Highest Aspirations Podcast: S4/E2
Routines for Reasoning: English Learners and Math with Grace Kelemanik and Amy Lucenta (Part 1)

Grace:
“For English learners in a classroom, you mentioned before, they're learning the mathematics, so the content is new to them in a new language, but there's also this sort of like third issue for them which is they're often learning in new context, right? In a new way of doing school and a new culture and that just increases the cognitive load before we even get to the thinking hard about the mathematics. Anything we can do to hold steady. Part of that work for English learners is incredibly supportive. If the English learners do not have to everyday learn a new set of instructions and directions before they even get started in the math thinking and the math doing, that frees up just a big chunk of brain space and lowers anxiety and helps them engage in the mathematics.”

Steve:
Hey everybody. Welcome back to Highest Aspirations. I'm your host, Steve Sofronas. How can building routines for reasoning help reduce cognitive load and anxiety for English learners in math classes? How can strategies like ask yourself questions, annotation, sentence frames and starters, and the four Rs help provide equitable access to mathematical thinking? What are some effective ways of providing students with the academic vocabulary necessary to have a seat at the math table? We discuss these questions and much more in part one of our two part series with Grace Kelemanik and Amy Lucenta, authors of the book, Routines for Reasoning, Fostering the Mathematical Practices in All Students.

Steve:
Most recently, Amy Lucenta served as a secondary mathematics clinical teacher educator for the Boston Teacher Residency program. Her experience spans K to 12 teaching, both middle and high school, then extending into elementary as a math coach. Her passion for helping struggling learners focused on developing the standards for mathematical practice is evident in the book and in our conversation where she continues to explore how to develop mathematical thinkers through establishing routines that lead to success.

Grace Kelemanik has over 30 years of mathematics education experience. As a frequent presenter at national conferences, she meets and continues to support countless math educators on their journey as thinking facilitators. She has served as an urban high school math teacher, education development center project director, and extensively supports new and pre service teachers through the Boston Teacher Residency program.

One quote posted on their website that really resonated to me was quote, "English learners come into our classrooms expected to learn mathematics, which is new to them, in a language that is new to them, in a culture that is new to them," unquote. We hope you walk away from this

conversation with some routines that will help support these learners. These routines will provide a structure for all of your students to get down to the business of discussing, defending, communicating, connecting, and reflecting on the learning of mathematics.

Just a quick side note. As I mentioned a few times in the episode, I am not an expert in math, but I think Grace, Amy, and I kind of come together in a way that brings our strengths to the table and may also expose some of our weaknesses, which I think is actually a great part of the conversation. Before we get started with our conversation with Grace and Amy, just a reminder that you can stay connected to us by joining our ELL community at ellevationeducation.com/ELLcommunity. There you can leave comments about this episode and others and you can also engage with great content like our short video series, blog posts, and articles. And finally, and this is important, please consider leaving us a review on iTunes or wherever you get your podcasts. This will help us continue bringing you the best topics and guests on Highest Aspirations and of course, provide us with important feedback about the Highest Aspirations podcast. As always, thanks for listening. Here's part one of our two part series with Grace Kelemanik and Amy Lucenta.

Grace Kelemanik and Amy Lucenta, thanks so much for joining us on Highest Aspirations.

Amy:
Hi, Steve. Great to be here. Thanks for having us today.

Grace:
Yeah, Steve, it's terrific being part of the Highest Aspirations conversation.

Steve:
Yeah, it's good to have you both as well. I sort of admitted before I started here that I am no math expert. I'm sure my wife who was a math teacher for a while is thinking how are you doing this right now? But, I think between your knowledge of math and English learners, and my knowledge of English learners, this is going to be really fun, and I have to say, I picked up your Routines for Reasoning book. I was a little bit nervous, but I sat one day, I got the motivation and I sat in my comfy chair, spent a few hours with it, I learned a ton, and I was so excited to see all the crossover between the work we're doing and the work you're doing. So, that being said, I think I'm pretty confident in the rest of this conversation.

Amy:
Great.

Grace:
Terrific.

Steve:
Let's start with the math practices, which I learned a tremendous amount about by reading the first couple of chapters of your book. There are those out there, like me just a couple months ago, who aren't familiar with the math practices or similar standards in states like Texas that are referred to as the process standards. Can you give us a short summary of what they are and why they are important for students, and if appropriate, for English learners in particular?

Grace:
Sure. The math practices or process standards, I guess simply put, describe ways in which mathematicians think and work. It's not so much the what of mathematics, like the content that you're learning, but how mathematicians use the content to tackle problems in the world, or to mathematize the world and make sense of it.

