Dan Meyer (00:03)

Hey folks. Welcome back. This is Math Teacher Lounge, and I am one of your hosts, Dan Meyer.

Bethany Lockhart Johnson (00:07):

And I'm your other host, Bethany Lockhart Johnson. Hi, Dan.

Dan Meyer (00:11):

Hey, great to see you. We have a big one this week to chat about and some fantastic guests. We are chatting about fluency, which is the sort of word and concept that I feel like people have very, very non-neutral associations with it. A lot of them are very negative, for a lot of people.

Bethany Lockhart Johnson (00:26):

I saw you frown a little. What's up with that, Dan? You kind of, like, shrank.

Dan Meyer (00:30):

I have strong feelings about it. You know, there's lots of ways that people go about helping people become fluent in mathematics. And a lot of them are harmful for students, and ineffective. And it got me thinking about fluency as it exists outside of the world of mathematics, where we have a lot of very clear images of it. We're getting fluent in things all the time. Like, as humans. Human development is the story of fluency. And I just was wondering....Bethany, would you describe yourself as fluent at something outside of the world of mathematics? What is that? How'd you get fluent at it? What was the process?

Bethany Lockhart Johnson (01:05):

Hmm, I think I'm a pretty fluent reader. I read all the time. I'm a happier person if I've read that day. I once saw this poster in a classroom; it said "10 Ways to Become

a Better Reader: Read, Read, Read, Read, Read...you know, 10 times. Get it? Reading? You get better at reading by reading! So I would say reading. And it's been kind of cool—I have a one-year-old who, it's been really exciting slash overwhelmingly anxiety-producing to see him get very fluent with walking slash running, 'cause he's getting faster every day. And it's kind of fun. When I think of what's something somebody's trying to get fluent with...walking! He's trying to be more fluid. He's practicing transitions. He doesn't wanna hold my hand while he traverses rocky terrain. He's getting better at it. He's practicing. What about you? What's something...?

Dan Meyer (02:08):

I think about driving a lot. I'm a very fluent driver and I think a lot about when I was first a driver, you know? And how I have my hands on 10 and 2, vice grip, and do not talk to me; do not ask me anything; don't ask me my NAME. I need to focus so hard. And then a year later, you know, I'm driving with one hand, smash the turn signal, take a sip off of whatever, change the CD. And then it's no big deal.

Bethany Lockhart Johnson (02:38):

Wait, did you pass the first time? Your test?

Dan Meyer (02:40):

Yeah, I don't like to brag about it. <laugh> But I do all the time. <laugh> But I got a hundred on my driving test. I don't care who knows it. And I hope it's everybody. But I guess all of this is just to say there are areas of life where fluency feels natural, with the case of walking. There's areas of life where fluency feels motivating, with like driving—I wanna be able to switch the CD out or whatever. And there's areas where fluency feels terrifying and hard to come by, like mathematics, sometimes. So we have a set of guests here. Our first guest will help us figure out what do we mean by fluency? And what's the research say about what fluency is and how students develop it in mathematics? And then our other guests will help us think

about what it looks like in practice in the classroom. What are some novel, new ways to work on fluency? So first up we have Val Henry, Dr. Val Henry.

Bethany Lockhart Johnson (03:32):

So we knew we needed help with the fluency definition, because when we think about it, it's kind of big, right? And we wanted to look at what research about fluency really says. So we called on Valerie Henry. Val is a nationally board-certified teacher, taught middle school for 17 years, and since 2002 has worked with undergraduates graduates, credential candidates as a lecturer at the University of California, Irvine, one of my alma maters. So after doing her dissertation on addition and subtraction fluency in first grade, Val created a project to study ways to build addition and subtraction and multiplication and division fluency while also developing number sense in algebraic thinking. And the pilot grew and grew over the last 18 years into a powerful daily mini-lesson approach to facts fluency called FactsWise. And when we thought of fluency, the first person I thought of was Val. Welcome, Val Henry, to the Lounge! I'm so excited to have you here. Welcome.

