

## Preschool Cognition: Supporting Early Math

Judi Stevenson-Garcia: Hi everyone. Welcome to our third episode of this year's Teacher Time preschool series. I'm Judi Stevenson-Garcia. Oh, and Treshawn are you muted, or do you have your phone on?

Treshawn Anderson: I'm muted, but I'm here now. I'm Treshawn Anderson.

Judi: Hi, how are you?

Treshawn: And hi, everybody. We're here from the National Center on Early Childhood Development, Teaching, and Learning, and we're excited to be here today to talk about cognitive development for preschoolers. Specifically, we're going to be talking about mathematics development. And we know that math may not have been on your favorite subjects list when you were in school, and for some people math can be so nerve-wracking. Perhaps some of us may have a fear of making a mistake or not knowing enough about math to be able to answer children's questions. So, if this is you, then you are definitely in the right place. On the other hand, if you absolutely love talking about math concepts with children, this will be a great reinforcement for you and perhaps you wouldn't mind sharing with us in the chat when the time comes for it.

Many of you are working so hard to learn about what math learning means for preschoolers and what you can do to support that development, and that's great and your interest in supporting children's math learning really inspired us to focus this episode on one of the preschool sub-domains in the Head Start Early Learning Outcomes Framework or the ELOF – that's a mouthful. So, today we're talking about geometry and spatial sense, which are part of the mathematics development domain. But before we dive into that, we're going to give you some information about this webinar because we'll be using some of the Adobe Connect features to help us interact.

Judi: Right, and I see lots of you have already found the chat box. So, right below our video there's a chat box. Go ahead and say hello. Jan Greenberg is our chatroom facilitator. She's in blue, and so she's going to be chatting with you guys. She'll also be giving you some links to resources that we mention. So, feel free to chat away in there and we'll also be asking you questions at some points, too. Definitely in response to some of the videos that we show, so make sure that you use that chat box and we'll be checking in with you there throughout the webisode. And if you have any questions related to the presentation or other related topics, go ahead and ask your question, and we'll try to get to them as soon as we can.

We do have a packed agenda today. And if you look at the top of your screen, there's a little person raising his hand, and if you click on that you can raise your hand as well, and there's going to be times maybe where we'll ask you to raise your hand, just kind of to say yes or no. We like to do a quick check-in with our audience sometimes. So, why don't we practice it really quick. Raise your hand if you are already seeing signs of spring where you live.

Oh, lots of you. Oh, that makes me happy. It's really cold here today, but we have little green things starting to come out of the ground. So, we do have signs of spring. Oh, every, oh, so many of you. That makes me happy. It's really nice, right, to have the signs of spring. And, hopefully, for those of you who didn't raise your hand, it's coming soon. So, that's how you raise your hand. So, when we do that next time, you guys have got that figured out. Also, as Jan has mentioned, in the chat box, below the chat box, there's some supporting documents. So, there's a copy of the PowerPoint, there's a viewer's guide, which is really important. You can download that and print it now, or you can keep it on your computer and type notes into that. It's a great way to keep track of the content that we're reviewing today and kind of walk away with some notes and ideas about what you're thinking. There's also going to be several videos in this session. So, if you're listening on the phone you won't be able to hear the audio of those videos. So, the best way to listen to the videos is to mute your phone and turn on the audio or the speakers of your computer for those video moments. And if you can't view or hear the videos, you will be able to watch them on MyPeers when the webinar is posted. And if you get disconnected for any reason, just go ahead and use the same link that you used previously and you'll be able to rejoin the webinar.

And then finally at the end, we're going to post a link to an evaluation form. We really appreciate it when you complete that evaluation because we use that information for improving our future webisodes. And when you complete the evaluation, you'll automatically be transferred to a page where you can download a certificate of completion for your participation in the webinar, and if you are viewing together with some colleagues on one computer and only one person is registered for the webinar, you can forward the evaluation link and your colleagues can complete the evaluation and then they'll be able to get their certificate of completion.

And just as a reminder, when we use the term "teacher" for Teacher Time, we are referring to adults who work in group care settings. So, any adult, whether a teacher or a family child care provider, we recognize that there's a wide variety in the types of learning environments for preschoolers. So, you may be working in a classroom with all 3-year-olds, you may be in a mixed-age group, or you could be a family child care provider and may be supporting infants, toddlers, and older children. But regardless of your environment, we hope that you find the information and the strategies and the resources that we're sharing really helpful for you where you are. So, we're hoping to have a really interactive hour. We're going to be busy, we've got lots of great videos for you. Use the chat box to add your thoughts and comments, and we will do our best to address them as we can.

Treshawn: Great, and Jenny said, Happy Friday. Happy Friday, everyone! Oh, Happy Friday. So, let's dig into our topic for today. So, we're going to focus on geometry and spatial sense, and these are components of the mathematics development domain in ELOF. So, let's start with geometry. So, we're going to have an activity where we'll show you three triangles. You see them on your screen. And then you'll have a little poll on the side where the chat box used to be. So, if you look at these three triangles, can you tell us in the chat box which one is the isosceles triangle? Isosceles, that's a big word, right? It's a fun word. Yeah.

Judi: And we'll give people 20 seconds to respond, and then we'll show people's responses. All right, looks like we've got a good number of answers. We can go ahead and show everyone the results. Yeah, let's broadcast the results. OK, so you should be able to see the results. Treshawn, you want to give us the right answer?

