Supporting the Intuitive Understanding of Early Math in Infants and Toddlers

Track A2 – Inclusive Child Development

17th Annual Virtual Birth to Three Institute

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These are the titles of each track:

A. Inclusive Child Development
B. Child Health and Prenatal Services
C. Family and Community Partnerships
D. Management and Professional Development
E. Home Visiting and Family Child Care

Operator: Please, stand by; we're about to begin; good day and welcome to the "Zero To Three Supporting the Intuitive Understanding of Early Math in Infants and Toddlers" conference call. Today's conference is being recorded; at this time I would to like to turn the conference over to Mr. Kelly Clair; please go ahead sir.

Kelly Clair: Hello everyone, this is Kelly Clair and I want to go over a few housekeeping items for you before we get started. For today's session we'll be taking questions via the private chat. So, if you look down at the lower left of your screen you will see a "public" and a "private" chat tab. If you click the "private chat" choose "leaders and assistants." That will ensure that your questions get to all of our speakers today. We will not be utilizing the "hand raise," so, please do not utilize that for today's session. With that I would like to turn it over to Sarah. Sarah, go ahead.

Sarah Semlak: Thank you Kelly. Welcome to the second webinar in the "Virtual Birth to Three Track A" on inclusive child development. The title of today's webinar is "Supporting the Intuitive Understanding of Early Math in Infants and Toddlers." Before I introduce our esteemed presenter Dr. Eugene Geist, I would like to take a minute to set the stage for today's discussion of how a solid foundation for later math learning develops in the first three years of life.

School readiness has always been a central focus of Head Start and Early Head Start services. Social competency or the ability to succeed in one's current environment and in the future is key to all

children's success. Beginning with 1304 of the Head Start Program Performance Standards developed in the late 1990s, moving into the School Readiness Act of 2007, and finally in late 2011, 1307 has broader focus on developing high quality comprehensive services that involves health and social services along with family and community partnerships. It is even now, more than ever, these requirements are closely aligned with child outcomes in five essential domains. When we think about these five essential domains they begin with physical health and development. They're followed by social and emotional development, approaches to learning, language and literacy and cognitive and general knowledge.

As we're reminded that all of these are so important to early math learning for infants and toddlers, I'd like to remind us of Dr.Ron Lally's Track A Webcast on the "Foundation for Life and School Readiness" that aired earlier this week. In that particular webcast Dr. Lally reminded us that the incredibly important pre-postnatal period as we think about a child's well-being and a family's engagement. As babies enter the world we want them to be able to engage in mathematically relevant experiences, ones that involve caring adults, those who nurture children's overall healthy development and love of learning.

We will hear during today's Webinar math is everywhere. Parents, home visitors, family child care providers and teachers have an incredible opportunity to promote very young children's love of learning and to support their development of concepts related to math. As was mentioned in yesterday's Webinar on reflective curriculum planning for infants and toddlers very young children are scientists. And we as the adults in the world are researchers observing and responding to their interests. For a crying newborn having the experience of a trusted adults who responds to their cries provides them with the early opportunity to begin to learn about cause and effect. When the same infant reaches out to nurturing adult's face and misses they begin to acquire an understanding of spatial relationships such as near and far.

As we now launch into our discussion of how each one of us can support a baby's intuitive understanding of math I would like to thank all of the participants on today's Webinar for taking time to join us. I want to remind you that you have the PowerPoint and other resources as a part of the email links that came with your confirmation for the Web cast. And you also have access to them afterwards with a follow-up email. With that I want to introduce Dr. Eugene Geist, Associate Professor at Ohio University's Patent College of Education and Human Services. Dr. Geist thank you so much for being here with us today. And let me go ahead and turn it over to you.

Dr. Eugene Geist: Thank you very much and thank you all for joining me today. As Sarah said the purpose of this session is to discuss the inherent understanding of early math concepts in infants and toddlers and explore how to facilitate early math experiences through observation and planning.

Many times we think that math doesn't start until maybe, you know, a child enters kindergarten or even first grade. And that's…what we're going to talk about today I hope you'll see that even in the zero to 3 range we see a lot of the very early constructs of math and the very basic foundations of math being constructed by infants through interactions with a stimulating environment without having anybody directly teach it to them and what we can do as adults to help to facilitate that construction. So the key messages that we will cover today are first that children are born with an intuitive knowledge of math and that parents and caregivers can further assist their children's understanding through daily interaction. Second, that adults facilitate early math learning through a variety of media such as active engagement with instruments, music and movement, sensory experiences, traditional building toys and daily routines amongst other things. This is not an exhaustive list. There are many other ways that parents and caregivers can support math with children 0 to 3. These are just a few that I'm going to touch on today. The third, that caregiver's comfort level with mathematical concepts can influence his or her ability to support infant and toddler...and infants and toddlers developing understanding of math. Many times what we call math anxiety gets in the way of us actually enjoying math. And therefore that kind of bleeds over into what we do with our children that we are charged with their care whether that's our own children or whether it's children that we are caregivers for. And finally the fourth point is that caregivers and parent engagement and experiences that support mathematical concepts will promote school readiness in the first three years of life. And we're talking about school readiness not in the terms of that we should be doing flashcards or what we would considered developmentally inappropriate things with children 0 to 3 so that when they enter kindergarten they can do addition.

We're talking about making sure that when they get to kindergarten that they are ready to succeed. We want them to have all the tools that they need to when they get to kindergarten they can succeed. And I think we can do that. And I hope that you will see throughout my presentation today that there are many ways to do this with children in the first few years of life that don't require developmentally and appropriate things to do such as flashcards or direct teaching.

So our first key message, the idea that children are born with an intuitive knowledge of math and parents and caregivers can further assist their children in understanding through daily interactions. And I like to think about this or call this emergent math because I think in my research it has parallels to what we know about emergent literacy. Emergent literacy we know from the research that children from the day they're born start to learn how to be part of a literate society, part of a literate community. And they do this because we sing to them. We talk to them. They are immersed in a language environment. And children who are immersed in families where there are lots of books and text around learn to read more quicker. And so it's very similar to what we see with math. And we use that as a model. And so if we think about emergent math we think that learning to think mathematically begins very early in life. And it's driven through a child's way of using their brain to organize their world. The relationships in mathematics develop concurrently and with interrelated manner in young children. In other words you

can't segment out things like addition or counting or patterning. They're all part of one large hole which is mathematical thinking in general. We know that we would…we expect that children learn mathematics through active engagement with a parent or caregiver or teacher. And this is true whether they are infants or toddlers or whether they are in high school. We also know that thinking mathematically and about relationships plays a special role in the mathematical development of young child and also finally that learning math is a developmental process. And we can watch children go through and pass through these stages in a variety of ways at different ages. Not every child is going to pass every stage at exactly the same time. But we do see a general pattern of development in children. And by watching children 0 to 3 you can see some of those interesting things in the way that they think and how those things changes ...how those things change. And hopefully today I'll give you some ideas of how then you as the parent or caregiver can support those things that you see to help them to move through that continuing.