Valerie Henry (04:36):

Thanks, Bethany. And thanks to you, Dan. It's great to be here today.

Dan Meyer (04:41):

Great to have you; help yourself to whatever you find in the fridge. The names that people write down on those things in the bags are just recommendations. It's potluck-style here. I'm curious, Val, if you're, like, on an airplane, someone asks you what you do, and you say you study fluency...what is the layperson's definition of what does it mean to be fluent in mathematics? And if you can give a brief tour through what the research says about what works and what doesn't that would really help us orient our conversation here.

Valerie Henry (05:12):

The first thing I have to do when I talk to somebody on a plane is define the idea of fluency. And I often use an example of tying your shoelaces. Because that works with first graders as well as adults. This idea that when we first start trying to put our shoes on and get those shoelaces tied, somebody tries to, first of all, just do it for us. But then of course maybe tries to teach us the bunny-ears approach. And we struggle and struggle as little kids and eventually either the bunny-ears approach or something else starts to work for us. But we still have to pay attention to it. We have to think hard and it's not easy. And then over time we get to the point where we basically don't even think about it. When I tie my shoes in the morning. I'm not thinking about right-over-left and left-over-right and all of those things. I just do it. And so that's a good, easy example of becoming fluent with something. I think what we're talking about today though, is the basics, the adding and subtracting that we hope kids are going to have mastered maybe by second grade, and the multiplication and division facts that we wanna maybe have mastered by third, maybe fourth grade. So now what does that mean to become fluent with those basics? I have a three-part definition that seems to match up really nicely with the common core approach to fluency. Which is, first of all, we want the answers to be correct. And then second, we want the answers to be easy to know. And so what does that mean? Well, to me, it means without needing to count,

Bethany Lockhart Johnson (07:12):

You mean without having to kind of muscle through it? Or say more about you mean.

Valerie Henry (07:16):

Well, I guess what I mean is that when you watch a young child try and solve something even as simple as two plus three, they might put up two fingers and then go 3, 4, 5 with three more fingers winding up on their hand, one or the other of their hands. While they're doing that, they don't really have a sense of whether even their answer is right or not, quite often. Especially when you get to the larger

adding and subtracting problems, you can see a lot of errors happening as they're trying to count. And it's taking up cognitive energy to do that counting process, especially as you get to the larger quantities. So my definition of fluency now is "getting it right without needing to do that hard work like counting." Now, some people might say, well, we just want them to have 'em memorized. But in my research, I've learned that a lot of very fluid adults don't always have every fact memorized. In fact, if you ask a room full of adults, what's seven plus nine, you might learn that they can all get it correct quickly, quickly...but they don't all have it memorized. And so when you ask them, "How did you get that?" Many of them will say, "Well, I just gave one from the 7 to the 9 and I know that 10 plus 6 is 16."

Bethany Lockhart Johnson (08:53):

That's such an important distinction. My brain literally just did that actually!

Valerie Henry (08:58):

<laugh> Right? <laugh> But you're fluid with it, because it doesn't take you much cognitive energy at all.

Bethany Lockhart Johnson (09:05):

Right.

Valerie Henry (09:07):

So now we have "correct without needing to put that cognitive energy," which usually means that you're counting. And then the third thing is "relatively quickly," so that you're not spending 15 seconds trying to figure it out. Even that part-whole strategy approach can be done really quickly, almost instantaneously. Or it can take a long time. So if a student can get the answer correct within, you know, three or four seconds— is I'm pretty generous—I figure that they're pretty darn fluent with that fact. So that's my three-part definition of these basics, fluency.

Dan Meyer (09:55):

I love the distinction between getting it correct and getting it quick. It's possible to be quick with wrong answers. It's possible to be like, "Those are separate components there." And I echo Bethany's appreciation for this third option in between knowing it instantaneously through memorization and muscling through it. But there's like a continuum there of how much energy it took you to come up with it that all feels extremely helpful.

