

## Doug Clements: Math is Fundamental for Development

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Claire Lerner: Welcome to the National Center on Early Childhood Development, Teaching and Learning podcast series, that's focusing on the Head Start Early Learning Outcomes Framework. In this podcast, you will hear from Doug Clements about emergent mathematical thinking. We hope you enjoy this broadcast.

Announcer 2: From the ELOF — "'Mathematics development in preschoolers' refers to understanding numbers and quantities, their relationships, and operation."

Claire: Hello, Doug. Thank you so much for taking the time to talk with us today about development of emergent mathematical thinking, one of the key domains in the Head Start Early Learning Outcomes Framework, which is fondly known as the ELOF, and which describes the skills, behaviors, and knowledge that programs should be fostering in all children. So, to start, Doug, why don't you tell us a little bit about your background and, of course, how it relates specifically to this concept of emergent mathematical thinking.

Doug Clements: Well, thank you. Thank you for having me. Yeah, I was a preschool teacher for one year and a kindergarten teacher for five years. And in that work, I just became absolutely enamored with the mathematical thinking of which young kids were capable. And from there on, I've just been fascinated with early childhood, birth through grade two, with my wife and colleague Julie Sarama. We were funded by the National Science Foundation to develop the Building Blocks math curriculum for 3- and 4-year-olds. And we have since done a series of five or six different studies finding what was effective for kids and also what was effective for teachers, helping them support kids in thinking about and learning core mathematical ideas.

Claire: Okay, great. Well, you're just the man we want to talk to, so let's move on and get right into it. Start by sharing with us any recent research on this topic that you think might be helpful.

Doug: There are two things I'd like to talk about very briefly. One is the surprising importance of early mathematics. Mathematics is cognitively fundamental. It's not just about number and shape. It's about the thinking and reasoning that kids do as they think about number and shape, that helps them develop cognitive skills that are fundamental to all the domains. So, we're fascinated with what kids learn about mathematics, but we're also interested and excited about what they learn about thinking and reasoning that carries them through the rest of their lives.

Claire: Why don't we start with this concept that children will develop a sense of number and quantity. What can you tell us about that?

Doug: It's so important, it underlies all the rest of mathematics, our core. The ELOF talks about kids should attend to quantity and play with objects, such as reaching for more than one object, using words such as "more" and "all gone" to talk about quantity, and eventually using number words, right? The interesting thing is, their ability to be sensitive to number goes even deeper than that. So, let's talk about some of the fascinating research that we found. A 6-month-old kid, you've even got him wired up to one of those kind of brain-wave machines, you're looking at their pulse rate and their breathing, and you show them a picture of three objects and three different objects and then three yet different objects.

And eventually, even a 6-month-old, given the idea of, "Okay, I've seen this before," and their brain waves start to go toward sleep, their breathing becomes more relaxed. If you show them two objects, oh, their brain lights up again, their breathing gets more rapid, their blood rate goes up, and they become more fascinated with the visual display. Yes, even at 6 months of age, kids can tell the difference between sets of three and sets of two. They're sensitive to number from the first month of life. And we can build on that and get them to recognize numbers and talk about them. Use the words "two" as soon as they have language.

So, even though it's introduced at the preschool level of cognition in the ELOF, teachers of toddlers should know, "You can be doing these kinds of things, too, talking about these small numbers in everyday situations." Instead of saying, for instance, "Well, don't spill those cups of water," say, "Whoa, those two cups of water — don't spill those two cups of water." So, use small numbers — one, two, three, even four and five, to describe what's going on when they're building with blocks, when they're playing with puzzles. How about with, when you get to the 3- and 4-year-olds then, way up to 5, what can we do there? You can play games where you get four or five objects and then reveal them just for two seconds and then hide them again and say, "Do you see how many?" And then kids might show that many fingers, they might say that number word.

We can give hundreds and hundreds of experiences, every week, to them, without taking much time out of your day, just being intentional with this kind of thing. We can build from just recognizing small numbers to recognizing larger numbers by intuitively breaking those numbers down. In other words, you show a child six, most of the research says we can't take in six. Adults think, "Yes, I can. I can roll a die and see six." Actually, if they do a brain-wave study on you, it's three and three you see, and you put it together to make six. So, challenge your 4- and 5-year-olds, especially, to do this kind of conceptual subitizing, where they see the parts and put it together into a whole. What a fantastic way for kids to start the road towards addition and subtraction, through intuitively recognizing how two parts of a set go together to make a whole.

Claire: Thanks so much, Doug. I think you've given us some concrete, actionable ideas for what this looks like in the classroom. And especially what I'm hearing is that you don't have to create a specific activity, but as they're engaging in everyday play, that there are endless opportunities to help them understand concepts related to number, just based on the objects they're playing with. And even with young children, also calling attention to how many steps they're taking, how many kids are in the line, how many napkins there are on the table can be done even with very young children who are even preverbal but still absorbing these concepts.

Doug: Yes, their attention to these things builds on those infant capabilities to be sensitive to number, even if the oral language is still very nascent, still in its formative stage.

Claire: Okay, great. Thanks so much, Doug. We really appreciate your time. We hope you've enjoyed this podcast featuring Doug Clements on how the Head Start Early Learning Outcomes Framework applies to emergent mathematical thinking in young children. Hope you have a great day.

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