grades is not only algorithmic, and in middle grades and high school, it seldom is. And then at the sixth grade, sixth through high school, we have fluency with variable expressions. Symbol pushing. It's a wordless, but still somehow almost verbal sort of fluency, with properties of operations as the grammar of the language. So there are a lot of buckets of it, and it changes and morphs as we move up through the grades. I would say I consider fact recall different from fluency. Recall is remembering or just knowing, whereas fluency refers to a calculation process which is written or mental.

Bethany Lockhart Johnson (14:54):

That feels like a really important distinction. And you know, I actually ... OK, the first time I met you was at a conference, and afterwards, you know, you had this long line of people to ask you questions and I had all these questions and you were very clear in redirecting my thinking. Which was important, because I was <laughing>... you're like, "No, Bethany, that's not modeling." I'm like, "But I don't get it!" You're like, "But it's not modeling." And I wanted to sit there and just have this whole conversation with you. But there were a lot of people in the room who also wanted to sit there and have this huge conversation. But had we sat down and I'd pulled out my list of things that I wanna talk to Jason Zimba about, fluency would absolutely be on there. 'Cause I am a big fluency cheerleader. But then when I'm having conversations with other educators, you know, they don't wanna hear my cheer, Jason Zimba. They don't wanna hear it. They want research. They want, "tell me the research!" <Laugh> So maybe you can share just some of the research out there on building fluency in the primary grades.

Jason Zimba (15:57):

Well, there's one helpful body of evidence summarized in a National Academies report called Mathematics Learning in Early Childhood: Paths Toward Excellence and Equity. And you can find discussions there, for example, about important kindergarten fluencies. So one of them I mentioned before is being able to recite the number word list in order. And so that report will cite research about that question, and what's known about the learning trajectories in a question like that, and why it matters, why that fluency is important. So the number word list becomes a tool. If you think about an early childhood way of adding $6 + 3$, you might hold 6 in your head and using your fingers to keep track, count 7, 8, 9. You may not notice it, but you're using a remembered number word list as a powerful tool there. You can get a sense of what an accomplishment that is if you try to add F plus C, using the alphabet. And you'll find yourself a bit tongue-tied as you try to do it that way.

Dan Meyer (17:02):

I would like to ask you how you feel as though the standards around fluency have been taken up, nationally. What is your take? What are successes and what are areas of growth?

Jason Zimba (17:14):

Well, first thing I would say is there's so many questions that the standards don't answer for an educator, for a curriculum developer, for a test developer. And so the early years were a lot about discussing and settling those things. Even a question like, "Should I do flashcards?" You know, it's not answered there. But in terms of how the country's doing with fluencies, I'm not sure we know. And that strikes me as peculiar. NAEP, for example, doesn't break this out cleanly. I have a weak hypothesis — I don't have good data for it, so I can't defend it very strongly — maybe it's more of a worry. Which is that the dials are all mixed up on fluency. On the one hand, I worry that word problems and applications and

problems about the connective tissue of math, like the distributed property, or the concept of a function, get proceduralized. And if so, then we're aiming for fluency with something that's not a procedure in the first place. There's another dial to worry about, is whether discomfort with repetitive practice is short-changing students of the power and the confidence that fluency can bring. That dial swings to the negative, too, where fluency's done poorly or disproportionately or humiliatingly or glancingly and ineffectually. There's an equity threat if a school systematically deprives marginalized students of the intellectual work and the intellectual joy and societal power of the discipline. I've walked hallways that were papered with multiplication facts so that students could practice them during transitions, but where I saw very little intellection was happening in the math classroom itself.

Dan Meyer (18:55):

That's really helpful. Yeah. One wondering I have here, in thinking about you roasting chickens or me, and my touchstone here is learning to do a thing in a sport. And like shooting from the same spot on the court over and over again. And actually not feeling any type of negative way about it. Like, feeling like this has purpose for me and is productive. And to contrast that with what happens in math classes, I'm really struck by what you're saying about how we are injecting fluency where it doesn't belong, perhaps doing word problems of a similar kind of template over and over again. Which is maybe not the intent. And also denying students, out of some, I think, healthy fear that I share, of the power of fluency. And I wonder if part of it is not knowing or not being able to communicate to students where fluency in math shows up in the game of math. Whereas you, when you're roasting a chicken, I imagine you have at least in some part in your mind the destination. Like the point of the journey is this will be sustenance for friends or family and me. I know why I'm shooting from this spot a hundred times is I'm gonna shoot from this spot again in a moment where it matters. And I guess I do have this wondering, and perhaps you can comment on it, is communicating the purpose of the fluency a necessary aspect here? How are we doing there? How can teachers make that clear to students, that we are not doing this for its own sake, but that it is part of a "game" or part of a "meal"?