Valerie Henry (10:21):

And you know, one of the things that I've noticed is that when kids are pressured to come up with those instantaneous answers, they often default to guessing and get it wrong.

Bethany Lockhart Johnson (10:30):

Mm, yeah.

Valerie Henry (10:30):

So that's one of the things that I've learned is that as we're trying to help students develop fluency, it's important to start with building their conceptual understanding of what it means to do, you know, 3 times 9 and what the correct answer is, maybe using manipulatives or representations of some sort. Not skip-counting! I really have found that skip-counting just perpetuates itself in many students' minds and that they never stop skip-counting, which means they're putting in not very much mental energy if it's 2 times 3 but a ton of mental energy if it's 7 times 8. Because frankly, it's really hard to skip count by sevens. And by eights.

Bethany Lockhart Johnson (11:18):

I can get to 14 and then I'm like, wait, wait, what was next? Right? No, no, no...21! What do you feel are some misconceptions that maybe teachers, maybe parents have about fluency in math?

Valerie Henry (11:30):

I think maybe one of the first ones is that if students count or skip-count, their answers repetitively over and over and over and over, that they're bound to memorize them. And the study that I did back in 2004, I actually had a school that had decided that they were going to do time tests with their students every day, all year. And that undoubtedly by the end of the year, those students would be fluent.

Bethany Lockhart Johnson (12:06):

And to clarify by time test, you mean like, sit down, pencil, paper, ready, go, worksheet kind of thing.

Valerie Henry (12:15):

Yes.

Bethany Lockhart Johnson (12:16):

Some of us might remember quite vividly.

Valerie Henry (12:18):

<laugh> Very vividly. And you know, you have to get it done within a certain amount of time. So they made it fun for the students. Apparently the students enjoyed it. I was a little leery about that, but in the end, when I went and checked on the students and I did one-on-one assessments with half of the students in every class that were randomly selected so that I could get a sense of where they were with their fluency—and these were first graders—they basically had nothing memorized. They were simply counting as fast as they possibly could. And, you know, mostly

getting the right answers. But they had not memorized. So that's one of the myths, I think, is that repetitive practice of counting gets you to memorization.

Bethany Lockhart Johnson (13:10):

If I put it in front of you enough times, you'll become fluent.

Valerie Henry (13:14):

Right, right. Now these students didn't really get any instruction, any help learning these. They just simply tested over and over and over. So that's another thing that I think is a misconception. It's that if we test students, but don't really teach them fluency, then they're going to become fluent. If we just test them every Friday or that kind of thing. And that they'll learn them at home. But really what that means is a few lucky kids who have parents who have the time and the energy and the background to know how to help will take that job on at home. Not that many students are really that fortunate.

Dan Meyer (14:01):

It's almost like the traditional approach, or the approach you're describing, confuses process and product. It says, "Well, the product is that eventually fluent students will be able to do something like this, see these problems and answer them, answer them quickly," and says, "Well, that must be the process then as well; let's give them that products a whole lot." But as I hear you describe fluency with bunny ears on shoelaces, there's these images and approaches and techniques that require a very active teacher presence to support the development of it. That's just kind of interesting to me.

Valerie Henry (14:35):

My initial project, the pilot project that I tried, was to simply ask teachers to follow five key principles. And the first one was to do something in the classroom every day for—I told them, even if you've only got five or 10 minutes, work on fluency for five or 10 minutes a day, and let's see what happens. So that was one key element was just to teach it and to give students opportunities to get what the research calls for when you're trying to memorize, which is actually immediate feedback. When I talk about immediate feedback with my student teachers, I say, "I'm talking about within one or two seconds of trying a problem, and then sort of immediately knowing, getting feedback of whether you got the answer right or not so that your brain can kind of gain that confidence. 'Oh, not only did I come up with an answer, but somebody's telling me it's the correct answer.'"