Treshawn: Yeah, the right answer is C. The isosceles triangle is C.

Judi: Oh, sorry, the right answer is B.

Treshawn: It's B?

Judi: Yes [laughs].

Treshawn: The isosceles triangle is B.

Judi: So, the isosceles triangle and, actually, it's funny 'cause we were talking early about an obtuse triangle.

Treshawn: Boy, I need some work on my math! [laughter]

Judi: So, the answer is B. An isosceles triangle has two equal sides and two equal angles, and so those little lines on the side of the lines going across the lines show that those two sides are equal, and those lines in the angles show that those angles are equal. And the A is a right-angle triangle because you can see that there's a right angle in the corner, so that's 90-degree angle. And C is an obtuse triangle with three different lengths of sides and three different sizes of angle, but it has an angle, that little shaded in place, is larger than 90 degrees. So, triangles, they're...There are all different ways to talk about triangles and different ways to think of them, but I will say that that center triangle right there can be confusing because it also could be called – this is the most common triangle that children are used to seeing and sometimes they don't see these other kinds of triangles, which is why it can be confusing.

Treshawn: So, I'll be honest. We were talking about triangles. Judi and I were talking about triangles while we were setting up for this webinar, and we were talking about obtuse triangles. So, I had in my head that C was the right answer. Answer obtuse triangle. Man, we're only human. I'm so sorry, guys, but B is right. So, anyway, you may be wondering why we even started this topic off with a poll asking you to identify a shape and all.

Judi: Why?

Treshawn: Well, that's because many people... [laughter] This is why. Well, many times people think that math is just about numbers and equations and measurements and other numerical concepts, but while math does include those concepts, we often forget about shapes, sizes, and patterns and more, and preschoolers are so eager to identify the shapes that they know all over the classroom and compare big and small objects and even repeat silly phrases or patterns in a book over and over and over again like "no more monkeys jumping on the bed." But believe it or not, ladies and gentlemen, that is math. So, focusing on the ELOFs of the main geometry and

spatial sense. In this episode, we're going to hone in on shapes, which is geometry and the position of objects within space, which is spatial sense.

So, first up, geometry because I need a lesson. So, as we stated before, geometry is a part of math, but it's mostly related to shapes and sizes and the positioning of figures. And the ELOF describes an important goal for geometry, and that is for children to learn to identify and describe and compare and compose those shapes.

Judi: Right, and we know from the research that early math skills predict later math success, and the more math-related activities that children do before kindergarten, the better they're going to understand math in school, That makes sense, right? But what you might not know is that early math skills also predict later literacy skills, and I saw someone earlier in the chat box mentioning how math skills are really important and they lay a foundation for literacy skills. And not only is geometry a part of math, but learning shapes and sizes and positioning also helps encourage development in other areas. So, when you think about literacy development, preschoolers who are able to recognize the differences between shapes also are better able to recognize the difference between shapes of letters. So, if you think about the triangle example, it's very similar in shape to a capital letter A, and there is a little triangle on the top of a capital letter A. So, it's really symbol recognition. So, recognizing shapes as a type of symbol, and letters are also a type of symbol, so it helps build that foundation. Preschoolers love to group like objects together, they love to put similar things together. So, a block area is a great place to do that.

So, for example, a child observes that putting a cylinder on top of a structure, it works when you put it up straight. You think of a cylinder, like a paper towel roll. When you put it up straight it'll balance, but if you place it with the circular side down it will roll up, right? If it's placed lengthwise. So, kids are experimenting with how shapes relate to each other and how they work together. We also want to remember that we have children who have different experiences depending on their home language.

Children who are dual language learners may be drawn to math exploration because it's so hands on, and you can explore without a language base necessarily in English. They can use their home language and explore concepts, even without a mastery of English. So, it's important to provide lots of ways for children to have hands-on experiences, and I saw some of you in the chat box mention that. Kids explore objects in space and we know, especially for dual language learners that are learning two or more languages at once, that it's really important to find out what they may know in their home language. So, be sure to ask parents if their child identifies basic shape names or knows positional names in their home language.

And then, additionally, we want to make sure that the activities – the hands-on activities that we provide are...meet the needs of all of the children that we are working with. So, if you have children who have diagnosed disabilities or suspected delays, they may need some additional supports or modifications, depending on what their specific learning needs are. So, for example, children who may have delays in fine motor development, they might need to work with larger

shapes at first in order to be able to manipulate them before they move on to exploring smaller manipulatives.

Treshawn: Yeah, and so as a teacher you have a lot – you have an important role to play because you expose children to shapes, sizes, and new math concepts just about every day, and you help children begin to learn these concepts for themselves. So, let's watch some teachers as they are supporting children learning about geometry, and as you watch, tell us the strategies that you see in how the children respond in these videos.

[video starts] Teacher: OK, what shapes do you know? Girl: Circle.

Another girl: Rectangle. [video ends]

[video starts] Teacher: Diamonds aren't super natural in the environment. Let's see what we can find.

Boy: And we see if find.

Teacher: Yeah. Oh, do you want to do the triangle? Andy just gave me the triangle back. [children squealing] That might be a little easier, I see one on the climber. Hey, Addison, safe bodies. You found a triangle, Andy, thumbs up. There's a lot of triangles on the ground over there.

Andy: I thought there was two triangles.

Teacher: You found two?

Andy: Two triangles.

Teacher: And look, Grady's looking for triangles, too. Do you want to go over with him? I think he wants to show you.