So what should we see? If emergent mathematics really is really the way that children learn math what are those things that we should see? And we should see children doing math independently without a parent having to be there to say hey let's do math or let's do flashcards. We would see math coming out through their play, through their talk, through their imaginative play or fantasy play or through their sensorimotor play with blocks. We would see concepts developing without direct teaching through children interacting with a stimulating environment. They pick up blocks, they make comparisons with blocks. They bang blocks together. You don't have to teach them how to do some of these things. You just have to be there to facilitate that learning. That...we'd would expect to see developmental sequence for learning math and mathematical concepts which we do. I mean we see that...I think it's kind of understood in K1 to three in the higher grades that there seems to be a sequence of learning. And you'd start off with counting and then you would go to addition...very simple addition and more complicated addition, subtraction and multiplication. But even with the 0 to 3, children with 0 to 3 there's a similar sequence. It just the content's just a little different. And so we have to watch very closely for the children going through those sequences.

The beginnings of math, we see the beginnings of math as early as infancy. And I would say even in those first few weeks of life there are some glimmers of things that show that children are at least receptive to certain mathematical concepts such as patterning which again we'll talk about a little later. And we would see children using math to make sense out of their world.

So let's have a little poll here, a little survey. I want to know how many of you have seen these thing in your experiences with young children. So Kelly could you…yes okay, go ahead and open up that poll. And so if everybody could just choose...could just have one, two...or pick up first, second or third choice and we'll give you a minute or so to do that. Okay if you haven't keyed in your selections if you could go ahead and do that now I'm going to go ahead and move on in about 15 seconds and have Kelly put up

the answers or the percentages and we'll have a little bit of a discussion about that. Let's say about ten more seconds. Okay, Kelly do you want to go ahead and throw those percentages up quick for us? Okay, I'm seeing the percentages for the third choice; so I'm going to talk about those first. So, it looks like 13 percent of you, more of you are seeing at least for the third…oh there's the rest of them.

Okay. So, the first choice we see concepts developing without teaching and also children doing math independently. That's very interesting. And also for, you know, second choice looks like again concepts developing without teaching and kind of a fairly balanced amongst those. And again that's very interesting that you are even just in your everyday working with children that you're saying these two things, children doing math independently that you see it coming out in things that they do. And that's good because we're going to be talking about how you can support that a little later and also concepts developing without teaching because, you know, it's hard to get that idea across even to teachers of older children that, you know, sometimes you just have to get out of the way of children. And they don't...you don't have to be taught some of this stuff if you...if it's facilitated correctly.

Sarah, did you have any comments that you wanted to make?

Sarah: Well I just want to kind of reinforce I think what is it you are seeing with our participants today and kind of celebrate I think the level of expertise that we have oftentimes represented in the world of Early Head Start and Migrant and Seasonal Head Start professionals that work with infants and toddlers around areas like math. So, I'm not surprised. I'm very happy to see these choices. I want to also at the same time thank you for starting us off on this wonderful conversation, as we're thinking about some of the key elements of math but also tying in with areas such as literacy. Because I think for many of our participants today, they may have had a lot of training and support around literacy and not as much for math. And I think that's where part of us selecting this as a topic for Virtual Birth to Three it's just again seeing what our participant's feedback is; and listening to you, I know we're going to have a wonderful 70-plus minutes of conversation around how emergent math begins from the time, as you said a child enters the world.

But as we're thinking about some of the specifics, I wanted to ask you about a news article, because as an expert in the area of math and as a constructivist we know that as children are engaging the world from the moment they enter it, how important it is that our parents, our family childcare providers, teachers and home visitors make available opportunities for them, both through their relationships but physical environments. So, with that in mind and thinking about math, what would you perhaps title an article on early math, because in our world we do a lot of writing for community partners. So let's pretend this article is going to be for our community people who know nothing about how infants and

toddlers learn math. So, Eugene if you wouldn't mind maybe a title for an article and then maybe what you would like to see the beginning of this article be, so maybe a few key principles.

Dr. Eugene Geist: Well I think that I would probably title that article something like: "Math Interactions Are Important Even for Infants and Toddlers," because I think that that's key to what we're going to be talking about today. And even as you said linking it back to the literacy, what we know about literacy; it's that interactive nature of how parents and children interact with each other and being able to support that mathematics but also how children interact with each other and how children interact with objects. So, it really is about that stimulating environment that supports interactions that can be based on mathematics. And again going back to the literacy and the emergent literacy; it's what we know and what we do with literacy already. And we know that it's good to read books to children even if they can't read yet or even if we think that maybe they don't understand all the words. We read to infants and toddlers. And sometimes it's the rhythm of the book that they like. And sometimes they're picking out certain words. But it helps them to recognize words and it helps them to become a literate person or even...and moving them towards reading. And that's exactly what we're talking about here with math is doing the same types of interactive...interactions with children, so that they can construct these ideas of math in a very natural flowing way to the point where when they get to say, kindergarten...and again we'll use the term being ready for school, they will be ready because they've had...their development has been supported through those interactions.

Sarah: Wonderful. Thank you so much. And I'm very excited about the direction we're heading now which is a deeper dive, as we think about some of the key concepts behind math and how some of them like the term "physical" and "social" might have a different meaning for some of us who don't have the depth of understanding of early math and how it emerges. So, thank you for that. And we're looking forward to hearing more.

Dr. Eugene Geist: Sure. Okay, so Kelly, if you could go ahead and take down the poll; I think we're done with that. And so as Sarah said, I want to talk a little bit about the types of knowledge. And this is...this actually is...the first two are fairly simple to understand. And I think that you'll... it'll be easy for you to relate to because I think you see it every day. The third one might take a little bit more thought process; it might be something that you see but it's...it may be a little bit of a new concept.

So, the idea of...what Piaget did in his theories...we know about say, his theories of sensory motor or preoperational stages and those things. But another thing that he did was he talked about different types of knowledge. And he came up with three. And the first one is physical knowledge. And physical knowledge is the knowledge of objects. And again, if you've watched children playing with objects or exploring, if anything, as you can see in some of these pictures some toddlers playing, infants and

toddlers playing with some confetti and some... I think that's some branches from a Christmas tree or a pine tree of some sort and the physical properties of those objects: How does it feel? How does it smell? How heavy is it? What, you know, What color is it? Those are all physical properties that as children they can get…they can understand those properties without an adult there to tell them.

