Office of Head Start - Numbers and Operations Math Webcast

(links for viewing and download at end of transcript)

Willa Choper-Siegel: Welcome to the second webcast in our six-part series on mathematics and the young child. My name is Willa Choper-Siegel, and I am an Education Specialist with the Office of Head Start. We're delighted that you have chosen to join us as we explore this most important topic -- number and operation. Before we get started, I want to take a moment to reflect on the last webcast and to thank you for all your emails, phone calls, and messages. Your comments and questions are extremely helpful as we continue our series.

We want to assure you that they have been carefully considered in the planning of this second webcast. Over the past several weeks, we've heard from people all over the country, from Head Start programs, Federal staff, universities, and other academic institutions, and the Early Head Start childhood community at large. One of the most exciting things we are hearing is the energy and excitement around math.

One participant said in an e-mail, "What a great way to start off the webcast series. The pictures, stories, and video clips really helped the concepts to come alive. And the warm and enthusiastic way in which presenters participated contributed greatly to reducing fear around the subject of math." This is exactly what we hope to accomplish throughout our series. We're so happy to be here today, just three weeks after our first webcast.

And we are pleased to be helping our early childhood community continue to grow as math learners and leaders. So please keep the feedback coming. Before we begin, I want to clarify our use of the word "teacher".

As you know, this webcast series is intended for personnel who support Head Start teaching teams including education and other managers, supervisors, directors, curriculum specialists, mentor-coaches, and T and TA staff. When we use the term teacher, we mean all adults who work with children. This includes center-based staff and home visitors as well as parents. I also want to clarify our focus.

In this 6-part series, we're looking at mathematics in-breadth and in-depth. In other words, we're pulling math out and putting it under the magnifying glass. We know that math is taught from a broader perspective. In fact, that is one of the most important lessons we hope you take away from this webcast series, that math is everywhere, and math learning can be connected to almost everything. Remember that word we learned in the first webcast? That's right -- mathematize.

Although we're focusing a magnifying glass on math, we're also trying to show you how to mathematize all types of learning experiences and find the math in other domain areas such as language and literacy, science, and approaches to learning. Then in our sixth and final webcast, we'll pull back from our magnifying glass and take a look at the bigger picture, reflecting on the key concepts we cover. With that, I think we're ready to begin. To help us do that, we're pleased to welcome Dr. Juanita Copley back to the studio.

Many of you already met Dr. Copley in our first webcast, and as one participant said, "We fell in love with her." For those of you don't know her yet, Dr. Copley is a nationally known expert in the field of early childhood math and education, and a professor at the University of Houston. Before I turn things over to Juanita, I want to remind you that there will be a two minute break in today's webcast. Then, the final part will feature a live question and answer session.

We encourage you to take advantage of the opportunity to ask questions about today's content. There are three ways to do this. Throughout the webcast, you may type a question or comment into the "ask a question form" that you see on the right side of your browser. And don't worry, submitting a question will not take you to another website or away from today's webcast. The second way to submit your question is by calling the toll-free number posted on your browser.

The phone lines will open in approximately one hour, at 3:00 p.m. Eastern time. Or, you may also fax questions to the number posted on your browser. And now, all those numbers bring us to the topic of today's webcast: Number and Operation. Juanita.

Dr. Juanita Copley: Thanks, Willa. I am so thankful to get to be here with all of you today. And thanks again to all of you for the positive feedback and wonderful suggestions you have sent us over the past few weeks. Before I begin, I want to emphasize an additional point. As you heard during the first webcast, preschool teachers often feel uncomfortable with mathematics content and their teaching of that content.

That could be true or partially true for you as well. This fear or avoidance of mathematics could be for many reasons. Perhaps you had prior experiences with math that were negative such as inadequate math education or important information that was skipped over when you were in school or little confidence in your ability to do math.

Whatever the reason, I know you would agree with me that learning is something we all strive to do, and as teachers of teachers, or teachers of children, we know that the best teacher is a learner as well. In the early 1900s, an influential librarian, John Cotton Dana, said, "Who dares to teach must never cease to learn."

I know that is a true belief of everyone who works with young children. So please know that you will be learning some math yourself during this webcast as well as learning math that is appropriate for your teachers and their children. When we develop our own mathematical knowledge and when we learn how children develop theirs, we will be better able to teach math. So let's get started. The topic of number and operations is the most important, recognizable math topic for young children.

Let's see how it relates to a very familiar situation, one that you have all probably experienced in some way or another, a field trip. Imagine that you are taking a group of young children to a farm that has a large supply of pumpkins like the one pictured here. Remember this picture, you will see it again. And on our field trip, each child will be selecting one pumpkin for their very own to measure, decorate, explore, and enjoy. Think of all the ways you will use numbers before you can even go on the trip.

Before you go, you must make sure you have enough of everything, enough vehicles to transport the children, enough adults for supervision, enough healthy snacks, enough name badges, enough pumpkins for children to make a choice, enough money for the entrance fee, and a container big enough to hold all the pumpkins so they can delivered back to the center.