Dan Meyer (15:38):

There's a lot of apps now in the digital world that offer students questions about arithmetic or other kinds of mathematical concepts and give immediate feedback of a sort: the feedback of "You're right; you're wrong" sort. Is that effective fluency development, in your view?

Valerie Henry (15:57):

I haven't heard and I haven't seen them being super-effective. The ways I think about this are "Immediate feedback isn't the only thing we need." Probably one of the biggest things that we need is for students to develop strategies. And this is one of the other things I've learned from international research, from countries that do have students who become very fluent very early, is that they don't shoot straight for memorization, but they go through this process of taking students from doing some counting and then quickly moving them to trying to use logic. So, "Hey, you really are confident that 2 + 2 is 4; so now let's use that to think about 2 + 3." Actually, as an algebra teacher, I would much rather have students that have a combination of memorization and these strategies, than students who've only

memorized. Isn't that interesting that my most successful algebra students were good strategy thinkers. Not just good memorizers.

Bethany Lockhart Johnson (17:09):

So you mentioned there were five that kind of helped root this idea in like, "What can teachers do? What is the best thing that teachers can do to support with fact fluency?" So, everyday was key.

Valerie Henry (17:22):

Then the next principle that I really focus on is switching immediately to the connected subtractions so that students—

Bethany Lockhart Johnson (17:33):

Not waiting until you've gotten all the way through addition. But making "Ooh!"

Valerie Henry (17:38):

Totally. And I didn't do that the first year. And when we looked at the results of the assessments at the end of the year, we realized that our students were so much weaker in subtraction than addition. So the following pilot year, we tried this other approach of doing subtraction right after the students had developed some fluency with that small chunk of addition. And we got such better subtraction results.

Bethany Lockhart Johnson (18:11):

What are the other principles?

Valerie Henry (18:13):

The biggest one is to use these strategies. So the strategies makes the third. And then the fourth I would say is to go from concrete to representational to abstract.

Bethany Lockhart Johnson (18:27):

Don't put away those manipulatives. Don't put away those tools.

Valerie Henry (18:31):

Oh, so important to come back to them for multiplication and division. And my fifth principle is to wait on assessment. To use it as true assessment, but not race to start testing before students have had a chance to go through this three-phase process. Which is conceptual understanding with manipulatives; building strategies, usually with representations; and then working on building some speed until it's just that natural fluency.

Bethany Lockhart Johnson (19:07):

I wanna say thank you so much for offering your really learned perspective, because you have not only done the research, but seen it in action and seen how shifting our notions of fluency and what fluency can be and what a powerful foundation it can be for all mathematicians. Really, that shift is so powerful. And I appreciate you sharing it with our listeners and with us. So we're so excited that we got to talk with you today, Val—

Dan Meyer (19:35):

Thank you, Dr. Henry.

Valerie Henry (19:37):

You're welcome!

Dan Meyer (19:41):

With us now we have Graham Fletcher and Tracy Zager, a couple of people who understand fluency at a very deep and classroom level. I wanna introduce them and get their perspective on what we're trying to solve here with fluency. So Graham Fletcher has served in education in a lot of different roles: as a classroom teacher, math coach, math specialist, and he's continually seeking new and innovative ways to support students and teachers in their development of conceptual understanding in elementary math. He's the author, along with Tracy, of Building Fact Fluency, a fluency kit we'll talk about, and openly shares so much of his wisdom and resources at gfletchy.com. Tracy Johnson Zager is a district math coach who loves to get teachers hooked on listening to kids' mathematical ideas. She is a co-author of this toolkit, Building Fact Fluency, and the author of Becoming the Math Teacher You Wish You'd Had: Ideas and Strategies from Vibrant Classrooms. Tracy also edits professional books for teachers at Stenhouse Publishers, including, yours truly. Thank you for all that insight, Tracy, and support on the book.