Okay, now, the adult can facilitate and say things like, you know, well, you know: Hey, what's it smell like or what's this or what that? But a child even if the child is alone they could pick that up; they can feel it; they can understand that object through their senses. And that is physical knowledge and something that you can understand simply by physically interacting with it. Social knowledge is the knowledge that somebody does have to tell you. It's knowledge that we...you couldn't figure out by yourself. And language is a good example of that. We speak generally English or again, it could be Spanish or French or any number of other languages that are spoken in the world. But we have to have somebody to teach us that language some…it's...because we all have to agree on the words that we use to describe things. And so children wouldn't be able to pick that up by themselves. They have to have somebody to tell them that. And then, finally, logical mathematical knowledge, and logical mathematical knowledge is the knowledge of relationships. And most of math is really based on this idea of logical mathematical knowledge.

Now, this doesn't mean that there isn't some physical knowledge involved with math and that there isn't some social knowledge involved in math because there is. There are some things in terms of math like how we write certain numbers or the names of the numbers that we give them that we do have to have somebody tell us. But in the basic underlying nature of mathematics seems to be very universal. And we even use it when we send a spacecraft out into space to communicate with other, you know, whatever's out there because we assume that math is kind of...is universal. And the reason we think that is because it is a...the knowledge of relationships that we construct inside.

So, if you look at your screen you see there are four items here. And when you put them...when you look at these you might put them into relationships. Let's just look at the pens to begin with. You might put them into a relationship of "same," because they're both pens. They both do the same thing. They both write. They're both kind of long and fairly skinny. But you could also say that they're different. You could put them into a difference relationship because they're not the same color. They have a different color. One's fatter, and one's skinnier. So, you could...it just depends on what relationship you want to put those in. And you could do the same for the erasers. They do the same thing, generally. They erase. But one erases chalk and one erases pencil. So, there are lots of things that you could make same and different. But those relationships exist in your mind okay? Those are constructions that you've made in your mind. You looked at them. It's not...they're not physical properties. The difference is not a physical property but it's in your mind.

So, another relationship that you can make between these objects is a numerical relationship. You could say that there are four things or you could say there are two pens and two erasers. But you put them into a relationship. And the "four-ness" of that group of objects is not a physical property of the eraser or the pen. It's actually a relationship that you made in your mind, you've constructed in your mind. And that's what we want to do with children. We have to understand that there's a lot of mental construction going on when they're putting things into relationships and that relationships like "same" and "different" and "more" and "less" will eventually lead to relationships of number and then more complex relationships of number. And even 0 to 3, those first three years of life children are beginning to make very, very complicated comparisons about things. Again they start off simple but by, you know, 3 years old they can make some pretty in-depth comparisons.

So, what is math? And math is a series of relationships, whether it's comparisons or contrasts on whether it's number and counting. And so...and if children are comparing shapes or they are comparing sizes of piles or they're making contrasts between things a lot of that is still math even though they're not maybe using numbers the way we would think of in, say, first or second grade. A 2-year-old or a 1-year-old is still making those comparisons and they're constructing that. They're building that idea of math inside that is going to eventually lead to them understanding math on a more complicated level. And the way that we can make sure that that happens is by facilitating early math learning as adults, through a variety of mediums such as active engagement with instruments, music and movement, sensory experiences, traditional building toys and daily routine.

So, again what emergent mathematics means to us in this case is creating stimulating environments in homes, making sure that parents and caregivers have...understand how to stimulate their child mathematically, either through objects or toys or through interactions by talking to their child. As adults, we need to recognize mathematical interactions in infants and toddler's everyday lives, look for those everyday lives. And again in the poll it seems like many of you are already seeing some of that. You're already seeing some of this in their everyday lives. And so finding a way to really expand on that is really what we're going to be talking about over the next few minutes and promoting a child's natural ability to use math.

What it is not is it's not prescriptive. This is not something that we're going to make a child do. We're not going to say: "Okay, today we're going.to have a half an hour of math lessons," and to...with a 1-year-old. "Today, we're going to do this or we're going to do this worksheet or we're going to do that." It's...so it's not prescriptive. And it's not about acquiring skills. We don't...I mean we're not talking about pushing 1 or 2-year-olds to be able to do double column addition or multiplication or division or anything like that. We're really just looking at giving them a stimulating environment that allows them to construct the basics of mathematics from within their natural growth patterns. It's not about recitation of math facts. Just like with literacy, you know, we're not focusing on children being able to

read sight words when they're 0 to 3. Just like that we're not worried about them understanding "two plus two" and being able to spit it back. And finally, it's not coercive. This is not something that we want to be giving stickers for or rewarding or even punishing children if they're not getting this right. It's something we want to build into a very natural, their very natural everyday lives.

So, some sample activities that you might see are...that we're going to talk about and that we see a lot of math in are: Rhythm and music, patterning, blocks and shapes, classification tasks, basically meaning: Putting things into piles of... that are the same. So if you have squares and circles. You put all the squares in one pile and all the circles in the other. Multiple classifications is just a more complicated way of doing that classification task because maybe you give a child a group of objects that have different characteristics like you have small, blue triangles and large, blue triangles and you have small, yellow triangles and large, yellow triangles. And then you might also have squares in the same way and circles, so that if you say to...if you ask them to sort them by the things that are the same, you know, can they put all the circles together even though they might be different shapes or they might be different sizes and they also might be different colors? And generally very younger children...very young children can't do that. They still want to put everything in its own pile that is exactly the same. And so that's an interesting one to watch. And also everyday activities and routines, the things we do every day whether that's diapering, feeding, tummy time or outside time... whatever has to be done on a daily basis through talking to children...what I like to refer to as "math talk" and also movement and dance which also involves patterning and rhythm.

Sarah: So Eugene thank you so much for helping to clarify for us today what math is for very young children and what it isn't and how we may be observing babies and toddlers engaging in activities through everyday experiences that can support their emergent development of math related concepts. I wanted to take a minute to just, for those of us that are so enmeshed in this world of Head Start Program Performance Standards, to just tie in what it is that Eugene is talking about which is the infant toddler piece.

So, as I mentioned earlier the five essential domains to the ten domains that are in the outer ring of the Head Start Child Development and Early Learning Framework. Because a number of the concepts that Gene is going to be taking us through today and linking with are actually identified in the outer ring and one portion or one of those ten domains is actually entitled "Mathematics, Knowledge and Skills." That includes as we think about some of what Eugene will be talking about the foundational pieces for things like number concepts, number relations, geometry, spatial sense, patterns, measurements. These are all, as we read through some of our materials, are identified as mathematical domain elements.