In addition, you must be able to identify all the numbers, the address of the farm, phone numbers to call in emergencies, phone numbers for parents and identifying numbers for the bus or the van that transports the children. Just think, you use all those numbers and the necessary operations of addition, subtraction, multiplication, and division just to get ready to go on the trip.

And the list gets even longer when you arrive at your destination and then return home. The point is numbers and their operations are everywhere. You use them all the time. They are a necessary part of our lives and our children's lives. One more point about the importance of this topic. Do you remember the graph we showed you during the last webcast? Let's look at it again.

Please note the light yellow area close to the word 'number'. Do you see how large it is? In fact, according to this graph, number and geometry should be given the most emphasis in pre-kindergarten. Today's webcast emphasizes one of those areas, number and operations. And our next webcast will focus on geometry and spatial relationships. Today's webcast will be divided into three parts. These are the same parts as the first webcast and the same format as all future webcasts.

Part one will answer the 'what' question. That is, what do children need to know to understand number and operations? Part two will answer the 'how' question. That is, how do children learn number and operations, and how can adults help? And finally, in part three, we will look at what else -- this will be your opportunity to respond to my questions or

to ask your own. So let's begin part 1 by discussing what is meant by number and operations. As you might expect, there are two parts to the idea.

First, number concepts. And second, what you do with those numbers. The operations. Typically, most people think the number idea involves counting and operations is the word to define adding, subtracting, multiplying, and dividing. As you will see, those definitions are quite limiting. There is so much more to number and operations.

So what do children need to know to understand number? For the young child, we typically talk about four ideas -- counting, understanding quantity, comparing, and numeral recognition. Let's begin with counting. Children ages two to five can memorize the sequence of number words from one to ten using a variety of musical approaches. You can often hear young children repeat a small counting sequence as they put blocks into a box or as they walk up steps.

However, they may or may not know that the list they are saying represents individual numbers or serves as labels for specific quantities. Listen now as we hear three four-year-olds counting with and without objects.

Please be aware that this video clip is a bit longer than those we will typically watch. It is important that you see these three typical four-year-olds display their counting skills in the early months of their preschool experience. As you will see, Cody, Malachi, and Iliana possess different counting skills as well as delightful dispositions. [Video begins]

Dr. Copley: Can you count for me?Boy: One, three... Dr. Copley: Go aheadBoy: Three, four, six, seven, eight, nine, ten.

Dr. Copley: Wow. You can count far can't you? What would come after ten do you think?Boy: Yellow. Dr. Copley: Eleven, yeah, it kind of sounds like yellow doesn't it? What would come after eleven?

I'm going to put this one here and this one here and this one here. Can you tell me how many that is?Malachi: One, two, three. Dr. Copley: So how many is that?Malachi: One, two, three.

Dr. Copley: How many would it be all together? Three. Right. It's three. One, two, three. Well, let me put one more on there and see if you can tell me how many it is now. How many is it now? Yeah, how many is that? Can you count them for me?

Malachi: One, two, three, four. Dr. Copley: Right. So how many is it? Four, that's exactly right -- four, you are exactly right. You know what...oops! Here, let's scooch back up that table..that chair got away from you. I will hold it. See if you can get up. There you go

Malachi: Why.. these chairs spin. Dr. Copley: They do spin, don't they? So how many do you have here, Malachi? Four. Right. Let me add one more. Now how many do you have?

Malachi: Umm... three. Dr. Copley: That many. Would you count them and let me see?Malachi: One, two, three, four, five. Dr. Copley: Five. So how many do you have altogether? Five.

Could you count as high as you can go for me?Girl: One, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen, fourteen, fifteen, sixteen, seventeen, eighteen, nineteen, twenty. Dr. Copley: Wow. You went all the way to twenty. What do you think would come after twenty?

Girl: Twenty-one. Dr. Copley: Ah. What would come after Twenty-one?Girl: Twenty-two. Dr. Copley: What would be after twenty-two?Girl: Twenty-three.

Dr. Copley: What would be after that?Girl: Twenty-four. Dr. Copley: Do you even know what would come after twenty-four? Girl: Twenty-five. Dr. Copley: What would come after twenty-five?

Girl: Twenty-six. Dr. Copley: What's after that?Girl: Twenty-seven. Dr. Copley: Twenty-seven --Girl: Twenty-eight.

Dr. Copley: What's after twenty-eight?Girl: Twenty-nine. Dr. Copley: What's after twenty-nine?Girl: Twenty-ten.

Dr. Copley: Twenty-ten. That is so good. You are so good. What do you think would come after 100? You don't know. No. It would be 101. Isn't that funny? Well, you are such a good counter. Here's what I would like for you to do for me. I am going to put this green piece of paper down, and I am going to put some cubes on it. OK? And I want you just to watch. I am putting the cubes on it and I want you to tell me how many there are. How many cubes are there?

Girl: Five.Dr. Copley: Five. Well, now wait a minute, you didn't even count. How did you know there were five?Girl: Because I'm smart.

Dr. Copley: Because you're smart? Oh, my goodness. Well, you just looked at them and tell? I can tell that I've got to have a bigger number don't I. Close your eyes again. Let me try a couple others. Close your eyes tight. I'm going to see if I can put on some really hard ones here. Let's see. Keep those eyes closed. Ok. Are you ready? How many are there on that card? You can count if you want to. Why don't you count?