Bethany Lockhart Johnson (20:49):

Dan and I were talking at the beginning of the episode about things we feel like, "Hey, I'm fluent in that. I'm fluent in that."

Dan Meyer (20:55):

Just very curious: What's something you would like to get fluent in outside of the world of mathematics, let's say?

Tracy Zager (21:00):

I'll say understanding the teenage brain, as the parent of a 13-year-old and 15-year-old. That's the main thing I'm working on becoming fluent in!

Bethany Lockhart Johnson (21:10):

Ooh!

Dan Meyer (21:13):

A language fluency, perhaps. All right, Graham. How about you?

Graham Fletcher (21:16):

For me typing, it's always been an Achilles heel of mine. So voice-to-text has been my friend. But it's also been my nemesis in much of my texting here and working virtually over the last couple years. So yeah, typing.

Dan Meyer (21:33):

Do you folks have some way of helping us understand the difference in how fluency is handled by instructors and by learners?

Tracy Zager (21:40):

I would say that the lay meaning of fluency is definitely a little different than what we mean in the math education realm. When we're talking about math fact fluency, which is just one type of fluency. So you gotta think about procedural fluency and computational fluency; there are lots of types of fluency in math. And Graham and I had the luxury of really focusing in specifically on math fact fluency. We're looking at kind of a subset of the procedural fluency. So the words you hear in all the citations are accurate, efficient, and flexible. There's this combination of kids get the right answer in a reasonable amount of time and with a reasonable amount of work and they can match their strategy or their approach to the situation. That's where that flexibility comes in. And there's like lots more I wanna say about that about sort of...I think one issue that comes up around fluency is that people are in a little bit of a rush. So they tend to think of the fluency as this automaticity or recall

of known facts without having to think about it. And that is part of the end goal, but that's not the journey to fluency. So this is one of the things that Graham and I thought about a lot was the path to fluency. The goal here it's that student in middle school who's learning something new doesn't have to expend any effort to gather that fact. And they might do it because they've done it so many different ways that they've got it, and now they just know it, or they might be like my friend who's a mathematician who still, if you say, "Six times 8," she thinks in her head, "Twelve, 24, 48..." and she does this double-double-double associative property strategy. And it's so efficient, you would never know. And that's totally great. That's fine. That's not slowing her down. That's not providing a drag in the middle of a more complex problem or new learning. So we're really focused on having elementary school students be able to enter the middle and high school standards without having that pull out of the new thinking.

Graham Fletcher (23:53):

And as I think about that, I think about how so many students will memorize their facts, but then they haven't memorized them with understanding. So that when they move into middle school and they move into high school, it's almost like new knowledge and new understanding that's applied from a stand-alone skill.

Bethany Lockhart Johnson (24:10):

So something that felt really unique to me, Graham, as I was diving into the toolkit, is your use of images, Tracy, Graham, is the way that you use images to help students notice and wonder to start making sense of these quantities and the decomposition of numbers using images. Can you talk a little bit about how images played a part in the way that you think about this building a fact fluency?

Graham Fletcher (24:41):

What I realized is so many times when we approach math with just naked numbers with so many of our elementary students, the numbers aren't visible. The quantities. They can't see them; they can't move them. They're just those squiggly

figures that we were talking about earlier on. So how is it that we make the quantities visible, to where students feel as if they can grab an apple and move it around? Because a lot of times we start with the naked numbers and then if kids don't get the naked numbers, then we kind of backfill it. But what would happen if we start with the images? And then from there, these rich, flourishing mathematical conversations develop from the images. And I think that was the premise and the goal of the toolkit.