Steve:
Yeah. I think with that definition and me reflecting back on my experience with the book, what I kept thinking is I wish math were taught this way, or my teachers taught math this way when I was growing up, cause I had a hard time with just the very kind of rote memorization and plugging things in aspect of it.

Grace:
Yeah, and we live in a constantly changing world right now. It's sort of the technology driven, data drenched world where we can ask Siri and Alexa math questions and they can answer them. We have at our fingertips and our lips, ways in which to kind of get the information and do the kinds of things that you and I learned to do by rote with paper and pencil. Really, what's becoming clear to us is that kids need to learn how to think and reason mathematically. That they're constantly positioned and they're bumping up against new experiences and new context and new technological tools to make sense of and use. We really need to ramp up thinking and reasoning in our math classrooms, and that's a challenge for all kids. It's particularly a challenge for students who often didn't have a seat at the math thinking table, like English language learners and students with certain learning disabilities. So, that was really a big motivation for Amy and Susan and I when we were working on Routines for Reasoning, how to provide access to the mathematical thinking and reasoning for all students.

Steve:
Sure, that's great. I see just connections right there in kind of the first introduction of this episode in we have the ability to find information, the what, really easily using technology. It actually affords us the opportunity to really think about the how we're learning, and to really think about the ways. I like the way you put it and I saw in the book quite a bit, the way that mathematicians think, and that goes right into your mention of the book there, Routines for Reasoning.

Your routines are sort of much broader than what teachers may be used to. When I hear the word routine, and I was a teacher for 17 years, a routine was like, all right, well classroom management routines. Like what do we do over the course of the day to make our lives a little

bit easier. But the routines that you're talking about here include these phases and I'll list them off, individual think time, partner work, whole class discussion, and math practice reflection. Can you tell us a little bit about why you use those four steps and why each one is important? Amy, if you wouldn't mind tackling that one, that'd be great.

Amy:
Yeah, sure, Steve. You really hit the nail on the head there. Routines have a variety of grain sizes and teachers use them for a multitude of purposes, from management, to materials, et cetera. But ultimately, the purpose is the same, so kids know what to expect and so teachers also know what to expect. For us, our routines are actually a student experience that's repeatable. You named these four chunks that we have in common in all of our routines, that they start with some individual think time. That's super important because students need time to make sense of what they're looking at or what they're hearing before they're ready to dive in. Particularly English language learners to have a little extra processing time so that they can make sense and prepare what they're going to say and process how they're thinking.

Then all of our routines have a heavy dose of partner work. That also is to provide every student opportunity to process an idea, to work with a partner, to co-construct understanding, to collaborate. Through that, they're building the mathematical thinking. They're building their own agency because they're the ones doing the thinking and they're given some time to process both the idea and the language together with a partner. Oftentimes that's in preparation for the whole class discussion.

We think the heavy lifting of developing mathematical thinking happens in the partner work, and then it gets synthesized in that whole class discussion. So that's always a part of our routines, and in that discussion, ideas are shared and reshared and synthesized, and then we return to the goal of the lesson which is the mathematical thinking, and students have the opportunity to reflect on it and actually name the kind of thinking they developed in the routine and prepare themselves to use that thinking again in a similar but new situation. Those four steps are present in all of our routines and they do speak to a larger grain size. Then within those four chunks, there are specific designs for interaction that really allows students to feel and benefit from routines.

Steve:
Right. I'll take two things out of there that I think are really important, I think you did a great job setting them up. I mean for me, there's that structure and agency piece that we never get away from. To me, as I was reading this, I was thinking oh, let's provide both the teacher and the student with the structure that you need to sort of know what to expect and we'll get to that in a second.

That freedom to concentrate on other important things. But also there's enough agency in there, right? Depending on the topic that you're discussing, and depending on how the teacher, that particular teacher, goes about presenting the lesson that is not going to stifle anybody's

creativity, I don't think, particularly given the fact what you just discussed, which is that idea of thinking about your own thinking, that metacognition piece, which to me was missing from math completely as I was going through it. It's really important for everybody and there's lots of research out there now that, particularly for English language learners as they're processing both the content and the language, that thinking about how they're thinking and how they're learning is so crucially important. I'm glad we talked a little bit about that.

You know, I just mentioned those routines, you write that they give teachers and students the freedom to concentrate on important matters instead of worrying about what am I supposed to be doing? What question will I be asked next? How will things work in today's lessons? Those, by the way, are all direct quotes from your book. Then you make this great comparison, which I love, about someone learning to drive and how that kind of works there, like if ... Well, I'll let you, Grace, I'll let you kind of talk about that. Could you put that all together like that driving metaphor and how it works in the context of an English learner in math class?