Jason Zimba (20:26):

Yeah, you know, there's a huge literature on motivation—intrinsic motivation. And I have not commanded that literature, so I won't try to speak too in too much detail about it. But I do think that you're not going to get very far with the repetitive work if someone is not invested in understanding and agreeing that this is gonna do something for them, if this is not gonna help them. You know, I agree with pretty much all the extant critiques of fluency implementation, except where they've led people to discount the importance of fluency itself, or misconstrue state standards about it. And there are pitfalls everywhere. You know, even to go back to the chicken analogy, the early phases of this can be unpleasant ... in that case, for the people eating the chicken I made. You know? But eventually you get the rewards. And being able to visualize that and wanting it to take the steps to move towards it is important, to have ownership of that. But without accidentally or intentionally conveying the idea that this is the subject, and conveying the idea that to be fast IS to be good at this. There are a lot of accidental or maybe even just unexamined value statements about the academic discipline of math that can leak through this. And that's really unfortunate. All the questions of time and timing of things ... I'm reminded, though, of a discussion, Dan, that you and I had once, about the zone of proximal development and how when we're learning new ideas all the time, and constantly stretching our brains with that, it can be kind of tiring. And it can be relaxing, in a way, just to bat a ping pong ball back and forth, you know, with regularity, and problems that you've seen before, and just almost clear your head by coming up against routine challenges. So it's a different mode. It might even might even be

compensatory to the hard intellectual work and the heady application work that we can be doing in math sometimes.

Dan Meyer (22:34):

Shout out to Dr. Gerardo Ramirez from our last season on math anxiety, who, as an antidote to math anxiety, proposed ritualizing the process of giving kids an old test just so they could reflect and have a moment of concrete reflection on how far they've come and what was harder is now easy, what was halting is now fluent.

Bethany Lockhart Johnson (22:57):

Before we wrap up, I'm processing what you're saying and I love that whenever I hear you speak about this, and I think this is gonna be the case for our audience, too, you're gonna help us push our thinking beyond what is just labeled fluency. And I think that's so important, and that's what we're hoping to do. So thank you for that. I have two questions that are just gonna poke ... this is just about the chicken, really fast. And then I do have one more fluency question. I know you didn't do all 30 simultaneously, but when you finish the roast chicken — and maybe it's 'cause I have a small family — do you do, like, a salad? Like, a chicken salad? With the leftovers the next day? <laughing> No, I'm serious! Because this is a real thing! If I have a roast chicken, what do I do the next day?

Jason Zimba (23:41):

Well ... let's take something just very cut-and-dried, and very boring, in a way. Let's say ... the standard edition algorithm.

Bethany Lockhart Johnson (23:52):

You can bring it back. I love it so much.

Jason Zimba (23:54):

<Laughs> There is intellectual content to it, which is kind of interesting. You know, you do those puzzles, the missing-digit puzzles, and sometimes they hinge on realizations or insights like, "Huh, the only digit I ever carry is a 1 — what's up with that?" And so you can even do some real math on those things, and learn things over time. And so, likewise, with roasting a chicken — I was gonna bring it back to the chicken — you learn things over time. Like, in my view, the smaller the chicken, the better it works. So I'm on a quest in my shopping all the time to find the littlest chicken that I can find there. And then, secondly, a new skill builds up from it, which is now I almost always do a homemade stock from the chicken bones when I do that. So then, when I make a chicken soup later on, it's better. So it's not the end of everything. It opens up new avenues for you.

Bethany Lockhart Johnson (24:47):

It opens up. Thank you. I would've had to try to wrap my m—, you know — I would've kept thinking about it <laugh>. But I wanna make sure we include in our show notes something that you published a while back, and I remember reading it ages ago, where you shared a little bit about your Saturday school that you did with your kiddos, and the way you practiced addition facts together. And I wanna make sure we share that, because I feel like it's such a fun ... I love peeking into the way that someone who has such a wide breadth of knowledge and just ... I don't know, what do you do with your kids to teach them this? I just love it. And I'm wondering, is there anything else you wanna share, that you wanna make sure educators — or maybe parents — know about the way we approach this work, moving

forward? We just came off of a math anxiety season, and we're trying to really <laughs> move away from math anxiety. And we know that just thinking about fluency facts can really stir that up for some people. So, any perspective you wanna share?