Girl: One, two, three, four, five, six, seven, eight, nine.Dr. Copley: How many?Girl: Nine. Dr. Copley: Nine. Would you check to be sure there's nine? Would you check it one more time? Do it one more time.

Girl: One, two, three, four, five, six, seven, eight, nine, ten. Dr. Copley: Ten. The first time you said nine. The second time you said ten. Do you want to do it again? I want to know how many there are. Try it one more time.

Girl: One, two, three, four, five, six, seven, eight, nine. Dr. Copley: Nine. I bet there's nine. What if I put just one more? How many? Let's do it this way so we can see...

Girl: Ten. Dr. Copley: Wait a minute, wait a minute. What did you just say?Girl: Ten if you put one more.

Dr. Copley: If I put one more, there would be ten. But you didn't even count. How did you know that?Girl: Because I'm very smart. Dr. Copley: Because you are very smart. See, that was a nine. Why don't you make a tower out of that one for me? Make a tower out of that, so we do not have to count those all over again. Just make a big tower.

Okay, hold it like this. Oh, yeah. Now how many is in that tower? You want to check it again to be sure? How many are in that tower? I'll hold it for you. Go ahead.Girl: One, two, three, four, five, six, seven, eight, nine. Dr. Copley: And I am going to put one more on. So how many would that be?Girl: Ten.

Dr. Copley: Ten. You didn't have to count. You're sure it's ten? Are you sure it's ten? Do you want to count it again to be sure? Count it again.Girl: One, two, three, four, five, six, seven, eight, nine, ten.

Dr. Copley: You are right. What if.. Okay, you said that's ten. How many is that?Girl: Eleven. Dr. Copley: Eleven, I am going to really try to fool you. There's how many there?

Girl: Eleven. One, two, three, four, five, six, seven, eight, nine, ten, eleven.Dr. Copley: All right, here you go. There's eleven there. All right. What's two more?Girl: Twelve. Dr. Copley: Twelve. You want to try and see? Count and see.

Girl: One, two, three, four, five, six, seven, eight, nine, ten, eleven, twelve, thirteen. Dr. Copley: Thirteen. I almost fooled you on that one, didn't I? Thirteen. One last one. What's one more than thirteen? Girl: Fourteen. Dr. Copley: You are right. And this time, I am going to count. [Video ends]

Did you notice the differences in counting skill? To count successfully, a young child must be able to do four things -- one, know the verbal sequence of numbers. Two, demonstrate one-to-one correspondence. Three, keep track of what has been counted. And four, say the last number to answer how many in the set or group, a task often called cardinality. Let's look at the first criterion for successfully counting: knowing the verbal sequence.

Please remember that there is no verbal pattern in the sequence of numbers one to twelve. Children just need to memorize those numbers. The verbal pattern doesn't begin until you reach the decade numbers. For example, after 20 -

- 21, 22, 23, 24, and after 30 -- 31, 32, 33, 34, and of course after 40 -- 41, 42, 43, 44, and so on. Please also note that the numbers eleven, twelve, thirteen, and fifteen are unusual, and in fact, do not follow a pattern.

That is, if the child follows the pattern of the others ten numbers, then eleven should be one-teen and twelve should be two-teen and thirteen should be three-teen, and of course, fifteen should be five-teen. In addition, the decade numbers such as ten, twenty, thirty, forty, fifty also have some problems. One-ty, two-ty, three-ty and five-ty would better match the verbal pattern. Now naturally, we're not going to change our language system.

However, it is important for us to know that many numbers in the counting system do not follow a pattern and that these verbal sequences must be memorized. Let's think back to Cody, Malachi, and Iliana's use of the verbal sequence in their counting. Each child recognized that there was a sequence. Cody skipped some numbers as he counted. Remember, one, three, four, eight, nine, ten. Did you hear his use of eleven? That is a difficult number to remember.

And yet, you could tell he had heard it before and was trying to connect it to something he remembered. Malachi was able to repeat the sequence when he had objects to count. However, in part of the clip you didn't see, he was unable to verbally count to ten when no objects were present.

And Iliana obviously had had many previous experiences counting. She was able to identify the verbal patterns after twenty and even carried it through to twenty-ten -- an excellent meaning for 30. A second criterion for counting -- using one-to-one correspondence -- simply means that children say one number word for each object to be counted, no more and no less.

As you saw, Cody partially demonstrated one-to-one correspondence even if the verbal sequence was not correct. And, Malachi was very clear in his use of one-to-one correspondence and even held up his fingers to show that they matched the objects he counted. We know from research that young children can best demonstrate this skill when the objects are in a straight line. Keeping track of what has been counted and what has not been counted is also an essential criterion for accurate counting.

This picture was Jose's representation of a plastic insect that he had uncovered in the sand center. The blue plastic insect had only six legs, but when Jose represented his discovery, he kept drawing legs. When I asked him to count them again, he did, and he counted the legs over and over again as one, two, three, four, five, six -- one, two, three, four, five, six -- one, two -- yes, each leg was counted, they were just counted many times.