So, it's really helpful today as we're keeping the focus on infants and toddlers to be reminded of the outer ring of the Head Start Child Development and Early Learning Framework and of course always be thinking of the continuum of children's development birth to five. So, again we're going to come back to infants and toddlers and this question about a news article Eugene. If you wouldn't mind since you've already given us a title for the article and some of the key pieces of what it is and an introduction that you would like to see in this article for community people. Could you maybe take it a step further as we think about the article and giving people in our community a little bit more of a sense of what is it that infants and toddlers are gaining through that planned and unplanned experience? What is it that we might want people in the community to know? Because I know you're going to continue to take us into a deeper dive around things like patterning and music and movement. So, just give us an opportunity before you take that deeper dive to think about that article and getting information out on early math for infants and toddlers.

Dr. Eugene Geist: Well I think that it's very important for the community people and for parents and community people, in general, to understand that math doesn't wait until kindergarten or first grade to start developing. And I think that maybe 30 years ago, 40 years ago we thought about literacy the same way. We didn't teach how to read until a child was in first grade. And we didn't assume that there was anything that went on before that. And right now we're at a point where we're starting to recognize that math is the same way. And so I think that understanding that math does... there are things that are going on before first grade in terms of developing math.

And in my opinion there are some very important things that are developing in those years even...I mean even again as early as the 0 to 3 years. Something as fundamental as understanding what it means to have one thing or what I like to refer to as the "concept of one." I mean, you know, children will...even earlier, children might say they have "more." They can tell the difference between sizes of piles. This one has less and this one has more. But an understanding that there's one thing and then if they have another one thing that they would have two things is really the first step on the road to being able to count and being able to add and being able to do those types of things. But it's a hard one to see happen in those first three years. It's hard to say: "Well that's where that happens." It might be easier to see when a child learned to count to five because you could actually, you know, say...hear a child count to five or when a child first understands things like addition.

So, I think that what people need to understand is that even though it might be hard to see some of those things that they are constructing and that's going on in their mind, there are some very important things going on in those 0 to 3 time periods.

Sarah: Thank you. That is so helpful. And it really is, we're going to be continuing on with the discussion today, I think helpful for participants as we think about the observation assessment piece that is so, I think, challenging at times, as we think about home visitors and family childcare providers and teachers trying to gather information that demonstrates change in a very young infant's development over time that does connect with math. So, I so appreciate what you're saying here Eugene of how those nuances in these first three years that definitely are skill-based and that will become more and more defined, as you said, whether it's through counting or identifying spatial relations and patterning and such, things that become more easily recognized in the three to five period that they are absolutely there and evolving in that first three year period. So, thank you. And with that in mind I know you're going to take the deeper dive as we look at patterning and some of the other things that experience or that infants and toddlers experience through day-to-day life. So, thank you.

Dr. Eugene Geist: Exactly. And as Sarah said, I'll...we were going to kind of go ahead and look at some of these things that 0 to 3 children are interacting with. And even though sometimes we...they may not be able to demonstrate some of this, it still is making a big impact on them. And the first one I want to talk about is patterning. Because there's a lot of patterning that goes on in children's lives whether it's visual patterns in terms of, you know, patterns in colors or shapes or as in the second one, which is a rhythmic pattern which is clapping hands or bouncing a child on the knee, which happens very early on in life, is probably one of the first mathematical experiences a child has is when they are being bounced on...or even rocked in their mother's arms and to try to soothe them, if they're crying or if they're hungry or if there's something going on with the child very early on in life.

And, you know, my wife is a music therapist and she...and we've done some research on things like steady beat and how it affects children and how it really can have an impact very early on in how they understand math and the mathematic instruction because that, you know, when you rock a child or bounce a child you're doing a very...it's a very steady beat. You know, and it does have a very rhythmic pattern to it. And also for example patterns that we see in predictable books which again are more rhythmic patterns. The story goes that Dr. Seuss, when he first decided, when he first came up with the idea to write his first book, he was on a boat. And he felt the rhythm of the engines. And there was a rhythmic drum to the engines. And that that rhythm actually helped him to come up with the story that he wanted to write that was based on rhythm. So, he didn't start with words. He actually started with the pattern, the rhythmic pattern and then builds his book on that and probably even successive books. Because I think if you read Dr. Seuss they have a very distinctive pattern to it. And so math and music to me has a very large role especially with infants and toddlers and even math, within math, especially with infants because they might not be able to dance or move around as much. And but they still are...can hear and they can still feel the music and the... and as you can see in this picture this is infants actually playing with a drum. So, they would listen to music or they would clap hands and then they wouldplay with the drum. And even...the infants might not have a very organized steady beat but they're...but you can watch and you can see them trying to come up with those things or trying to repeat those patterns.

But there is a lot of patterning in beat, rhythm, tempo, volume, melody, harmony from within any of those...any type of songs or music that we use with infants and toddlers.

And so this is just an example of a song with a pattern. And again I'm not the best singer, so I have a better example of another song that we'll put on next. And so this is something where you can see the pattern say: [Singing] "little baby don't you cry, little baby don't you cry." [End of singing] So, you can see that it's a repeated pattern. It's an A, B, A, B repeated pattern. And we see that in the second verse which maybe has a little bit different melody to it, but it still has the same type of rhythm to it. So, I would like to show you...or I'd like to play for you an example of my wife, actually... who's a much better singer singing another song that has a good patterning to it and so that you can see it.

So, Kelly if you want to go ahead and play that music.

Female: Train is a coming. This is for an infant. It shows an A, B A, B pattern. [Singing] Train is a-coming, oh yes. Train is a-coming oh yes. Train is a-coming, train is a-coming, train is a-coming, train is a-coming, oh yes. Better get your ticket, oh yes. Better get your ticket, oh yes. Better get your ticket, Better get your ticket, Better your ticket, oh yes. Room enough for baby, oh yes. Room enough for baby, oh yes. Room enough for baby, room enough for baby, room enough for baby, oh yes. [End of singing]

Dr. Eugene Geist: And I think that you can see in that song... and I don't know about any of you, but I was tapping my foot to the song even though I've heard it many times before. And I think that you might be able to envision yourself holding a small infant and singing that song to the infant to... well, I mean it could be any time. It could be before nap time. It could be whenever. And I think that you could also see you might actually even be bouncing the baby to that rhythm. And so there are many songs like that. Train songs are great because they tend to have a really good pattern and rhythm to them.