Grace:
Sure. I'd love to. We use the driving metaphor in the book to talk about building a habit and getting to a place where you're doing something without even having to think about it. I'm kind of chuckling to myself because I've got a teenager who recently learned how to drive.

Steve:
Horrifying. I'm almost there.

Grace:
Good luck.

Steve:
Thank you.

Grace:
I was reminded again as I was sitting white knuckled in the passenger seat of just how many things you have to be thinking about seemingly all at once and anticipating when you're beginning to learn to drive this powerful vehicle. And that that changes, though things change rapidly depending on what kind of road you're on or what you're doing. Then at some point you have enough experience getting in, starting the car, driving, it becomes routine for you because you keep doing the same things over and over again and you no longer think about it. Now we are at a point where you get from point A to point B and you're like, huh, I could be thinking about something else while I did that.

For English learners in a classroom, you mentioned before, they're learning the mathematics so the content is new to them in a new language. There's also this sort of third issue for them, which is they're often learning in a new context, right? In a new way of doing school, in a new culture. That just increases the cognitive load before we even get to the thinking hard about the

mathematics. Anything we can do to hold steady part of that work for English learners is incredibly supportive. If English learners do not have to every day learn a new set of instructions and directions before they even get started in the math thinking and the math doing, that frees up just a big chunk of brain space and lowers anxiety and helps them engage in the mathematics.

Their classmates for whom English is the first language, when the teacher says, okay, group up or work with a partner or do this, they know those words and they do it pretty quickly. But an English learner who's maybe never done school in a US classroom may not even know how the classroom operates. Every new instruction, every instruction is new and takes effort to think through before you even get to the mathematics instruction.

Steve:
Right. I'm so glad you brought up the cultural element and the element of school may be different, the context is different, and you kind of alluded to just those effective filters that immediately go up when something's different or new and you tend to retreat or tuck into your shell, which definitely happens frequently with English learners, unless there are these kinds of routines in place. The other thing I'll take out of that is, we never get away. I think I say it in every episode that good instruction for English learners is good instruction for all students, and in this case, I definitely think that is the case. I mean, I don't think there's going to be any sort of advanced students who complain that we have these routines that make me kind of process this stuff a little easier. I feel like that's ... is it fair to say that that's good instruction for everyone?

Grace:
It is, Steve, and it's helpful to the teacher.

Steve:
Yeah.

Grace:
In the very same reasons that it's helpful for the students, routines are helpful for the teacher because they know the flow of the lesson, they know what they're doing next, it becomes second nature like driving that car, they know what's coming next, so that frees up their brain space to really pay attention to what the students are saying and doing and how they're thinking and making sense of the mathematics because they're not thinking about what's my next move? Do I want kids to partner up for this or should I hand the papers out now? Those decisions are already pre made. They are baked into the structure of the routine.

Steve:
Right. Yeah. Boy, there's so many places I could go with this car metaphor. I'm going to resist that temptation. Maybe that's another podcast episode, but you know, there's just so many things that can be introduced into that and I just love it and I recommend folks take a look at that part of the book. I really enjoyed that.

Let's get into your, there's four strategies that I want to sort of delve into here and I'll name those as well. For every anybody listening, there's a lot of strategies and routines and names here. We'll link to lots of resources and the book, obviously, itself so you can dive in further. The purpose of this is to give people an idea of what these routines are and get people to know a little bit more about how they can support their English learners, and other students really, in math classes.

The four strategies are ask yourself questions, annotation, sentence frames and starters, and the four Rs. Let's go through those. Tell us what they are and maybe introduce if there's one that you think is particularly applicable here. Maybe we can dive in a little further or if you want to go into some others that's fine as well.

Amy:
Yeah, so each of our instructional routines has the chunks you were talking about, kind of the big picture flow. Then they also have these four strategies baked into each of the routines. These strategies are actually supports for all learners, but they're supports for different reasons. We'll talk a little bit about that. They don't just support students and engage them. They orient their thinking to the standards for mathematical practice. I'll give a brief description of each one and then maybe as you said, we'll take a deeper dive into one or two of them, but ask yourself questions are questions that we as mathematicians ask ourselves, like what is this problem about? What's the important information here? Or does this remind me of something else I've seen? We use them explicitly in the routines to develop them in students so that students internalize them and ask themselves those questions even when we're not there. To go back to the car analogy, to develop their own internal compass rather than listening to an external GPS.

Annotation provides a visual support for what's being said in the room.

Steve:
Crucial.