In the counting video clip, Iliana demonstrated her skill of keeping track. If you remember, when she first counted the nine cubes, she counted one cube twice and left out one cube thus getting the correct answer. When I asked her to count again, she counted one cube twice and said there were ten.

The different answers bothered her, and then she tried again. Did you notice how she picked up each cube, moved it slightly, and said the number? This time she kept track and counted accurately. The fourth and last skill in counting is the ability to answer the "how many" question with the last word in the counting sequence.

That last number is called the 'cardinal number', and the ability to say that number is called 'cardinality'. Did you notice that Malachi had a unique way of responding to my 'how many' question? Several times when I asked how many objects were on the card, he looked at me in a puzzled manner and then began to count again. Finally, he simply showed me his fingers to answer the question. I am sure that you noticed that I answered the question by simply saying the number of fingers he displayed.

Now let's talk about a second aspect of understanding number. As I mentioned previously, counting is critical. But with that said, understanding what quantity each number represents is critical as well. In this picture, children are representing the quantity 'ten' by holding up their "red" fingers. They may not be about to label it as 'ten' and may not recognize any other sets of ten objects as 'ten'. Yet, it is a beginning understanding of quantity.

Patterned sets of numbers like those found on dominoes and dice can help children recognize small sets of numbers. The ability to automatically recognize number patterns is called 'subitizing'. The place of subitizing in the development

of members is open for debate. Some theorists suggest that young children can subitize before they can count. Others believe that counting comes before subitizing. Whatever the case, subitizing is a fundamental skill in the development of a child's understanding of number.

If children can see that the quantity 'four' could be represented as a square as shown on a die or in a line and the quantities are the same, well they may be able to understand that how a quantity is arranged does not change the quantity. That is, they may be able to understand that four counters in a line or four pips on a domino represent the same quantity. Remember the hoop game from the last webcast? Those children were beginning to understand the quantity 'five'.

This ability to see a group of five in parts such as one group of 3 inside and one group of two outside enables children to take apart numbers mentally, work on them, and put them together again. Let me tell you a story about Juan. We had been playing the hoop game with the number five, and as we were playing, I would record their answers on a chart, and everyone that gave me an answer, I would record, make a record of that point. And as I did it, many times got three inside, two outside.

I'd ask the next child, and that child would say, "I got three inside, two outside" and I would record that. I would go to the next child and they would say, "I got three inside and two outside." Well, by the time I got to Juan, I had had that same answer about five times. And, he looked at me in a very frustrated way and said, "Ms. Copley, if you get three and five, you always get two outside."

I thought, "Yea, that was wonderful" because what he had just demonstrated was the idea that it's going to stay the same number no matter what I did with it. And I thought that was a great way to talk about it. Well, one of the easiest ways to begin to understand quantity is to use your fingers. Remember Malachi's use of fingers to answer the question, "How many?" In this picture, children are representing the quantity six with one finger on one hand and five on the other.

Let me show you what we do with our fingers to help us understand the quantity six. I had children hold up, just like these children did, five on one hand and one on the other. And, then we will make sure it's six and we will count them on our chin...one, two, three, four, five, six and then I will say, "Ready, one, two, three, switch." I would say, "I wonder if we still have six?" Now I understand to you that may seem, of course, we have six. But to children, it is very important again to count...one, two, three, four, five, six.

And then I will say, ready, one, two, three, switch. And we may do it this way and we may do it this way, we may even do it this way, but the quantity stays the same even if we switch them around. As you can see, these are models that just help children see that no matter what the order, the quantity stays the same -- an important concept. So what representations do children need to visualize and create so that they understand quantity and we know that they do? Well, let's try a little test.

Everybody take your hand, wherever you are, put your fingers together -- three fingers up in the air. And what I'd like for you to do for me, wherever you are, is put this on your chin. I assume that some of you put it on your chin because you heard me say chin. I assume that others of you put it on your cheek because you saw me put it on my cheek. That simple illustration makes you notice that some of you listened and did the task, and similarly, some children will learn about quantity by orally counting and describing orally, a set of objects.

Did you also notice that some of you watched what I did and followed those directions? Likewise, some children need many visual pictures of quantities to understand them. The important thing is to know that many examples with many different materials will help children understand quantity. To learn about some of the possibilities for young children, let's see how prekindergarten teachers represented the quantity 64 at a recent workshop I did.

Although the number 64 is certainly too high for three- and four-year-olds to represent, I think it will give us some good ideas for children's representation. This representation was made with small popsicle sticks. Please note in some cases they stacked the sticks in sets of ten, making them easy to count, and then others, they made picture of sets of five consisting of four in a square with one stick in a diagonal, similar in some ways to the tally mark we often use.

Also, see that the grouping made it easier to count or identify that the quantity 64 was represented. Well let's look at another one. The representation of these squashed marbles or "jewels" as my children call them, all have different arrangements even though each jewel just represents the quantity one. The color combination at the bottom...four green, four blue, four green, four blue and so on with 16 sets, helps you to see that four times sixteen is 64. And grouped as they are, you wouldn't need to count each object.