I want to move on and talk about the everyday activities because I... this is also where we see a lot of math, in things, everyday things like taking turns, mealtime, nap time, fantasy play, diapering, also tummy time. You can see here the picture, this is my son when he was may be just turned 3 years old. And he has always been into cooking. And his school has done cooking since they were very young. And from within that there's the measurement, being able to measure things. The children would help

with the measuring. They would help with the stirring. They would take turns. And how many stirs is each person going to get. And so they...there was a lot of talk about how in making this food and doing these types of things how much of this do we put in there? How many times are we going to stir it? How many...who's going to stir for this one and so from within those types of experiences and everyday activities, just being a facilitator and talking about some of those things. And again, this is my son, who's

about to turn 5 now. But when he was, you know, when he was 2...since he's been 1 or 2 years old we've been ...we would do math talk. We would talk to him about asking how many or how much. We would do...talking about quantities and asking him to tell us some things so much so that now he actually expects that when he asks the question like what's five plus five that I will ask him first what do you think it is because I want him to talk to me about math. I don't want to give him the answer because that'll shut down the conversation.

So, I will ask something that allows us to keep going. And even with younger children that's what we have to avoid is just kind of telling them things as if oh, you're going to be collecting this knowledge but rather getting them to think about it, getting them to be interactive. And along those same lines this is what we want to do, we want to get caregivers, get ourselves to be thinking this way and understanding and liking math and not having a bad attitude. So, caregiver comfort level with mathematical concepts can influence his or her ability to support infant and toddler, infant, and toddler's developing understandings of math. And the basic idea here is that poor attitudes rub off on children. And, you know, many of my students I see it in them because they're very open with their...when they talk about how they really don't like math and how much math anxiety that they have.

But even parents...there are a lot of parents who will when they're talking with children or they're doing something, they have their children along they'll say little offhanded comments like: "Oh math is hard or I hate math or I've never been good at math" or those types of things. And this could lead to less math interactions between adults and children. Adults who don't like math or don't...they will tend to avoid talking about math. Instead of giving positive messages to a child and talking about math and doing the math talk they would tend to avoid that. And that's what we need to make sure that we stay away from, because I mean we're talking about children 0 to 3. There...you don't have to have a whole lot of math understanding to help them to understand certain things, like being able to count or shapes or those types of things. You simply have to just have or at least portray a good attitude towards math, because gender stereotyping also comes into this. And we know that girls tend to get more negative... get sent more negative messages about math than boys do. And so we...with those negative messages many times they do affect the girls more than they do boys which tends to then exacerbate the problem of the gender stereotyping.

So, let's do a little one word activity. In the public chat area, if you could just write one word that comes to your mind when you think about math... that would be great. So, Kelly I don't know...if you could open up the public chat for them and, you know, it seems to me that I'm seeing a lot of people that are saying "numbers," that "math is about numbers." And, of course, we know that it is. And but, again as we've been saying, especially with children 0 to 3 they might not be thinking about numbers. But still they are constructing that underlying understanding of numbers. And I'm seeing a lot of people saying that "math is fun." And that's really great. I really am so glad to see that there are a lot of people out

there that think that math is fun. But I'm also seeing some that are saying that it's "hard" and that it's...there's one that says, "stressful." And I've seen some that have ...and generally like the one that says "stressful" seems like the negative ones tend to be in capital letters as if it is very stressful. And "exciting," I am so glad to see that. I'm so glad to see. Sarah, did you have any comments that you'd like to make about what we're seeing here?

Sarah: So, Gene it's...or this is amazing to see the reactions. And I have to say that we got mildly distracted from our end here, because you were saying I think the word "fun." It's really again, as I think about our audience out there of people who are working with some of the nation's highest risk infants and toddlers; while we know we have some reservations around math, I think what you mentioned earlier about literacy, if we can just be more intentional and what math means, ultimately, to all children and their outcomes around school readiness and then, what it is that we do or we don't do to influence them; it's just so fun to look at all the different words that are streaming by. I was wondering as we're thinking about your own experiences... and so we're going to be coming up to...I know you have some polls that are coming. But when you have worked around even I know you're in a university there, but with students who don't always have such a positive attitude towards math, do you think you could give us a couple of ideas for folks who are trying to support parents who have infants and toddlers and folks that have staff that have may be some anxiety towards math? Are there any things that you found can be really helpful?

Dr. Eugene Geist: I think that it's almost like therapy. This...but I think the first thing that I do with many of my students is just let them talk about some of their... why they think they have a bad activity or a bad attitude and what actually caused some of the... some of that...those bad feelings. Because I think they have to address that first. And I think many times that helps them to see: "You know what, I want to make sure that I don't do that with my children or with the children that I am having an impact on." And I had one student that she said that her...we did a... we were talking about math anxiety and I...she almost cried. And I...we were talking about some of her experiences. And she said well, you know, my teacher they would... we would have math folders and we would have to turn them in at the end of each week and we would get them back on Monday the next day. And the teacher would put stickers on the folders on, you know, how many you got right or if you did well or something like that. And she said that she never got any stickers on her folder. And so she would take her folder after she got it back and she would draw stickers on her folder so that she felt that she fit in and that she...because that was so devastating to her. And even in college, even this has been what, 15 years since this happened, she... when she was telling the story she was tearing up and she was choking up. She could hardly tell the story. That's how much of an emotional impact that had on her.

And I think the first thing we have to do is look inside ourselves and find our math anxiety and address that and figure where'd it come from and understand that we don't want to pass that on. And so to do that we have to make a deliberate choice to think about math. Because again were talking about

younger children. And it...so it's not your ability to do the math, because it's really just about your fear or our fear of doing math with young children.

Sarah: Oh, Gene, I love it. I'm just looking ahead, of course, because I know what' yet to come and talking about as you just said where do these attitudes, where do the anxiety or the joy for those individuals who find math fun, you know, really thinking about where you're headed next in the conversation which is those learned behaviors versus not, and really again how important the role of adults working with infants and toddlers around early math concepts is going to take us as we continue with this conversation so thank you, thank you, thank you, that was very fun for those of you participated in the open chat.

Dr. Eugene Geist: Yes, thank you all. It was very enlightening. And for those of you who found math fun I've got some good news. And for those of you who found math to be hard or stressful it may not be as much of good news. But what...we're going to do a little math problem, in a few seconds because I would like for us to examine some of our learned behaviors and some of where this comes from and because in the...as I...in the example that I gave you of one of my students, you know,12 years of traditional schooling have taught us a lot of things about what math is and how we react to math. And I see this when I work with my students, that they assume that the teacher is always going to have all the answers. And they will avoid risk of being wrong when...as you'll see when we do this math problem when I gave this to my students, you can clearly see that they are avoiding trying not to be the one to give the wrong answer. They see math as a solitary task.