Child: Right here.

Teacher: Yeah, you guys both found it. Oh, and the cones make a triangle shape.

Andy: Yeah, yeah.

Teacher: Yeah, Grady found the cone, and you agree, Andy. Awesome! Does it kind of match?

Child: Let's find more!

Teacher: Find more, find more! [video ends]

Treshawn: Those are some great videos. I love how they're using the outdoor environment to recognize the shapes in their environment. That's awesome.

Judi: Yeah, some mentioned...Steven mentioned open-ended questions, identification, searching in the real world for shapes. All right, that's so authentic. That's great. And they use different kinds of materials, responding to children's interests, and you could tell, they were really into that activity, which is great. Something that they were really interested in. Also getting to move their bodies, which is always good in the outdoor experiences. [Judi and Treshawn talk over each other] Go ahead. Oh. go ahead. No, go ahead.

Treshawn: I was going to say, I like how the teacher in the first video really gave the child time to figure out which shapes were which and then, you know, didn't scold her or make her feel you know bad about not knowing the shape but instead wrote it in a different color so she can remember So, that's some individualizing and ongoing assessment going on, but we'll talk about that later. Go ahead.

Judi: Yeah, that was great. No, that was a good thing to notice. So, we're going to talk a little bit about spatial sense, just introduce it quickly, and then we'll talk more about it as we go on. But go ahead and raise your hand if spatial sense is an area where you feel like you could use some more strategies for supporting children's development. If you need strategies to help develop spatial sense, just give us a quick hand raise. Oh, maybe that's why you guys are here. Lots of people need spatial sense, OK, good. We're going to give you some strategies today. So, the main idea around spatial sense. So, this is the part of math that's really related to knowing the shape of your environment and where you are in your environment and the way that, that objects in space relate to each other. So, a great way to think about spatial sense is your capacity to parallel park your car. So, you could think about the size of your car and then you have to, without using measuring tape, kind of eyeball and think if your car is going to fit in that space and then you have to guide your car into that space successfully. So, that requires a lot of spatial sense.

We don't expect children to be able to do this, but the things that they begin developing right when they're born is a complex cognitive skill that develops over time, and the opportunities that we give them to use their bodies in space and to explore the way shapes relate to each other in space, that's really what helps them eventually get to that point where they can pass their driving test in the parallel parking. So, they're learning to understand the position of their bodies, this is why kids bump into each other a lot 'because they're still trying to figure out where they are and the relationship between other objects – where – where they – where their bodies are in the playground, right? Are they under a structure? How low do they have to duck to get through without bumping their head? Or if they're on the top of the slide or if in the front of the line. Spatial sense also involves the ability to recognize and imagine or think about the way that shapes move. Or transformation of them or drawing them. So, this idea of taking an image of a shape and being able to make it with other shapes, or be able to draw it on a piece of paper, that requires spatial thinking as well. So, thinking about the relationship between two-dimensional shapes and three-dimensional shapes and how they're related to each other. We talked about the cylinder example, right? So, understanding that underneath the cylinder, on the face of it is something that looks like a circle, right? And also thinking about putting two shapes together to make a new shape. So, some children will discover if you put

two certain types of triangles together, you will end up with a square or a rectangle. And, Treshawn, I don't know if you have anything else to say about spatial knowledge?

Treshawn: Yeah, so by the end of preschool most children will have a basic knowledge of spatial – spatial sense. You know, knowing directionality and order, like "up and down" and "front and back," and can generally follow directions involving their own body, such as being asked to stand up and place their hands on their head or walking backwards. It's important to remember though that for some children, the development of spatial sense can be somewhat difficult. Understanding the relationship between your body and the objects in space can be challenging, especially if you have conditions such as cerebral palsy or autism or developmental coordination disorder. So, children with spatial sense delays or difficulties may have some trouble with math activities that require you being shapes in space or creating patterns. But we'll show more on this topic about strategies you can use to support children's development in this area.

Judi: Yeah, that's great. And you have such an important role in supporting children's development of spatial sense through indirect instruction like from music and movement games or by setting up something like an obstacle course on the playground. When we allow children the space to explore movement and positioning of their bodies or objects in their world, you're supporting the needs of all of your children by providing adaptation so that they can move within the space in the way that they are able. And so for this opportunity, we're going to watch some teachers as they support children's spatial sense in this way. And as you watch, please keep chatting in the chat box. I see some of your comments that I want to get to about the previous video. But tell us what you see around how teachers are supporting spatial sense and how the children respond.

[video starts] [boy screams] [women laugh] Teacher: Can you do it again for us? Push it up, Zayden.

Woman: Zayden, sure, why not? Uh-oh. A little too hard, huh?

Teacher: Push it up, Zayden. Push it up, Zayden. All the way to the top! All the way to top! Almost. All the way to the top. Yeah! Ride it down. Woo, all the way. [video ends]

[video starts] Teacher: Through the tunnel.

Child: Oh, whoopsies.

Teacher: Through the tunnel, you got it, what's really.

Child: A big tunnel.

Teacher: Oh, make it bigger, good idea.

Child: But the horsies.

Teacher: And your horse is going through the tunnel as well. [video ends]

Treshawn: These were great examples of spatial sense. They're using lots of spatial language like "up and down" and "put it on the top" and "go through the tunnel," and just using those words, yeah, Vanity, you noticed that you've used spatial language is really important. And then someone just mentioned, Vanity also mentioned, praise and encouragement. Sometimes when we just praise children when they do something or they follow the direction that you're giving them, that like triggers them to say, "Hey, maybe I did that right, maybe I do know what 'up' means or 'on top' means," or something of that nature. So, it's great that you picked that out.