The sets of ten shown at the top of the picture illustrates six sets of ten with the remaining four also allow you to quickly see the quantity of 64. This jewel representation is not as easy to count because they don't seem to be grouped. However, if you look carefully, the spiral is made with eight of one color, eight of another color, eight of another color and so on, resulting in eight different colors of eight jewels each. Or, eight times eight is 64. In these representations, teachers use colored square tiles to make the quantity of 64.

You can see a variety of arrays, one that contains two across and 32 long. Another one is four across and sixteen long. Please note the square near the bottom of the table. It has eight across and eight down. In other words, 64 is a square number, because 64 tiles can make a square. Do you remember somewhere in sixth or seventh grade when you learned that the square root of 64 was eight?

Can you see that representation here using the tiles? 64 is a square number and the square root is the number of tiles that are on each side. Can you see how representations can lead to understanding of vocabulary? Let me tell you a story about Emily. Now, Emily was a kindergartener but one of our number stations that we did in kindergarten was to take whatever number we were working on, they were to take that number of colored tiles and see if they could make rectangles with it.

And of course, look for the very special rectangle which would be a square. We had a list in that kindergarten classroom that said these are all the square numbers we have discovered. Children understood square numbers to mean you could make a square out of that number of tiles. We had the number four written down. We had the number nine written down. And when I walked by the classroom, Emily came running out saying, "Mrs. Copely, Mrs. Copely, we have discovered a new square number."

When I asked what it was, she said, "I don't know. It's too big to count." So, we had to go into the classroom and first of all they had to prove to me it was a square, which they did by showing me that each side was exactly the same length. When I looked at it, indeed it was a big number. It was 144 -- it was a twelve-by-twelve square. After we counted it, we wrote that up on our chart as well. This last photo shows one last representation for today, the box or volume model.

Do you see the eight cubes in the front of this picture? Eight cubes made of eight cubes each resulting in eight times eight or 64. Each one of the children in my class, whatever number were working on, they make boxes out of cubes. And in fact, one of the things they find out very, very quickly is that some numbers you can only make a very long box. For instance, the number seven. You can -- for instance, the number seven, you can only make it in one long box, one cube after another.

That is because seven has a very special property -- it is a prime number. Now I don't tell them that it's a prime number necessarily at all, but they find out very quickly that some numbers can only make boxes for snakes. In fact, in 64, you're going to see one large cube that can be made from 64 smaller cubes. It would be four cubes in height, four cubes in length and four cubes in depth. 64 is a cubed number. And the cube root of 64 is four.

Again, that is something that many of us learned in 7th or 8th grade, but the visualization or representation makes it easier to see and understand, something we all need to keep in mind for children's math as well. So, obviously young children are not going to develop the quantity 64. But what representations can they make as they investigate a quantity appropriate for their level, four? I want you to watch the following video clip as children make four in two different ways.

[Video begins] Dr. Copley and children: One, two, three, four.Dr. Copley: Would you show me four fingers? Could

you show me four fingers? How old are you?Child 1: Four.Dr. Copley: It is easy to show that.

Child 2: Four.Dr. Copley: How old are you?Child 3: Four.Dr. Copley: How old are you?Child 4: Four.

Dr. Copley: Oh, my goodness. Today you are going to look at my dice right here. Look at this. How many -- what number is that?Child 4: Four!Dr. Copley: How many fish are there?Children: Four.

Child 1: Three.Dr. Copley: Oh, you know what, you said something good. You said three, and one more is?Child 1: Four.Dr. Copley: You are good. How many is that?Children: Four. Five.

Dr. Copley: You didn't even count, did you? One, two, three, four. How many is that?Children: Four.

Dr. Copley: Four, one, two, three, four. How many is that?Children:Four.Dr. Copley: One, two, three, four...

Put four on each one, and I'm going to count. Let's see. How many do you have? Count for me?Boy: One, two, three -- Dr. Copley: You need another one, don't you? Yeah.Boy: There.

I like the way you girls are putting those out. Can you help me count? Let's take one of yours. Can we count?Boy: Yes.Dr. Copley: There are four on this one. Can you put four on that one? Help me count.Boy: One, two, three, four, five, six..

Dr. Copley: Oops. Too many? Can you take off some? Because we want four on each one. Four is our number for today. Four is the number for today. Girl: I put four on it. Dr. Copley: You are doing a nice job...

Dr. Copley: How many do you have there? One, two, three, four. Does everybody have. . .look how four looks different with everybody's. Very nice. Don't knock it over and don't blow on it. You've got the tall one. Look at these, guys. How is this one and this one the same? Boy: Mine is the tallest.Dr. Copley: How is this one, this one and this one the same? They all have the same colors, don't they? [Video ends]

Those were just two ways that children made sets of four. They also made sand recipes by pouring four cups of sand into a large container. They created pictures in the art center using four shapes and four colors and they set the table for four in the housekeeping center. In this photo children were especially proud of their number four sculpture made with four chenille strips, four tongue depressors and four feathers. Look at their smiles.