Tracy Zager (25:22):

When you look at how fact fluency has traditionally been taught, it's all naked numbers. And sometimes we wrote 'em sideways. Like, that's it. That was our variety of task type. Right? Sometimes it's vertical; sometimes it's horizontal. And that was it. And I've just known way too many kids who couldn't find a hook to hang their hat on with that. It didn't connect to anything. And so part of why I knew Graham was the perfect person for this project was his strength in multimedia photography, art, video. And so we started from this idea of contexts that for each lesson string in the toolkit, there's some kind of context. An everyday object, arranged in some kind of a way that reveals mathematical structure and invites students to notice the properties. So we start with images of everyday objects: tennis balls, paint pots...um, help me out; here are a million of them. Crayons—

Bethany Lockhart Johnson (26:18):

Crayons, markers.

Tracy Zager (26:18):

Shoes, right? Sushi, origami paper, all kinds of things in the different toolkits. So there's a series of images or a three-act task or both around those everyday objects, and then story problems grounded in that context. And then there are images with mathematical tools that bring out different ideas, but relate in some way to the image talks. And we do all of that before we get to the naked number

talk. Which we do, and by the time you get to the number talk, it's pretty quick, 'cause they've been reasoning about cups of lemonade. And now when you give them the actual numerals, they're all over it.

Bethany Lockhart Johnson (27:03):

I have to say too, as somebody who—particularly in middle school—navigated math anxiety, we recently talked with Allison Hintz and Anthony Smith about their amazing book Mathematizing Children's Literature.

Tracy Zager (27:14):

Yay!

Bethany Lockhart Johnson (27:14):

And I was explaining, like, if I sat down at the beginning of a math class and my teacher opened a picture book and said, "We're gonna start here," I felt my whole body relax. And if we start with this image, if we start with just looking at an image and making sense of an image, I feel like that could be such a powerful touchstone for all the work you do from there.

Tracy Zager (27:41):

That's core. That's a core design principle, is that invitational access. There are no barriers to entry. There's nothing to decode. There's nothing formal. We've been learning from Dan for years about this, right? Of starting with the informal and then eventually layering in the formal. I was in a class in Maine where they were doing an image talk and it's these boxes of pencils. It's a stack of boxes of pencils and they're open and you can see there are 10 pencils in each box. And so there are five boxes of pencils each with 10 pencils in it. And then the next image is 10 boxes of pencils and each box is half full. So now it's 10 boxes each with five. And the kids are talking and talking and then the third image, I think there are seven boxes each with 10

pencils in it. And she said, "What do you think the next picture's gonna be?" And this girl said, "You just never know with these people!" <laugh> I dunno!"

Bethany Lockhart Johnson (28:37):

That's kinda true. Knowing you both, it's kinda true.

Tracy Zager (28:42):

Like if it's seven boxes with 10 in it, one kid said, I think it's gonna be 14 boxes of five. And other kids are like, I think it's gonna be 10 boxes with seven. And they start talking about which of those there are and the relationships between—

Bethany Lockhart Johnson (28:58):

But they're making sense of numbers!

Tracy Zager (28:59):

Totally. So all the kids felt invited. They can offer something up. They're noticing and wondering about that image. They're talking about it in whatever informal language or home language that they speak. And that was core to us. That was a huge priority, because honestly, one of the motivations to talk about fluency is that it's always been this gatekeeper. It has served to keep kids out of meaningful math. Particularly kids from marginalized or historically excluded communities. So they're back at the round table, doing Mad Minutes, while the more advantaged kids are getting to do rich problem solving. And so, we thought, what if we could teach fact fluency through rich problem solving that everybody could access? That was like square one for us.

Bethany Lockhart Johnson (29:45):

That's huge.