Amy:
Yeah. As I said, we're big fans of whole class discussion, but if the whole class discussion is in the air, that's really hard to follow for a variety of reasons. Maybe it's for reasons of, I don't know, auditory processing. Maybe it's because there are attention issues. Trying to track something just in one mode is difficult. Obviously, for English learners, having a visual support for what's being said in the room to really develop an idea is super critical. So, annotation connects the verbal and the visual. We use annotation really purposefully to highlight mathematical practices. Whether that's structural thinking of quantities and relationships, and we use color purposely when we annotate so it helps organize thinking and orient to certain aspects of it. Like I mentioned, each one of these strategies will support students and engage them and also orient toward a mathematical practice.

Steve:
Is that, if I can just dive in for a second, is that color, you mentioned that you use colors purposely and deliberately. Is that something that is established at the beginning of the school year as part of a routine? Green means this, red means this, blue means this, or is that something that's a little bit more open-ended?

Amy:
It's a little more open-ended. I'm kind of chuckling thinking, wow, that would take an incredible amount of organization.

Steve:
I know, I know. I'm thinking the same thing when I asked it, but I was just curious.

Amy:
No, it's more like, say you're looking at a problem situation and there's a number of chocolate bars in with one group of friends, and in the problem situation you can underline that in green, and then you can look at say a tape diagram or a visual representation of the problem situation and shade that the part of the visual in green so that it references back to the quantity. In a much smaller sense, the colors are purposeful. Yeah.

Then the other two remaining strategies are sentence frames and starters, which obviously for English learners are a huge support to give them language to start their share-out or their sharing of the idea, their articulation, to give them a running start in the language. They support a variety of other learners, again, for different reasons, maybe for students who have anxiety when they go to share in math class. It gives them a starting point and it gets them going, or organizing their thinking is difficult. It gives them that starting point.

What we're really always aware of is, although these strategies support a lot of students, it's for different reasons. It's not that all students are coming to the table with similar needs and that's why we're using the same support, but they're strategies that actually meet a range of needs for different reasons.

Then lastly, the four Rs, repeat, rephrase, reword and record. Grace, do you want to talk about the four Rs and why you use each one? That's kind of our most frequently asked question.

Grace:
Yeah, sure. In a classroom when a student shares a mathematical idea, one of the things that a teacher wants to be thinking about first out of the gate is did everybody hear it? If everybody hasn't heard it then we want to ask the student to repeat it or maybe a student who did hear the idea share to repeat the idea. Then we want to make sense of the idea. Asking students, one or two other students to rephrase the idea, to say it in a different way, gives the class an opportunity to kind of process and those students an opportunity to process the idea. Can they rephrase it with their own words? Then, and this is, I think, a part we'll talk some more about,

this balance between real precise language, like mathematically precise language or academic language, and everyday language students might use to talk about their mathematical thinking in the classroom and communicate.

Steve:
Right.

Grace:
This idea of rewording. We've shared this idea, we rephrased it, we really understand it, now might be the time to reword it with some increasing precision and mathematical language. Then finally, the record piece, which is as a teacher, I'm thinking about, is there language that we're using or want to be using that I should be recording visually so students can be using it as a reference while we're talking about this idea in the lesson? The big thing to point out here is that the repeating and the rephrasing and the rewording by and large are being done by the students, not the teacher. So often in a classroom, a student will share an idea and the teacher will rephrase it, or reword it, or repeat it to make sure everyone heard it, or make it more precise. When they do that, not only are they sort of robbing kids of an opportunity to process the idea on their own, but critically their robbing kids of the opportunity, in particular English learners, to try out language and speak in the classroom.

The third reason is they're essentially sending this tacit message that you don't have to listen to your classmates. If this is something important, I'll repeat it for everybody to hear. We want kids listening to each other and working with each other's idea and having lots of opportunities to articulate verbally the ideas in the classroom.

Steve:
Yeah, just hearing you talk about the four Rs, particularly the rephrasing part, really all of it, but I guess the culmination of it is their rephrasing and then the recording, so you can see what was rephrased and what language was used. It's a breath of fresh air for me, and I'm sure a lot of listeners out there who also sort of experienced math in maybe the way that I did. Thinking about the English learner, I mean this is, it's so crucial and it's just so, so nice to hear that that academic language, that vocabulary, is such a key component of the structures, or the four strategies that you have set up and should become kind of routine.

I did watch some videos that you have, which we'll link to, that showed this in action. It was just, I mean it was just great. You see the students working on this. Again, it's not just the English learners who are benefiting from it, but boy, I mean it is specifically and helpful, I think, for those particular students and I'm sure others as well as you've witnessed it. Just from my sort of bias lens, that just sounds so nice and I'm sure others were thinking the same thing.