Here, four-year-old Mia declared that she could make a five sculpture if she just had one more of everything. In this one, three-year-old Nathan said, "I made it myself and it's four." This photo shows just another way to make four. Each child collected four leaves during a nature walk and made leaf people. The list of possibilities to represent the quantity "four" could go on and on. In fact, we began to make a list of all the things that come in four.

Wheels on a car, legs on a dog, legs on a chair, legs on a table, and so on. After all of these experiences, children began to see the quantity four, an important understanding for number. Comparing is another aspect of number that is important to the young child. Very young children learn very quickly the meaning of the comparison word "more" as they identify their favorite food. While they are not comparing the number of objects in one set to another, they do know they want more than they had before.

Initially, children compare two sets by just looking. They select the pile that has more because it looks bigger. Later, children determine which of two groups of items has more by lining them up side-by-side and seeing which row is longer. Please note that they typically don't compare two objects by counting, such as they don't understand that eight necessarily is more than six.

Rather, comparison is first done by matching the objects of one set to another. In these two pictures, you can see two sets of tomatoes made by four-year-olds before they made pizza for a class project. From their distinctive smiles and frowns, you can see that 10 children like tomatoes and six children do not. These pictures form the beginning of a bar graph that further illustrated this comparison.

Number comparisons can happen in many settings. The children in this next video clip were in the class science center using magnifiers to observe pennies. As you look at this picture, you can see that one side shows shiny and the other shows not shiny.

I joined this group and asked them to use a sorting mat shown in this photo and separate their five pennies into two groups, those that were shiny, and those that were not shiny. Then the children made crayon rubbings of their pennies so that we could remember how many they had in each section. Watch as we compare the groups of pennies and determine if there are more shiny pennies or more that are not shiny.

[Video begins] Dr. Copley: How many do you have, Mark, that are shiny?Mark: Six.Dr. Copley: And how many not shiny?Mark: Four.Dr. Copley: That is kinda like somebody else isn't it? Don't you guys have the same thing kinda?

Mark: Yes.Dr. Copley: How many do you have that are shiny, Nathan?Nathan: Two.Dr. Copley: Two? And how many not shiny?Nathan: One.. This is shiny.

Dr. Copley: Do you think that is shiny? I think it could be, yeah. I'll let you put that over there. Very nice. Nathan: Two.Dr. Copley: Two not shiny. Very good.

You had four shiny and just one not shiny?> >Child: One, two, three, four, five.Mark: Five.Dr. Copley: Yes, it looks like you had five shiny.

Child: One, two, three, four, five.Dr. Copley: So did you have more shiny, Mark, or more not shiny?Mark: More shiny.> >Child: One, two, three, four, five.Dr. Copley: More shiny, right.

Child: May I count them? One, two, three, four, five. One, two, three.Dr. Copley: You're right! You are right. How did you know that? Did you just count them?Child: Yeah.

Dr. Copley: Very good. Let's look at Desiree. Desiree's paper has how many that are shiny? One, two, three. And how many not shiny, Desiree?Desiree: Two.Dr. Copley: Nathan, help Desiree. Does she have more shiny or more not shiny?Nathan: More not shiny.

Child: More shiny.Dr. Copley: Why do you think more?Child: Because one, two, three, one, two.Dr. Copley: What do you think Desiree? Do you have more shiny or more not shinyDesiree: More shiny.

Dr. Copley: Why do you think more shiny? Desiree: More shiny, because I have three.Dr. Copley: And then over here you have just two? Right?Desiree: Yes.Dr. Copley: Okay. Good.Child: If you put them all together, you get one, two, three, four, five.

Dr. Copley: Now what is that again? Tell me that again. If you put them all together you get how many?Mark: Five.Child: One, two, three, four, five.

Dr. Copley: Wow. That's really good thinking. Okay, Mariah. Let's look at Mariah. Mariah has how many shiny? Nathan: One.Child: She has one shiny.Dr. Copley: And how many not shiny does she have? One, two, three, four, is that right, Mariah? Mariah, is that right? You have one shiny and four not shiny.

Child: Yes, but if you put them all together, it makes, one, two, three, four, five.Dr. Copley: It does -- if you put them all together it makes five. This is Mariah's question now. Mariah, do you have more shiny or more not shiny?Mariah: More not shiny.Dr. Copley: More not shiny, don't you. When you grabbed them, you were like me, you got a lot of dirty ones, didn't you? Yeah.

Dr. Copley: All right. And the last one here is Nathan. Let's see, Nathan, how many shiny did you have?Nathan: Two shinys.Dr. Copley: And how many not shinys?Nathan: I think he has just three. Mark: One, two, three, four, five, six.

Dr. Copley: I think you are right, it does make six and you got an extra one.Nathan, which did you have more, more shiny any or more not shiny?Nathan: More not shiny.Dr. Copley: More shiny, didn't you? You had a lot more not shiny. [Video ends]

I hope you noticed that we were doing more than comparing in this activity. We were also decomposing the number five into its parts. Did you hear Isaac as he reminded us how many pennies there were all together? He really understood the operation of putting things together. Finally, number involves writing the symbols for number. These symbols are called numerals. Just as children should see letters of the alphabet displayed, they also should see numerals in their world.