Judi: Right, and someone also mentioned organizing outdoor activities. [inaudible] So, especially thinking about moving your body, the outdoor opportunities are really abundant. So, that was a really cool little slide, and the teacher used that opportunity to build some of his language skills and also help him think about... and he's also learning physics, right? Like, how hard does he have to kick that car to get it back up the ramp? We'll talk about physics at the end of our episode. Well, not exactly physics, but close, so.

So, to have us think a little bit more about how children develop geometry and spatial sense skills, we invited Dr. Clements, Doug Clements, and Crystal Day-Hess to explain a little more about how children learn and develop skills in geometry and spatial sense. So, Dr. Clements is one of the leading experts in early childhood math development, and he's one of our partners at DTL. So, please listen. We have two different videos of him talking about some really important developmental sequences and, as you watch, please remember to add comments or questions in the chat box.

[video starts] Crystal Day-Hess: Thank you for joining us again, Dr. Clements, as we continue to talk about preschoolers' math and learning and development. So, we know that cognitive development includes skills such as reasoning, memory, problem solving, and thinking – all of these that are important skills for math and that can be supported by math learning and teaching. And, in fact, we know that in the ELOF, the cognition domain includes a subdomain that is geometry and spatial reasoning. What can you tell us about these areas?

Doug Clements: It seems like geometry and spatial reasoning...Spatial reasoning, maybe, but geometry? Come on. Come on. Geometry, you know, isn't that a 10th grade subject or something like that, that everybody struggles with? No, you know. It is part of how kids come to know the world for sure. So, spatial reasoning, kids really have learned so much about navigating their bodies, and for the language to be attached to that, it's very important. So, as we describe how kids move, you know, "Boy, you ran really fast and then you turned right around that table" and, you know, did this kind of stuff. As well as the typical, which we should be doing a lot of. Not just "get that," but you know, "Beside, beside the desk over there, right under the chair is another two blocks. Can you get those and put those on the shelf where they belong?" And then they go to the shelf and maybe there's a shadow, a silhouette of that shape block and they have to match that. Think of all the geometry and spatial relations that are going in there.



And then geometry is always filled with spatial relationships. So, kids need to learn about shapes early on. Shapes are very important to kids. Very young children learn first their vocabulary words based on the shape of objects more than other attributes. But we often teach shape. When we start with kids, we often use typical shapes like this. Well, there's nothing wrong with starting here. You know, a three-sided shape, all the same sides. It's got its base horizontal here and the like. Unfortunately, in the U.S., many fourth graders, when they're asked, "Is this a triangle?" will say, "no" and they'll say it's upside down. So, we need to give kids a much richer experience with shapes. The developmental progression of learning about shapes starts as kids learn a word for a particular shape, but then they have to learn more. They have to build a richer visual image of shapes. So, this is also a triangle like this, this, or this. This is also a triangle, long and skinny, the way that kids talk about it. But if we give them experiences with a wide variety of shapes when they're three and four year old, it'll make a huge difference to develop this kind of rich notion. And then eventually, even preschoolers can tell you this is not a triangle, and I can show you why. It's got one, two, three, four sides. So, when they do this, they're talking about the spatial attributes of that shape. They can also talk about if you turn it, there is a spatial word, too. You know, the fact that they talk about these kind of things are very important to both spatial and geometric understandings.

Crystal: Can you talk to us a little bit about how geometry and spatial relationships are related concepts?

Doug: Yeah, so to understand geometric forms, you really use a lot of spatial relationships. Just think of that, you know, two long sides the same length in describing a figure. They're...the same length means you're making a spatial relationship between the size of those things. So, it's always there right? We tend to think of spatial relations as above and below and the shapes as something different, but describing those shapes is very much into spatial relationships. And when we get to composing shapes, when kids start putting shapes together to make other shapes, to make objects, or to make other shapes so that, for instance, if I had two of these, I could actually, you know, make a rhombus here. So, when they're combining those, they're talking about and thinking about geometric motions. Slides, flips, and turns. And those are spatial relationships of an utmost importance, too.

Crystal: And it seems this could come into play when kids are doing more of the traditional puzzles that we often see in classrooms.

Doug: Yeah, absolutely. So, unfortunately, what many puzzles represent is not a challenge to kids' spatial thinking. So, if you've got an inset puzzle and kids are putting a cow into the cow shape, that's pretty easy. Preschoolers can do more. So, we do a lot of puzzles where shapes have to go together to make different shapes or different objects. To do a picture – tangrams is an illustration of those, when you make a dock or something out of the tangram pieces. Combining those pieces and seeing how they combine is both a spatial relationship of the highest order and knowledge of how shapes make other shapes. [video ends]

Treshawn: That's great to hear from Dr. Clements about making shapes and sequencing and you guys brought a lot of points that he was talking about. So, we're going to continue on and

watch a couple more videos, excuse me, about a preschooler who is starting to become more analytical with shapes. Talking, feeding off of what Dr. Clements is saying, but as you watch, observe what she does and look for the strategies that she uses as she sorts out these shapes.

[video starts] Girl: I'm counting the sides and the corners. One, two, three, four.

Adult: And how many corners?

Girl: One, two, three, four.