Even when I say: "You know, I would want you to spread out. I would like for...you can talk to people. I want you to work together." They still would rather work by themselves. They see math as a solitary task. And they expect instant validation. When they give me an answer they expect that I'm going to say: "Yes that's right or no that's wrong, right away." "This is the answer and look at me." And even when they say their answer they say it as a question. I'll say what do you think the answer is? And they'll say: "50?" like it's a question. And I say well is that a question or are you giving me the answer? And then they'll say: "Oh well it's: 50. That's the answer that I think it is." But just almost subconsciously they say it is a question because they expect me to tell them whether they're right or wrong. And also we also have learned the value the product over the process, meaning it's more important to get the right answer than to think about all the thinking that went into getting that problem.

So, here's our math problem. It's a little brainteaser problem. It's...and so a man buys a horse for $50. He then sells it for $60. And then a buys it back for $70 and sells it again for $80. So, your job is to figure out: Did he make money or lose money and how much did he make or lose? And so, I'd like for you to go ahead and work on this for a few minutes. And then when you think you have an answer you can enter

it in our little poll here. And while you're working on it...I don't mean to bother you while you're doing it...but I just wanted to say that, you know, I do this with a lot of people in person when I do presentations like this in person. And generally when I say we're going to do a math problem there's a moan that goes up throughout the room of people. And I had one lady once that actually stood up and told me she was not going to do this problem. She said, "I am not going to do it and you can't make me." And so I said: "That's fine. If you don't want to do it, you don't have to." And I give you the choice too. If you don't want to do it, you don't have to. But when we got to the discussion part where we started discussing answers she actually had done it. And she actually became the most vocal person in standing up for what she thought the answer was.

So, again she had a lot of math anxiety but yet when the question was presented in a certain way... I'll give you a few more seconds to think about this problem. Okay, Kelly you want to throw up those percentages? Let's see what we have here. Okay, so we have a cluster of people around breakeven, plus 10, plus 20; 23 percent think it's 10; 18 percent think it's 20; 2 percent think it's 30. We have 1 percent think that he ...or a couple percent that think that he lost money at 10 and 30. Okay, Kelly why don't you go ahead and take down that poll. And I would...again normally if I do this in person... and we're running a little short on time but I always like to get people to discuss their answers and trying to get people to talk to each other. And you can see a lot of those things we talked about on the last slide, you can see those things emerge in the way that people try to answer their problem. They'll give their answer as a question. They...they're more interested in the answer than in the process. And again that leads to my next question because generally people will work on this problem for a while and they'll talk, they'll give their answers and they expect me to tell them which answer is correct so that we know who was right and who was wrong. Because that's what math is right, knowing who was right and you was wrong and who the teacher said was right and wrong. And so the final test is that and again what I'm going to do here is...oh, that was the poll we already did...is how would you feel if I didn't tell you the answer?

And again this is another poll. So, let's have Kelly go ahead and throw that out there. And we expect that teachers have answers. And we expect that once we've worked a problem for a little while that we are going to give our answer and then we can be done with the problem and the teacher can give us an answer and then we can move on. Now the thing is that if I give you the answer; let's say on this question if I give you the answer to this question generally what's going to happen is if you got it right you're going to go yes I knew I was right and if you got it wrong you're going to go I knew I was never good at math anyway. And then you're never going to think about this problem ever again. Okay, you know, a year from now somebody will ask you and you'll go: "I don't remember that question." But if I don't give you the answer to this question, you're going to think about it. It's going to bug you. You're going to go ask your husband or your wife. You're going to ask your best friend. You're going to ask the person next to you. You're going to ask the person on the bus. It's going to bug you. You're going to think about it. And my guess is that even though you're probably not going to be very happy with me... Kelly, why don't you throw up the percentages there.

Not so happy, yes a lot of people aren't going to be not... aren't going to be too happy with me so that's nice. I'm glad that you were at least not very, very... most of you weren't very, very angry although there were a number of you that were very, very angry. Sometimes when I do this in ...with large groups I feel like I'm going to get lynched. And when people see me through the rest of the conference they all want to...they all stop me and say, you know, they'll tell me they will say so is this the answer? And I'll say well, you know, do you think that's the answer? Why do you think it's right? And they get very angry when I won't tell them whether they're right or wrong. But again what you'll do is you will try... you will think about this problem. And you will get...if you think that your answer is right then you will stand up for that answer until you are convinced that it might not be the right answer, till somebody convinces you otherwise. And I think that in that situation the more people would talk about it, eventually, everybody would agree on an answer. But the thing is that this type of thing and when I do it in groups it always seems to be fun for people. Even though they get angry because I won't give them the answer; it's a math problem that they take out of the room and keep thinking about, because it's kind of fun, even if they don't like math or they think they're scared of math. It's something that they still keep doing. Okay, thank you. Kelly, you can go ahead and take that down.

So, let's look at our final key message here as we wrap things up. Caregiver and parent engagement and experiences that support mathematical concepts will promote school readiness in the first three years of life. So, what can we do? What are the things that we can do? We've examined our own math anxiety and our own feelings towards math and we know kind of how we can make a stimulating environment. So, what are the things, very concrete things, that we can do? Well, as I've been saying all along: Interactions with children are vitally important. You need to be a facilitator of children's knowledge, not just a transmitter; you're not just telling them math and getting them to spit it back but you're giving them materials; you're giving them experiences; you're talking to them; you're putting drums out so that they can play with the drums. You're having the march around the room in a rhythmic pattern. You're singing songs. And you're asking them questions about math. You're focusing on the math that's in that situation. Being an active observer of children's actions and exploration that's the way that you're going to be able to be a facilitator. You look at what they're doing and then you say what type of questions could I ask that would extend their thinking on this? What type of things could I ask that would keep them thinking about that? Just like with the horse problem that I just showed you, my role if we were having a discussion on this would not be to tell you which answer is right or wrong but rather to ask questions that would facilitate more discussion or to get people to talk to each other or to facilitate different ways of thinking about the problem. I mean: I've had people with that problem pulling money out of their pockets and saying you know: "Look, I've got $10 bills; let's just do it this way and or people drawing things and coming up with many different ways to solve problems. And that would be being a facilitator. Well, is there another way that you can solve this, think about this problem being a facilitator? Providing appropriate materials and activities, encouraging children to think about and recognize relationships between objects, helping children to make connections. All these things again go into being a good facilitator.