Quantities can and should be labeled with numerals so the children can begin to identify the symbols for five objects or fifteen students or eight gerbils. This is a picture from William's journal. As you can see, he included the picture of five pumpkins and a repeating pattern of the numbers six, seven, six, seven, six, seven. When William made this journal entry early in prekindergarten, he did not understand the quantities of six and seven, and in fact could only count accurately to five.

However, he was experimenting with the number symbols, and his representations resulted in patterns -- a wonderful beginning. So let's review. What do children need to know to understand numbers? They need to have procedural fluency and be able to count accurately. They need to have a conceptual understanding of quantity. They need to know how to compare quantities, and they need to begin to understand numeral labels for quantity.

Number is certainly much more than counting. Now let's look at the second part of this topic, operations. What do children need to know to understand operations? Most people think about operations as addition, subtractions, multiplication and division. For young children it is more applicable if you think of operations as being categorized according to children's actions -- adding to, taking away and sharing. Problem-solving.

Most of us remember the math word problems from our earlier education. And in many cases it was not an enjoyable experience. Young children use operations to solve story problems. These problems should relate to the child's world and encourage a variety of methods or strategies. To help us understand how children learn to use operations to solve problems, let's look at a problem for adults -- one that I used during a professional development experience for prekindergarten teachers.

A few years ago I found the following story in a Pennsylvania newspaper. Brother is added to 27. An eight-pound boy, her 28th child was born today to Mrs. Philip E. Webster. Mrs. Webster is 44 years old and was married when she was sixteen. Of her children there were three pairs of twins and two sets of triplets. Each of the 28 are still alive. Wow, what a story. Can you see why I thought prekindergarten teachers might find this an interesting problem and one they could relate to?

Notice there is no problem or question stated, so I had to make up a problem that teachers would be interested in solving -- one that might have many different solutions or strategies that would work. The problem I decided on was how many months of Mrs. Webster's life was she not pregnant? An interesting question. The teachers agreed. In fact, they solved it by talking to each other and asking questions to clarify the problem.

As you can see, they posted their solutions on poster paper, and although most solutions were the same, all the strategies were different and revealed different operations that would produce a reasonable solution. Let's look at two of them. This one was particularly interesting because they drew a picture to determine the number of pregnancies. Can you see the twins in some of the circles, triplets in others, and all the single ones? This next one is similar.

This particular one was similar to the method that I used as I solved the problem. Pictures often help many of us visualize the problem and solution. This group used a particular organizer to show the multiple births. They used an arrow to show that there were three sets of twins... two, two, two and two sets of triplets... three, three. So, why would I use this, or why did this tell us about children's use of operations in story problems?

Did you see what I did with the problem about Mrs. Webster? First, I selected a news story that is interesting. Second,

I shared the different strategies for solving this problem with other teachers using the information on their posters. Third, I asked them to explain the results on paper. So, what does that have to do with young children? First, it is important to use a story problem that is based on children's experiences.

These stories could recount a class experience or something that you read to the children. Second, encourage a variety of methods or strategies. And finally, ask children to explain their answers to their friends or the class. Let's look at some children who solved problems and review their work. This student used some fish manipulatives and a work mat to describe how many fish were swimming in the ocean.

The children knew that there were some fish swimming in the seaweed -- five -- and some fish were not swimming in the seaweed -- four. The question was, "How many fish were there all together?" This five-year-old used a picture of her friends to answer the question, "How many shoes do you and your friends wear?" When she responded, "six shoes", I asked, "Can you count anything else?" She responded, "six eyes, six hands, six arms, six legs, lots of sixes." This page was put in a class book called One Friendship.

This is a picture that a six-year-old drew after going on a field trip to a farm. He was asked to draw a picture of two different kinds of animals and then to tell how many tails and how many eyes he saw. He counted and he found eight tails. He wrote that word tails as t-e-o-s. That was his inventive spelling. And then he found 16 eyes, and of course, he wrote that in his inventive spelling as i-a-s.

When I said I don't see 16 eyes, he looked at me with a bewildered look, put up two fingers and touched each animal and said, "See, they all have two eyes. You don't have to see them, you know, Mrs. Copely." Adults see sharing a quantity equally as a division problem. For example, if we had 72 dollars and we wanted to share that between two people equally, we would simply divide 72 by two and give each person 36 dollars. For a young child, sharing will probably be a dealing out strategy.

In fact, we know that even three-year-olds can divide a group of items into equal groups. Let me tell you about Chris as he shared his birthday cookies. His mom had brought a group of cookies and there was a group -- he had a play group of five children. And he got this big bag of cookies. She had planned about three cookies per child. But, when Chris had shared them, he dealt them out as one to his friend, one to him, one to his friend, one to him.

And of course, there were five friends and he had a whole stack of cookies because he always shared them with himself. When I asked him if that was really fair, because I looked out and saw only two cookies per friend and he had a stack, he said, "Of course it is, Mrs. Copely, it's my birthday." Not quite a mathematical answer, but very practical. One of the most powerful strategies for solving problems is that of composing and decomposing numbers.