Adult: So, tell me how those are alike?

Girl: They have four corners, and they all have four sides.

Adult: And what about those?

Girl: One, two, three. One, two, three.

Adult: OK, well, you've got more shapes in there. Can you find a place for the other ones?  
[plastic crinkles]

Girl: Does this have four sides or not? 'Cause there's one there and then those.

Adult: Well, run your finger along the sides and count them.

Girl: One, two, three, four. Four.

Adult: OK.

Treshawn: By now we have a lot of home visitors that join us for our Teacher Time webisodes, and that was one was a video in the home that they had, that they were using with children, teaching parents how to facilitate that conversation. But you guys are really great at responding, definitely verbalizing what she was doing. She was sorting the different shapes. Someone even mentioned, not only identifying the shapes but talking about why are triangles and why they are squares and circles. That's another good way to go, dive a little deeper into learning about math.

Judi: Yeah, I think what we see here, and I know I saw some comments earlier about the kids exploring shapes outside, and one of the challenges of exploring shapes outside is that shapes aren't always perfect in nature, right? And so sometimes you might have something that looks like a triangle but isn't really a triangle or isn't really a square, and that's a great opportunity to challenge kids. And you can use language like, "Well, yes, it does look like a triangle. You know, it has three sides, but if you look, you know, there's not three angles. It's rounded on the corners. And that would make it not a triangle. So, I think that that's fair.

And the teacher here was very effective, and I love that pause when the little girl goes to put that shape down on the triangle pile and she's like, wait a second, and she noticed that little corner on the top was not, it wasn't a point or an angle, and so she counted the four sides, which was fabulous. So, offering children the chance to play with different shapes like Dr. Clements was saying, have a wide variety of shapes and a wide variety of experiences. Someone mentioned that it was a tactile opportunity there. Right, so she's using her hands, which is making those connections in her brain, which is really exciting. So, let's keep listening, Dr. Clements has a little bit more to offer. He's going to give us some strategies. Many of you said you wanted some strategies for supporting spatial awareness and geometric thinking. And so as you're listening, tell us in the chat box what strategies you hear and that you might like to use with your children.

[video starts] Crystal: So, we know that practical experiences that kids have play a really important role, and we know that adults are key in setting up these practices and activities. Can you give us some quick tips for things that we can do in the classroom to support kids? Learning of spatial reasoning and geometry?

Doug: Yeah, so much of it. We can use these spatial words and should be using these spatial words all day, right? You know, find things under or over or to the side of or in back of, or the, like, when you're lining up and when you're doing them. And then some special activities aren't a bad idea. How about setting up a maze outside, right? And then talking to kids about how they're moving through that maze. So, it's not just that you're behind Geoffrey and you're ahead of Anita or something like that, but also how you moved through it, you know. You know, shoot down here until the end and then turn and go this way. You know, you can do it and just providing that kind of language and that excitement is great. Of course, with something large like a maze like that, children with different physical abilities, we should be very sensitive to that and be able to either provide them support or modify the maze for them.

Crystal: Now that example sounds really exciting. It has a lot of spatial reasoning involved. What are some other activities we could try in the classroom that support geometry learning?

Doug: Ah, yes, so when we're talking about shapes, that's so important for kids. We need to move beyond. Listen. This is a common set of shapes called the pattern blocks that people have in their classroom. It is fantastic. I love it. For composition of shapes, which we'll talk about in a minute, it's perfect. The trouble is, every triangle is green and what's called equilateral, all three sides the same and the like. But every triangle is green. So, it's unsurprising to have kids call this one the orange one rather than a square. So, they're not even using the shape vocabulary, but they're also not seeing the wide range of shapes. So, you want to compliment that by having some set of shapes somewhere where you see rectangles that are different, right? So, this one's longer and skinnier than that one and the like and there's a wide variety of them. And then you want some shapes where you can contrast them with rectangles 'cause, unfortunately, most of us were taught rectangles have two long sides and two short sides. Well, this one has two long sides the same length and two short sides, but no right angles.

So, we need to talk to kids about, give them better vocabulary for the parts and the attributes of shapes, and they'll take it from there. Seriously. And helpful in these kind of things are using shape books and the like. So, this is a shape book. This one's called "The Shape of Things," and it's got one compliment to it right away. The first time they introduce a triangle, it's, quote unquote, upside down, it's not with a base horizontal. And it's got a nice border of triangles here and then it shows how two triangles together can make something else. And this composition of shape is emphasized in yet another book. This one's called "Changes, Changes," and this is – this couple in this book will create a house for themselves. Very nice except they had a little emergency. The house starts to burn down, but, being resourceful, they take their shapes that made the house and turn it into something else. The kind of creativity that this illustrates is just really nice because once they put out the fire with their fire hose here, the only trouble with that is they get a little too much water and so they have to build a boat. This kind of thing can really emphasize to kids the same shapes can make different things. So, it talks about the composition of shapes, but it also teaches an important lesson about creativity with mathematics. [video ends]

Treshawn: I love how he mentioned being creative with math. That's a great way to go about math instead of just being standard and labeling shapes and numbers and things like that. But just using your environment, using mazes, using lots of spatial talk as children are playing, that's great. So, we're going to watch a video now of a preschooler using spatial skills, and as you watch, think about some of the strategies that you guys are talking about in the chat box and let us know in the chat what you observed this child doing.