Dan Meyer (29:46):

That's great to hear. What's been helpful for me is to understand that students who are automatic, that's just kind of what's on the surface of things. And that below that might be some really robust kind of foundation or scaffolding that bleeds to a larger building being built, or it might be just really rickety and not offer a sturdy place to build farther up. It's been really exciting to hear that. I wonder if you'd comment for a moment about, in the digital age and—I'm at Desmos and our sponsors are Amplify and we all work in the digital world quite a bit. There are a lot of what report to be solutions to the fluency issue, to developing fluency in the digital world. Just lots and lots of them. Some that are quite well used, others that are just like X, Y, or Z app on the market. You can find something. Do you have perspectives on these kinds of digital fluency building apps? Like, what about them works or doesn't work? Let us know. Graham, how about you? And then Tracy, I'd love to hear your thoughts too.

Graham Fletcher (30:47):

Yeah, I think that's a great question, 'cause there's a lot of shiny bells and whistles out there right now that can really excite a lot of teachers. But I always come back to what works for me as a classroom teacher is probably gonna work in a digital world as well. So what are the things that I love and honor most about being in front of students, and how can I capture that in that virtual world? I think one of the things that really helps students make connections is coherence. I think coherence, especially when you leave students for—you don't get to talk with them after the lesson is done—so I think about how we can purposefully sequence things through a day-to-day basis. I think coherence is something that gets really lost when we talk about fluency, especially with whether it be digital or whether it be print, because what ends up happening is we say, "OK, we have all these strategies we need to

teach," and it becomes a checklist. So how is it that we can just provide students the opportunity to play around in a space, whether it be digital or in person, but in a meaningful way that allows them the time and the space and that area to breathe and think, but be coherent. And connecting those lessons along the way. And I think coherence is one thing that a lot of the times it's harder to—when we're in the weeds, it's so hard and difficult to zoom back out and say, "Do all these lessons connect? How do they intentionally connect? And how do they purposefully connect?" And without coherence, everything's kind of broken down into that granular level. So when looking at—I think about Desmos and I think about the Toolkit and I think about how Tracy and I talked a lot about, "Well, this, does it connect with the context problem, does it connect with the image talk, or the lessons? Like, how does it all connect and how are we providing students an opportunity to make connections between the day-to-day instruction and lessons that we tackle?"

Tracy Zager (32:44):

I'm reminded of a conversation that Dan, you and I had a long time ago, in Portland, Maine, in a bar. I'll just be honest. <laugh> And we were talking about how, in the earlier days of Desmos, you were stressed out by what you saw, which was kids one-on-one, on a device, in a silent room. And you were like, no, this is not it. This is not what technology is here to serve. We can do so many things better using technology appropriately, but we can't lose talk and we can't lose relationships and we can't lose formative assessment and teachers listening to kids and kids listening to each other and helping each other understand their thinking. Right? So when I think about the tech that's out there for fact fluency, most of it is gonna violate all rules I have around time testing. So that a whole bunch of it, I would just toss on that premise. They're really no different than flashcards. It's just flashcards set in junkyard heaps. Or, you know, underground caverns. Or with a volcano or whatever. It's the same thing. There are some lovely visuals—I'm thinking of Berkeley Everett's Math Flips. Those are really pretty. Mathigon has some really nice stuff that's digital. And I think that those resources invite you to kind of ponder and

notice things and talk about them. All the tools that we design in the toolkit are designed to get people talking to each other, and give teachers opportunities to pull alongside kids and listen in and understand where they are. For example, our games, we didn't design the games to be played digitally, even though you could, and people did during COVID, because we want kids on the rug, next to each other, on their knees; I've seen kids like across tables. I was in a school recently where a kid was like, "I hope you believe in God, 'cause you're going...!" You know what I mean? <laugh>. Like they're all pumped up.

Bethany Lockhart Johnson (34:41):

They're invested!