So, as we wrap up here: There's just a few things I want you to remember about what we've talked about, the really important points. First, that learning mathematics begins at birth and that mathematics has a developmental sequence. And again this comes very similarly to the things that come out of our understanding of literacy and emergent literacy. Mathematics is linked to brain development. This is...all of these things are true again with literacy. Interactions with mathematics as infants and toddlers can promote later math concepts. And again be...I can't overemphasize how important it is to be a facilitator. Infants and toddlers: They don't need flash cards or memorization. What they need is somebody there to talk to them, to ask questions, to construct good experiences for them where they can explore and using math talk where you can ask some questions, you can ask them to... for example in this picture a good math talk for a child might be, you know: How many sponges do we have on the table or how many sponges do you need or how many marks have we made on the paper or how many different colors do we have? I mean simply just asking how many questions is one of the easiest ways to do math talk.

Let children show or tell you. Instead of you showing and telling them, let them tell you. And again I told you that with my little boy I will...if he asks me a question my first response is always to ask him what he thinks. Because I want to know now he's thinking about it before I start to interject what I think. Help children make connections. Help them to think about things like you might say: "You know, you put three green marks on this paper and there are three green marks and two yellow marks." And so you can help them to make connections about how many of one group they made and how many of another group they made through their questions or just through talking to them. And again asking questions, that all goes back into being a facilitator. And I think another thing that I can't overemphasize is how important it is just to kind of get out of the way sometimes. And we don't...while we want to make sure that we plan a stimulating environment and we want to think about curriculum for children 0 to 3 and how we're going to promote math. When we're in the situation we want to... we don't want to over control. If the children are doing something with the materials that you didn't think...you didn't plan for, you don't...don't say: "No, no, no don't do that, this is what I want you to do."

Instead, think about how you could change the activity to follow what the children are doing. Don't push them to do something that they're not ready for or even that they don't want to do. Follow the children's natural progression. Follow what they want to do as much as possible. Give ample encouragement, a good positive encouragement. And again we've already talked about this. But as much as you can stay away from saying: "Math is hard or I don't like math." Talk about how you like math or "math is really fun" or "wow, let's use math to solve this; I think that would be great." So, being a good role model is very important.

Sarah: So, Eugene thank you so much for making the discussion today so relevant to the range of adults who support infants and toddlers in our Early Head Start and Migrant and Seasonal Head Start program. As I was just listening to you and again thinking about all the very natural ways, once somebody understands that development, the emergence of math from very early on...I would hope that they would feel much more comfortable as you mention words like curriculum and how no matter what area we're considering with infants and toddlers appreciating how there are, of course, all those planned and unplanned moments; so that the more that folks really understand what you have shared with us today, how naturally it is that children are infants and toddlers who are sensory-motor learners just naturally engage with things that lead into math. It makes me think about as a toddler-teacher all those family-style dining experiences that I know our teachers in center-based or in family child care homes enjoy.

We're trying to figure out how to encourage a child to help set the table when in fact they don't have one-to-one correspondence. So, they may pile up all of the plates in one spot and one of the...and all of the cups because they haven't quite gotten the idea that we need one plate per chair for each child that's going to be seated at the table. That when we think about counting as a later skill, whether it's developing at 3 or 4 four years of age, the children at that point for having the experience of helping to set the table learn to assign something like a number name to each of those table, to those chairs, to those plates that they, over time, through everyday experiences with trusting adults are able to move towards what we think of as more traditional math.

I loved what you again did early on by bringing the literacy piece in, because I know for our participants, today, many of us remember and still struggle with in the community folks saying literacy is ABC. And I love the way that you've helped us to understand that math is just like with literacy not simply saying numbers. That it emerges in so many different ways. One of my favorite is again going back to family style dining how things spill and the idea that suddenly as we think about containment and spatial relations where when a child goes to pour their first couple of water and that very large container of water isn't enough for them to realize that that little cop can't hold it all. And so they just continue to pour and to pour and to pour, because it's again where they do not necessarily have this whole spatial piece and understanding of "more" and "less" down and the fact that they're just plain old-fashioned sensory motor learners. And so almost everything they do can eventually lead them into an experience that could with the guidance of a trusted adult lead to their enjoyment of things related to math.

So, with that I also wanted to remind our participants that hopefully they were able to participate in yesterday's vBTT reflect...excuse me, webinar on reflective curriculum planning for infants and toddlers, because as we began this webinar we're talking about how each of our little birth to 3-aged children are scientists. So, so many of the elements that were discussed yesterday in that particular webinar tie in with our little beings that love discovery. And again so much of that math and science will relate like literacy to later school readiness and success in life. So with that I wanted to go ahead and open up to

our listeners the "private chat" option. So, as Kelly began the webinar today reminding folks at the lower left-hand side of their screen, there is both the public chat but then a "private chat" option. So, if you have questions for Dr. Geist if you would just go ahead and enter those we will go ahead and present them and just continue with a little bit more discussion here of this wonderful topic of how math is emerging from birth.

So, oh, I see we have a first question here. It says: "I like your idea of math during tummy time. As a home visitor what can I tell parents about this opportunity and how they can support their child's learning?" Are you able to address that for us Dr. Geist?

Dr. Eugene Geist: Absolutely. Well, I think as with any case it's always individual but and not...going back to the music and rhythm I think that, you know, when children are doing tummy time I think, you know, talking to them and singing to them and many times, you know, you see their little arms that are waving. And offering them toys to interact with whether those are blocks or rings because what they'll do many times is they will explore them using that physical knowledge, using their sensory motor awareness.

So, they might be comparing things and giving them a lot of toys and a lot of stimulating things to look at and make those what we talked about earlier with comparisons. And again getting back to the music part of it, I think many times, you know, doing things where you can where there's clapping or there's singing or very simple songs that have good rhythms to them, good patterns whether those are melodic patterns or rhythmic patterns are very good to do...to use during tummy time. I think that, again, observing a child and seeing the things that they seem to be interested in is always one of the best things to do. And so every child might be different during their tummy time. They might enjoy exploration or they may enjoy, you know, making a lot of noises and a lot of babbling or cooing or relation types of things. And so even doing kind of an echo response with a child that is doing some vocalizations would also be a way that you could come up with certain patterns. You know, if they are going la, la, la and you say la, la, la; I mean that is a pattern and they would hear you do the same pattern that they just did and you may see their face kind of go: "Hey what'd you do?" So, that's another example of things that you could do. But I think it's always picking up on what the child is doing and how can you build on their activity during that time. And then how...and even thinking how am I...what am I going to do next time in tummy time because I know that they do this or I'm going to see if I can build on that and do...and try to get them to do this.

Sarah: Wonderful. Thank you. And that I get really does tie us back into yesterday's webinar, as we're thinking about both the planned and unplanned side of a responsive, meaningful curriculum for infants and toddlers. So, you just gave us some wonderful examples of, again, if we can identify what it is that math looks like in very young children that we can through very, you know, natural engagement with them promote this readiness for taking on more complex mathematical concepts as they move into the 3 to 5 period and beyond. So, thank you so much.