[video starts] Teacher: The yellow one. She wants you to find this shape. Can you put your hand in the box, not all the way here. And feel inside, don't look. Put your hand in and feel inside. See if you can find one.

Girl: Well, you can make it a rocket ship.

Teacher: Does that match?

Girl: No.

Teacher: No, how come it doesn't match?

Girl: Because it's a...that one's a triangle.

Teacher: It has how many sides?

Girl: Three.

Teacher: And this one is a...?

Girl: Four.

Teacher: It has four sides. It's a rectangle. So, put that one back in the box and feel around and try and find the one that feels like...

Girl: That's the same.

Teacher: Can you feel around and find this shape? OK, so you all talk to each other and tell me, do they match?

Girls: Yes. Yeah.

Teacher: OK, tell each other why they match.

Girl: Because they both are three sides.

Teacher: And what else does a triangle have?

Girl: Three angles.

Teacher: Three angles.

Girl: I can make diamond with that.

Teacher: Are they exactly the same?

Girl: No, but they don't 'cause they don't have the same color.

Teacher: They don't have the same color. Are they the same size?

Girl: Yeah.

Teacher: Yes? OK, so we're going to switch. [video ends]

Treshawn: I love this video. It's a different way to use spatial sense. So, the child can't see what's going on inside of the box, so she's got to try to figure out and feel the sides and try to figure out which one is the triangle, which one has three sides. And I love how excited she was when she finally got the right one and the teacher, you know, shared her excitement as well. And then, like we've talked about before, they talked about it. Why does this not match or why does it match? That's it, that's a great way. Easy to do. Little tissue box and you can do something like that, either in the home-based setting or in the classroom.

Judi: Yeah, and pulling out the wrong shape isn't really a failure. It's an opportunity to compare and contrast shapes. So, like, all right, well, is this the right one? Nope, OK, try again. And I see some comments about the peer interaction, which is really great. You know, they're encouraging each other to... and telling each other and they're being really positive and social. Really simple, easy activity and, like Dr. Clements said, offering a wide variety of objects and a wide variety of opportunities to engage with objects is really interesting. And also supporting that kind of different spatial sense where I have to feel this and think, you know, to myself if I'm

feeling the right shape. It's a different way of thinking about shapes and solidifying those concepts in your brain.

And this is a great transition for us to think a little bit about a different domain in the ELOF, which is approaches to learning. And we talk about approaches to learning every Teacher Time because it's so important, and what you noticed about that interaction is exactly what we mean when we say approaches to learning and why it's important because it's not just about what children are learning, but it's about how they learn. So, this domain includes initiative, curiosity, and creativity, and we saw some of that curiosity just in the last interaction, right? Like, can you find the right shape and is it the right shape? One of the important goals for children in approaches to learning is persist in a task. So, this child needed to persist. She needed to keep reaching in until she found the right shape. She needed to demonstrate flexibility about thinking, use her imagination, that's what she was using in her play and interactions with others.

And some of the ways that children can meet these goals within the context of geometry and spatial sense are thinking about working out a challenging puzzle or getting a block structure to balance just right without falling over. Preschoolers will persist in this task, even if it's frustrating, especially if we're setting up an environment like the one that we just saw, where there's encouragement by teachers and peers. Geometry includes talking about two- and three-dimensional shapes. So, children who already have an idea of what a square might be could be confused when you introduce them to a cube, right? Especially your younger preschoolers, and they might still want to call it a square, which is fine, but the approaches to learning goal for this promotes their ability to be flexible in their thinking. So, let's think about why did you call that a square? Because they see the face of the cube and not the shape name that they know. And then lastly, you know, think about children who are playing outside.

We've talked a lot about experiences outdoors, building spatial skills. If they're playing on structures, if they're building with large blocks, they're using their spatial sense and at the same time they're learning to express their creativity and imagination during this play, and those are two other approaches to learning goals. So, we're going to watch another video here where the preschool teacher is providing a safe learning environment, where she's encouraging the children to show initiative and curiosity. And she's also supporting vocabulary by narrating what the children are doing and giving them some new words. So, as you watch, just tell us what strategies you observe and think about the relationship between approaches to learning and geometry and spatial sense.

[video starts] Teacher: We're going to look for shapes. Remember when we did the letter scavenger hunt inside and you guys looked for letters all over the classroom? Yeah. When we go outside, we're going to look for ovals and stars and squares and circles and rectangles and triangles and diamonds or rhombuses.

Boy: [inaudible] Diamond.

Teacher: Can you guys think in your head of where we might easily find a triangle outside?

Child: Yeah.

Teacher: Where do you guys think there might be a triangle outside?

Child: I know.

Teacher: Where?

Child: A squirrel.

Teacher: Where the squirrel is? Maybe.

Boy: Triangle, triangle.

Teacher: It is a triangle.

Child: Over there, under the birdhouse.

Teacher: Oh, the birdhouse has a triangle. So, if the birdhouse was outside, and there is a birdhouse outside, we should check it out. It has a triangle at its roof. So, you guys see how we're going to look for it in the shapes of things. So, like, if I wanted to find a square, where might there be a square?

Child: In there.

Teacher: The barn window is a square, right. So, when we're looking, we're not going to just find a square hanging out. We're going to look for it in the shape of bigger things. OK? All right, Kevin will you look for a square when we go outside? Will you look for an oval? [video ends]

Judi: I see that some of you are commenting on the relationship between approaches to learning and cognitive development, which is so true, right, that and some of you are saying executive functioning, which is great. So, this ability for children...Persistence requires executive function, right? I'm frustrated because this thing that I'm trying to do is not working, and I have to control my frustration so that I can focus on the task at hand. And when you provide really safe learning environments for children to be curious and to show interest and to try things and try them again, it really helps them develop that cognitive skill that's really going to help them overall approach their learning task in a way that's going to help them be successful. So, I'm really glad that you mentioned that.