Tracy Zager (34:45):

They're psyching each other up and down and they're interacting and it's social and the teacher's walking around and she's listening to the games. And they don't actually need any bells and whistles. They need dice and they need counters and they need this game that is actually a game. In all of our conversations, games have to actually be games. Games cannot be "roll and record." Games have to involve strategy. They have to be fun. So in designing those games, we didn't feel like it brought any advantage to make that a digital platform. But things that did bring advantages digitally, like the ability to project these beautiful images or to use short video in the classroom, that really was a value-add that enabled us to do something different in math class than we had done before, and to get kids talking in a different way than they ever had before. When I think about fluency, historically, if you say like, "OK, it's time to practice our math facts," you hear a lot of groans. And when I see a Building Fact Fluency classroom and I say, "OK, it's BFF time!" There's like a "YEAAAAHHH!" You know? And so that's what we're after.

Graham Fletcher (35:47):

It's all about kids, really, for us. And I think at the heart of it, we made all the decisions with teachers and kids at the forefront of it.

Tracy Zager (35:55):

I know of high schoolers who are newcomers, who have experienced very little formal education, and speak in other languages, are using it as high schoolers, because it involves language and math and all the deep work in the properties and it's accessible, but it's also not at all condescending or patronizing. Like we designed it to be appropriate for older kids. So that's just something that I think we're both really proud of. One thing we thought a lot about, especially in the multiplication-division kit is how a classroom teacher could use it and a coordinating educator in EL, Title, special education, intervention could also use it because there's so much in it, that students could get to be experts, if they got extra time in it, using something that's related and would give them additional practice. So they could play a game a little bit earlier than the rest of the classes. And they could come in already knowing about that game, or they could do a related task. We have all these optional tasks that no classroom teacher would ever have time to teach it all. So the special educator could use it and have kids doing a Same and Different or a True/False, or some of the optional games. And then the work in both special education and general education could connect.

Dan Meyer (37:20):

I just wanna say that this is an area that for so many students, as you've said, Tracy, it presents a barrier for their inclusion in mathematics. It's a very emotionally fraught area of mathematics. And we really appreciate the wisdom you brought here. And just the care you've brought to the product itself. Your knowledge of teaching, knowledge of math, and yeah, especially a love for students feels like it's really infused throughout Building Fact Fluency. If our listeners want to know more

outside of this podcast, outside of the product itself, where can they find your words, your voice? Where you folks at these days? Tell 'em, Graham would you?

Graham Fletcher (37:57):

You can find us at Stenhouse, Building Fact Fluency. And then Tracy and I, currently playing around, sharing ideas a lot on Twitter, under the hashtag #BuildingFactFluency. That's kind of where we can all come together and share ideas. And then also on the Facebook community, where there's lots of teachers sharing ideas.

Bethany Lockhart Johnson (38:19):

If you were to ask our listeners like, "Hey, if you wanna keep thinking about this, here's something you could try or here's something you could go do," what could be a challenge that we could share that could help us continue this conversation?

Graham Fletcher (38:35):

Online you can actually download a full lesson string. And a lesson string is a series of activities and resources that are purposefully connected. You can pick one or two of those from the Stenhouse web site, Building Fact Fluency. You can try the game. You can try one of those strategy-based games. You can try an image talk and just see how it goes. And just share and reflect back, whether on Twitter or on Facebook. But it's kind of there, if you wanna give it a whirl. And as Tracy was sharing, even if you're a middle-school teacher or a high-school teacher, we really tried to think about those middle-school and high-school students keeping it grade level-agnostic. Just so every student has those opportunities for those mathematical conversations. So download a lesson string and give it a whirl, and we'd love to hear how it goes.

Dan Meyer (39:25):

Bethany and I will be working the same challenge with people in our life.

Bethany Lockhart Johnson (39:29):

Yes.

Dan Meyer (39:29):

Enjoying some fact fluency with people in our homes, perhaps. We'll see. And we'll be sharing the results in the Math Teacher Lounge Facebook group. Graham and Tracy, thanks so much for being here. It was such a treat to chat with you both.

Bethany Lockhart Johnson (39:42):

I love learning with you and just helping to shift this idea of fluency into something that can be accessible and powerful and positive.