Jason Zimba (26:02):

Yeah, I'll say something about the Saturday school that I did with my kids when they were little. At different times in their math education, I saw ways that I wanted to step in and maybe just buff things up a bit. And so we did that with addition facts. And one of the things about flashcards is you should spend most of the time on the facts that are known but not yet remembered. Understood, but not yet remembered. A lot of repetitive practice ends up wasting time because it doesn't concentrate on exactly the parts that are needed. So, nowadays, technology will do this for you. But I invented a method for this, where once the fact was remembered, it would go into a box, and they owned it then. And then, at the end of the session, they could dump out the box and color in or highlight the parts of the chart that belonged to them. And that was very motivating. And I'll say, knowing I was gonna come on today and talk about fluency, I interviewed my kids, who are now teenagers, and said, you know, "What did you think about that? Are you glad we did that? Was that horrible? Did you hate all that?" And they said, "Well, I didn't always ... I had better things to do with my Saturday, mostly, in the mornings." You know, which involved, like, My Little Pony or Wild Kratts or whatever, whatever was the obsession of the age. But they said, "I'm glad we did it. It's just good to just know it." And I think that has something to do with how we stayed motivated, how we kept their identities intact, in doing this work. It's sensitive work, it's soul craft. And I would say that when you say, "What do I wish people understood about fluency?" I might broaden that question beyond educators, to more broadly, all of us Americans. And I wish we had a stronger view of what math is and what math education is. Namely, a kind of education with the depth and transformative power of education in all of its other forms, too. And math education is not only techniques, but also disciplinary patterns of knowledge and thought and student metacognition and identity formation. It's a big ball of wax. And to concentrate on this part of it is important, but the challenge is always to do that without losing sight of the whole.

Dan Meyer (28:22):

That's really exciting. I wanna say just one thing about what I love about what you shared about Saturday school, that I think is absent from a lot of fluency practice I see in schools. Which is this representation of what has been ... if not completed, able to be set aside. I think a lot of the ways fluency shows up in schools is in worksheets or activities where it feels as though it may as well be endless. <Laughter> There's probably more worksheets where that one came from. There's probably other math facts or whatever in the drawer. But this sense that "I have accomplished something" — and I heard that also in your discussion of the zone of proximal development, and how we need to have moments to reflect on what has been learned and what is what is easy that was previously hard — I hope that over the course of our conversations with more guests, we'll learn more and more techniques for humanizing fluency in that way. Really appreciate it.

Bethany Lockhart Johnson (29:14):

Yeah. Thank you so much for your time. Thank you, Jason Zimba, for being with us and answering all of our questions so patiently, just like you did in that conference room when the line was stretched out the door. And, you know, just thank you. We really appreciate you continuing to share your perspective and your years of knowledge. Thank you. Thank you, thank you.

Jason Zimba (29:35):

Thank you, both. I enjoyed the conversation.

Bethany Lockhart Johnson (29:41):

Dan, I want you to remember the way it felt when your child first made a squiggle on the paper that they recognized as the number 5. And they also knew that that squiggle meant five things, and you could break it apart in all different ways, and oh my goodness, they have five fingers on one hand! That level of joy, that is new, right? A newness. And I feel like we both came out of this conversation with Jason Zimba a little bit newer, a little bit fresher. New things to think about. I really, really enjoyed that conversation, and it bodes really well for this season. I'm so excited, Dan. How are you feeling?

Dan Meyer (30:20):

Yeah, I am 10% more of a believer. I'm definitely reconsidering my vegetarian bona fides; <laugh> Jason's description of roast chicken, not gonna lie, got a little mouth-watering there. But yeah, I think I recognize, in the kids in my life, and in Jason's descriptions, and yours, what a joy it is to be able to do a thing less haltingly, more easily, than I did before. And I hope to find a way to thread the needle to accomplish that while also avoiding some of the more negative and well-known outcomes of how fluency is taught. Maybe especially in middle and upper grades. Exciting conversation all the way, though.

Bethany Lockhart Johnson (31:03):

Right. And then that thing, that thing that you now own and know? Then that thing you don't even think about anymore. 'Cause you've got it. It's in there. And it lets you do all that other stuff, right? We're not still thinking about addition facts, 'cause you've got it. But it fuels you, right? It's the foundation that allows you to then do all this other cool stuff. So yes, I'm excited about this season. And thank you, listeners, for being with us, for our diving into our sixth season. We've got a lot more in store for you. And in fact, this season we're releasing episodes even more frequently. We are very excited about that. We have lots of great conversations coming up. And to be sure that you catch all the episodes in this new season, be sure that you subscribe to Math Teacher Lounge on the podcast platform of your choosing.

Dan Meyer (31:51):

And hit us up if you have your own ideas you wanna share, at MTLShow on X, formerly known as Twitter, or at the Math Teacher Lounge community on Facebook. We'd love to hear from you how you're thinking about fluency as well.

Bethany Lockhart Johnson (32:03):

And check out our show notes! We have that blog post we were talking about, about Jason's Saturday school and rumor has it, we might even put in that chicken recipe.

Dan Meyer (32:12):

Thanks so much, team. Bye.