Some other things I see, you know, here where she's really providing some support for the children to help them be successful in this task. So, giving them some examples ahead of time, helping them to understand, and showing examples of the task. And as some...Sherry, you are so right on. There are those two names for a diamond. There's the rhombus. That is the actual geometrical term, so I love it when I see rhombus used. You may have heard Dr. Clements mention a rhombus. That shape is a rhombus, and that is the term we definitely should be using. And you can use it with a – my two-year-old knew what a rhombus was. You can use it,

it's not too big of a word for a two-year-old, so you can definitely use that early on with kids and they'll understand it. And it's really important for developing their understanding in the future of shapes and relationships and comparisons and differences between different shapes. Treshawn, did you have something to say?

Treshawn: Yeah, to that point, someone asked at what age should we be, you know, diving into more detail about shapes and geometry and spatial sense. And I really just think it's an organic thing. As children are showing interest, as they're curious in your everyday language, as you're talking to children, you know, incorporating math language in what you say. Like Dr. Clements was saying, instead of saying, "Let's pick up the blocks," you can say, "There's two more blocks under the chair, can you grab that?" And that hitting the geometry and, you know, the numbers with children. So, I don't think there's a specific age. I think it's just an organic way that we talk to children and just learning how to incorporate that language into our everyday environment. So, that's a great question.

Judi: Yeah, and there are infinite toddler touch-and-feel books that have, you know, shapes. You can talk to children about, you know, "Oh, you're banging two cubes together. What sound does that make when you bang the cubes together?" I mean, building that math, the more opportunity we have to build math language into their vocabulary, the better they're going to do later on, and so it's never too early to start incorporating. Our last session that we did on infant-toddler mathematics, we talked about from the very beginning, we can talk to children about numbers and relationships and counting. The same is true for geometry and spatial thinking. "Oh, you know, your stuffed toy is under the blanket. Now he's on top of the blanket," right?

So, it's really, we don't have to wait til preschool. We should not wait til preschool to start thinking of and using this language and encouraging children to think about these concepts. So, observing and documenting growth in children's geometry and spatial sense requires you to be focused when you observe and be intentional in your engagements with children.

So, we're going to use the chat box now in a new way. So, if your birthday – so listen to the question – if your birthday falls between January and June, list some of the areas in your classroom that you feel like it's best to observe and assess geometry. So, in that left, yeah, in that left, long box there. Where in your classroom can you assess geometry skills? And then in the other box to the right, if your birthday falls between July and December, tell us what areas in your classroom may be best to observe spatial skills.

Judi: And I would say also, this could be in your family child care center or, if you are a home visitor, where would you support families in thinking about and using these two topics. Make sure everyone has a chance to participate in this. I've seen lots of block centers.

Treshawn: Yeah, someone said everywhere, which, yeah, that's true. There's shapes everywhere.

Judi: Families could use grocery shopping, definitely, lots of shapes at the grocery store, right?



Treshawn: Yeah, and for the spatial sense, you guys said you needed some ideas. I see lots of ideas coming up: playground, music and movement, the science center. Looks like you learned something today, that's all I wanted.

Judi: I want to make sure that you remember also the spatial sense has the big kind of "where am I in space?" ideas, but it also has those relationships. Remember, Dr. Clements says that, really, geometry, it's hard to talk about geometry without talking about spatial sense. So, even thinking about your fine motor, if you have an area where you have some fine motor toys. You know, just the ability to be able to put some shapes together, to connect them, or manipulating some puzzles, those things are also supporting children's spatial sense.

Oh, looking for shapes riding in the car. Yeah, I love these ideas. Please, if you are working with families or you want to offer families opportunities... I remember I was in a classroom where they had a sign-in board in the morning, and they said, you know, "What shape did you see on your way to school?" And so parents were able to fill that out with their kids. It's just a nice way to communicate with families about using math language and give them the opportunity to use that when they're at home.

Treshawn: Oh, a workbench, I like that. Blocks, tabletop toys, yeah.

Judi: Making self-portraits, ooh, I like that. That's like a spatial thing and could be a geometric thing. Oh, that covers lots of, that covers lots of, I like that. Sounds great. Oh, community walks?

Treshawn: Yep, definitely. Yeah this is great.

Judi: Dramatic play, thank you. This is a great place to incorporate math and ideas, definitely. That one I love. I've seen dramatic play areas where they have, like, the outline of the pots and pans so that the kids put the pots back where, you know, where the shapes, they match the shape for, like, the hanging spatulas and spoons. And that's a way to support spatial thinking as well. Like, putting things back where they belong supports spatial thinking, and so you can definitely use your dramatic play area to help organize – organize your space and also help with cleanup time, which is always great.

Treshawn: I love how you guys are also talking about transitions. That's always a tough time in classrooms or for parents and teachers, and so using, you know, using your space around you to figure out how to incorporate these ideas into your transitions is really great.