Grace:
Implied in all of this, I think, is if you watch the video or dig further into these routines, we're not big fans of pre-teaching vocabulary. We're big fans of having students work on mathematics,

make sense of it from where they are using the language they have to make sense of it, and then introducing the appropriate mathematical language when there's a need for it. Like when they now have something to attach meaning to that new word with, or a new phrase with, or it helps us because it helps us be specific about an idea.

Steve:
Yeah. I was actually going to get to this question later, but I just kind of flipped my sheet over because I do remember it and you just mentioned that idea of pre-teaching and I'd like to kind of dive into that a little bit more. I know there is some research out there that that encourages teachers to refrain from pre-teaching math vocabulary. What are some effective ways to provide language and vocabulary to English learners so they have equitable access to this rich academic discourse and the lesson? I think that those, the routines that we talked about and then this four strategies do build that in, but if you're about to do a lesson, something related to, and again, my ignorance will show here with math, but maybe you're talking about fractions and there's just certain language that the students need. How do you go about doing that? Is there a way to introduce that right before the lesson starts? When you say pre-teaching, I'm curious what that conjures up for you. There's the idea of, as a Spanish teacher, I refrained always from, and I think all good teachers do, of giving students a list of vocabularies for them to memorize and then the end of the week we have a quiz but it's totally out of context. What is your idea of pre-teaching there?

Amy:
Well, I like talking about this right after the essential strategies because the essential strategies serve to get ideas out there and build language through that. Your example of teaching a fraction lesson, say you're adding fractions. We are big fans of using visuals in everything we do, so a lot of our routines have visual representations baked in. Students grapple with an idea in the language they're comfortable in, in their imprecise, informal, sometimes primary language. They grapple with the idea, and when we share the idea out and have some annotation to go along with it, students might be using words like "this" and "that" to really mean numerator and denominator.

Steve:
Sure, that's probably what I'd use.

Amy:
Me, too.

Grace:
The top and the bottom.

Amy:
While the teacher's pointing to it or annotating, circling it and connecting it to a visual representation, or the students referencing it visual and talking about the three is over there. No,

no, no above, and they're giving directions and they're not using precise mathematical language. Then that idea gets rephrased and another student adds another layer of precision. Now that the idea is out there, if there's precise math vocabulary, the teacher may say something like, and do we have a word for that in math? Or the teacher may say, and we have a word for that in mathematics, it's called numerator. But the idea gets out first and in multiple ways and multiple modalities. Then there's residue of it. It gets recorded through annotation and the record part of the four Rs. That way students have that language to use again.

Another way we really provide language and vocabulary to students is through the language we give them. That sounds a little redundant, but what I mean is when we pose an ask yourself question, there's language in it. That language, we're saying it and we're modeling it and then students are internalizing it and we reference back to the ask yourself questions. If we say, what are the important quantities in this situation? Remember quantities, we describe quantities with the number of and we give a sentence frame for it. Now we're linking it to their language production. That provides access to students through ask yourself questions, through sentence frames and starters.

When we work with teachers, we get down to the nitty gritty and teachers ask, well how am I going to do this? So, we have some tips for using sentence frames and starters. We know a lot of teachers already use them and teachers have found it really helpful to think about the specifics of using them by posting the language, by modeling the sentence frame and start or starter, and then expecting all kids to use it. That's vastly different from saying, Oh, there's a sentence frame up there if you need it.

Steve:
Sure.

Amy:
It's very different than saying, so when you turn to your partners, start with I can ... Sorry, I'm not coming up with a good one. When you turn to your partners, start naming the quantities, start with the number of or the amount of. Now when they turned to their partners, they're sharing specific ideas and using that language and vocabulary and then there's residue of it. They get to the meta reflection at the end of the lesson, and they now are reaching for that language that's been used, and they've heard it receptively, and now they want to use some of it and apply it in the meta reflection. There's residue around the room for them to reach to.

Steve:
Yeah. It sounds to me, and correct me if I'm wrong, but just to kind of break this down, there's a deliberate yet somewhat subtle infusion of language and vocabulary throughout the entire process with sort of contextual, visual representations and different layers of expression. The student, I feel like while they're going through it, isn't being bombarded with this giant vocabulary list, but it's getting in because they have to use it, and then it's rephrased, and then they have

time to actually think about it using metacognition, think about their thinking, and then they get to use it again. Is that a fair kind of simplified version of what you said?

Amy:
Steve, that's so good. I can't wait to hear this and quote you on that.

Steve:
Oh listen, if you quote me on something for math, I think I will be the hero of my household. You have my permission to absolutely do that, and I will get lots of points from my family who think I'm mathematically inept, so that's great.