There is a second question that's come in here via the "private chat" room. And it is...says: "Is there a written developmental math progression?"

Dr. Eugene Geist: There are probably a number of them out there. I think that it just depends on the person that's making them. I've put together one that I put in my book, "Children Are Born Mathematicians" that was based on at least a culmination of as much of that progression as I could...or much of the research as I could find. So, there is...so that...I would refer you to that just because that's the one I'm most familiar with because I put it together. But it's by no means the only one or the only way to look at progressions of mathematical progressions because, you know, children; each child is different. So, there's going to be the general overall development that we see, but then each child is going to be a little different in terms of how they go through that. I think what you see in with young children in 0 to 3 it's...it can be rather hard to actually see the things that are going on because it's tough to get inside their head and sometimes they're not always the most verbal people.

But I think what you see is that they go from an idea of developing this idea that there can be quantification, that you can have things...and then that first level of quantification is "more" that, you know, I want because basically, you know, I want "more" or we think about it through feeding. We always say do you want more? Do you want more milk; do you want more bananas; do you want more this? And so that's one of the first things that they might come up with. I...you notice I didn't say "more and less;" because, actually less is a more complicated developmental concept that they don't quite get until a little later. So, it really is just talking about more, which one has more. And then they would move on to that to being able to a more complex understanding of "more," to where they would be able to say, you know: "Oh, there's more in this pile than in this pile," to as I said earlier, that concept of one, being able to understand that you can actually put things in groups of...by one distinct item what I call "a one."

And then eventually that leads to them being able to count those things and then of course then to addition and those type of things. And from within there, there are... observing the child you can see how they move through and where they are and what type of questions they're asking or what types of things they're doing with objects. So, I think also you see in those first two years of life it is... it really is based on a lot of sensory motor explorations. They're picking up blocks; they're banging them together; they're looking at them; they're comparing them. They're seeing what they do when they drop them or they're picking up things and hitting them to see what types of sounds that they make. And those are all sensory motor explorations but they're also making those comparisons in their mind in terms of what they're doing. And then that becomes more refined as they get into some of the preoperational stages and you start to see even in 3-year-olds you would start to see that fantasy play start to develop, which to me that's one of those key lines in developmental sequence.

As Piaget said, you know: "It's sensorimotor and then all of a sudden it's preoperational." And to me the biggest sign post is when they start to use fantasy play. And in that case that's when they start to use math to organize some of their fantasy play. And they might be...you know, Michael would always be making pot roast or cooking in his little thing and he would have to come over make sure that everybody had some. And those are really rich places where you can ask questions. So, I don't know if I answered your question as well as I possibly could have, but I think if you want a nice laid-out progression you can check out my book or again I'm sure that there is some other ones out there too.

Sarah: Great. Thank you so much. And just for participants to be reminded you have a Viewer's Guide. And in the Viewer's Guide is a list of resources. And one of them is the book that Eugene is referring to. So, it should make it very easy; it's Chapter 5, the one on infants and toddlers. It's a great chapter, so, thank you.

Here comes another question. This one's a little longer, so just bear with me for a second here. "As a nation, our students are lagging behind in math in comparison to other industrialized countries. Can you speak a little more from your research and clinical background about how relevant the first three years are to setting a strong foundation for understanding high level math concepts?"

Dr. Eugene Geist: Well that's a very good question. And I would say because it's my research area that it is vitally important to later understandings of math and higher level math concepts. And I think possibly some of the most important things have to do with that emotional response to mathematics. Because I think there's a way that children, before they enter school, and even in that 0 to 3 area, they really do start to get bad messages about math from their parents or the adults around them. And they start to get that message: "That I'm not expected to be good at math or I don't even want to get into that math thing because mommy doesn't like it and daddy doesn't like it." So, I think that it really is that exposure to math. And again, it's a lot like what we talked about with literacy. Children in those early years that have lots of books around they get the message that: "Hey, reading is something that's important. Reading is something I want to learn how to do because I'm going to really need to have it and mommy and daddy have all these books around the house and I want to be...I want to do what they're doing." And I think that math is much the same way in those first three years of life if children are growing up in an environment where they see a lot of numbers and they see math being used all the time and they hear their parents talking about how much they really love doing math and how math is really exciting they start...that rubs off on them. That very early message rubs off on them.

And so I think that that becomes very important just that emotional side of dealing with math, not even the idea of, you know, what type of skills do they have or those types of things. But I think that again

that there are a lot of things that we can do very early on in life that can give our children a step up to being ready to enter kindergarten or first grade ready to go. I mean I talked about my 4-year-old soon-to-be 5-year-old and he's to the point where he can do pretty high level addition problems. You know, and he does this by himself. He'll ask me questions like what's 12 plus 12 and I'll say well what is it? And he'll say it's 24. And I'll say well how do you know that? And he'll show me on his fingers. And he'll say well because I did this. And he has a very...I mean the way that he explains how he's figured out the problem is always amazing to me. And how he got to there at the end of being 4 years old is because we've been doing that since he was born. We've been doing the asking questions, the math talk, the giving him a stimulating environment. So, that by the...now he's just getting ready to enter kindergarten in the fall but he's already doing first and second grade addition just because it's interesting to him and he likes to do it. And so I think that that's what we have to do is getting children even before they enter kindergarten because we are seeing research that says when... that there are a lot of children that are entering kindergarten with bad attitudes towards math and that are already behind their peers in math.

And I think that that's if we can do that, get some good research and some good activities being done in those first three to five years we can really improve what happens then in K12. And the thing is, you know, I've been doing research in this area for a long time. And when I look for grants from say the National Science Foundation or for other places, generally they want to fund high school and middle school math programs. They will grudgingly fund K through eight math programs or K through three math programs. But when you start to say: "Oh, I want to do preschool and infants and toddlers," they kind of laugh because they don't see the...they don't see where the math is and so they really don't fund a lot of programs for that and...because a lot of the funding is on the other end. And so hopefully as we do this a little more we'll see a little more funding for that. That would be great.

Sarah: Wonderful. Well, I want to thank you and all of our participants for their participation today and for your wonderful presentation on "Early Math for Infants and Toddlers." I want to again remind our viewers of the Viewer's Guide that came with your confirmation email for the webinar. You will receive a second opportunity to get the material and the PowerPoint when you get a follow up email. But, thank you, again Dr. Geist. And we look forward to hearing more from you and more based on your research around math and young children's learning. So, thank you all. Enjoy the rest of your day.

Dr. Geist: Thank you, Sarah. And thank you everybody for listening.

Sarah: Bye-bye.