Judi: So, let's think just a little bit more about assessment. These are all great opportunities. So, these are great opportunities to encourage children to engage in learning opportunities that will really support their development. But I also want you to remember all these areas that you mentioned, you want to be really focused and intentional about your observations and what you're documenting with children. And so, if you think about, does this sound, you know, some

of what you said seems like everywhere we can observe this, but if you want to identify specific skills, you know, make sure that if you're, if you have a goal for children around or if you are hoping to understand what children know and understand about shapes and their relationship, you know, think about where you really could spend some time observing, engaging with children, asking them questions, providing them a wide variety of shapes and objects to interact with and then make sure that you're documenting the things that you learn from what you observe.

It's also essential, and some of you mentioned this, it's essential to make sure that you have two-way communication with families about the types of activities they do at home that promote children's development of geometrical or math concepts, including spatial thinking. So, you know, if your families do go to the playground you can talk to them, or what are some things that you can do when you're on the playground with your child that will really support them in thinking about their spatial abilities or geometry. And this is a good time for you to share ideas of what you are doing in the classroom and offer activities they can do at home. Like some of you mentioned going to the grocery store or identifying shapes as you're on a community walk or walking to school or driving to school. And, you know, just with some of you may have been or may be intimidated by math, families may be also. So, helping families learn to approach math with an open mind and offering really simple, easy activities really is going to make it better for everyone. So, and remember, as always, families are the best source of information about their children's growth and development, and it's important to understand what they know and are able to do at home and school, so that we have a really complete picture.

And for children who are dual language learners, I mentioned this back at the beginning, remember, they may know or may have math-related language in their home language but not in English. So, we want to make sure if we're assessing the whole child that we really do try to understand what they know. They may be able to say on top of, behind, next to in their home language and not have those words in English. So, we'd want to make sure that we're communicating with families about that. And it's also possible to assess what they know, even without being able to speak their language. So, if you don't share the home language of the child, there's a lot you can observe about the way that they engage with shapes and the way that they manipulate their bodies in space. And so, being intentional and focused about your observation, even if they don't have the language, you can still do a lot through observation to see how they're moving their bodies and other shapes through space.

Judi: So, the last thing that I want to show you before we leave today is this PDF. It's an interactive PDF that explores the concept of STEAM. So, I'm sure many of you, if not all of you, have heard STEAM. This is this combination of science, technology, engineering, arts, and math. And when children have the opportunity to explore their world, they learn new STEAM-related skills, and many of you have mentioned those today. Art opportunities, engineering. We saw that little boy exploring physics, right? Trying to push that chair, that little car, back up the ramp and so I wanted to share this resource with you. It is in the supporting documents, and if you download it, when you open it, you're going to be able to interact with it.

So, I'm just going to show you really quickly. Let's just make sure I'm sharing the right thing with you. I'm going to share this PDF with you just so that you can see what it looks like. So, it has several sections. It shows you how children engage with STEAM. What is STEAM. It gives you an outline of all of the components and basically what they cover. It gives you strategies for supporting STEAM learning. So, it gives you some insights into what we've talked about today: using the vocabulary with children, listening and responding, helping them solve problems, helping them explore math. It gives you some good questions to ask when you're in the classroom and concepts that you can cover. How to be creative within all of these math and science related. I love this in the art area, right. You're doing science. What happens if you combine two colors? How did you make that shape with your clay? If you want to talk about spatial skills, right. And then some important thoughts about individualizing instruction. You've got some great activities for you here. I know you were looking for strategies for supporting these. We also have some activities for adults to help you grow in your understanding and capacity to support STEAM. And then finally you have some resources. This resource is going to help anyone who's working with children and families, birth to age five, and I hope you all download it. It's also available on the ECLKC, so if you want to look up the STEAM IPDF, you'll be able to find it on the ECLKC. And we hope that you'll share that with your colleagues and with your staff that you work with so that you can really jump into, not only supporting math, geometry, and spatial sense but all of these really important areas of growth and development for young children. So, we are...wow! That hour went by like in a flash.

Treshawn: Yeah. We've talked about everything we needed to.

Judi: We did.

Treshawn: We talked about everything. We did.

Judi: Yeah, so the other resource that I want to make sure that you all find is – this is also on the ECLKC and I think Jan is going to put a link in the chat box, too – but the Effective Practice Guide for cognition. There are Effective Practice Guides for all of the ELOF domains, and all of them except for the perceptual motor and physical development are up in the ECLKC. So, there's one about cognition and it will guide you through. It'll show you examples of supporting early math development. It will give you strategies to try in your classroom. It'll give you the opportunity to think about how those strategies went and reflect on it. So, please take advantage of those Effective Practice Guides. They're really, really valuable.

We also mentioned that this episode will be available on MyPeers. So, if you're not on MyPeers yet, Jan will send you, put a link in the box so that you can join MyPeers. It's a great community. We have a teaching – Teacher Time community but there's also lots of other communities out there to support you in what you're doing and just get support and information from your colleagues who are in it and really have a lot of great ideas to offer. We also have two opportunities to use your smartphones if you sign up for Texts for Teachers. A couple times a month you'll get texts on your phone with some links to resources that will be helpful from the ECLKC and then also the ELOF2GO. If you love the ELOF and you really want to learn more about it, the ELOF2GO app allows you to jump in to each of the domains and the sub-domains

and get some ideas and strategies for supporting children's growth and development in those areas. All right, well, I'm going to sign off. Thanks, Treshawn, we'll see you next time.

Treshawn: Yeah.

Judi: Thanks, everyone. Join us again next month. We'll see you on our next Teacher Time.