That is, understanding the parts of a number, taking them apart and putting them back together again. Remember the penny activity you just saw in the video clip? In reality, children were decomposing the quantity of five pennies into those that were shiny and those that were not shiny; an important operation. Let me illustrate this type of problem-solving with another video clip of four-year-olds solving a problem that actually occurred in their class. Outdoor play time was over and everyone had been called in.

Alex had stayed outside and when the teacher counted everyone, she knew that someone was missing. Fortunately, they quickly identified that Alex was missing. And when Alex was discovered, he explained that he had been playing the hiding game.

Wisely the teacher connected it to math, and after explaining that the hiding game could not be played when it was time to come in, she used it in a story problem. Listen to a group of four-year-olds participate in a weekly theater experience. First, you will see them act out the problem. Second, you will see them talk out the problem with a partner. And third, you will see them draw the problem on their own work mats.

[Video begins] Dr. Copley: Here we go. Welcome to the play put on by our class. First of all, I would like to tell you who the actors and actresses are. There is Esmeralda. Esmeralda, bow. Very good. And you all clap. Good. There is Malachi. Malachi, bow. Very good. There is Isaiah. Bow, Isaiah. Very nice. Mia. Bow. Very, very, nice. One day out

in the playground four boys and girls went outside to play, and their teacher said, "Boys and girls --"

Child: Two boys.Dr. Copley: "Two boys and two girls, you go out and play." So go out and play, go out and play, go over and play. Run out there because you really want to be out and playing. They went out to play. Now, boys and girls, how many boys and girls went to play? Would you look at me and show me, audience? Look at what she said. Everybody do this. There were two boys, right, Child: Two girls.

Dr. Copley: And two girls. Very nice. Now remember that, audience. It was now time for them to come in from recess, and Mrs. Copely said, "Come in, come in from recess. Come in, boys and girls." Come in, come in, come in. Run in. Oh, it's time to come back to school. Come on in. Here they come. Hi, Isiah. Hi, Mia. Oh my goodness, somebody is hiding. You know, boys and girls, there are two that came in. How many people are missing? I want to hear from the audience? How many are missing?

Children: One, two.Dr. Copley: One, two are missing? Are you sure?Children: Yes.Dr. Copley: How many boys are missing?Children: There is one.

Dr. Copley: One. How many girls are missing?Children: One.Dr. Copley: One. Just one girl. All right. There are two people coming. You guys come back in. Let's go. Here they come. Let's see if we are right. Come on in. Go fast so I can see you. Here they come. There is one boy and one girl. Very nice. Give them a hand. Didn't they do a nice job? Very nice. Everybody bow.

Teacher: Go ahead.Child: One, two, three.Teacher: Count again.Child: One, two, three.

Dr. Copley: Tiffany, are your eyes closed?Teacher: ..count them again. -- count them go. One, two, three, four. You are so smart.Child: Four!Dr. Copley: Check and see, check and see.

Dr. Copley: Do you know what I saw? I saw some of you hiding all four people. Nobody even came in. I thought that was pretty cool. I saw some of you hiding three people. And there was only one showing. I saw some of you hiding two people. And there were two showing. And I saw some of you hiding only one. And do you know what else I saw? I saw somebody hiding zero people, and they almost tricked their partner. Their partner said -- kinda of looked at it and kinda it was real funny. Then went oh, you can't trick me, zero.

Dr. Copley: Three you can see. And how many are hiding?Child: One.Dr. Copley: One. Let's look and see. One. Could you listen to his story now? How many do you see?Child: I see two.Dr. Copley: And how many are left? Two are hiding?

Child: Yes.Dr. Copley: Look at that. Two are hiding. [Video ends]

Let's look at some more pictures from that exercise. Children work with their peers and told a story using a green bush to hide some of the pretend children. Children then used a playground mat and colored circles to represent the children on the playground. After adding arms, hair and legs, children then taped the edge of the green bush to their paper to hide them. Each of the pages then became part of a book entitled How Many Are Hiding? It was a book that was very popular in our class library.

Now, let's review. What do we mean by operations? We have talked about joining or adding to operations, separating or taking away operations, sharing operations and decomposing and composing operations. I am sure that many of the examples I have shared are common experiences in your work.

Hopefully you have seen some additional possibilities that will help you work with teachers as they help children develop those skills, conceptual understanding and strategic competence with number and operations that is so critical to mathematics understanding. So we have answered the "what" part of our webcast. What do children need to know to understand number and operations? After we take a quick break, we will address the "how" question. How can we facilitate children's learning of number and operations? We'll be back shortly.

Welcome back. That was a short break, wasn't it? We are now ready to begin the second part of this webcast. We know the "what" -- now we need to know the "how". How do we facilitate children's understanding of number and operations? Or put more simply, how do we teach number and operations? As in the first webcast, this question will be answered in three different ways. First, what do we want children to learn or what are the specific outcomes of number and operations?

Second, where do children learn the concepts of number and operations? And third, how do teachers intentionally plan and implement the learning of number and operations? As you saw in the first webcast, the Head Start Outcomes are consistent with NCTM's Prekindergarten Focal Points. Because of the importance of this topic to young children's mathematical understanding, there are many outcomes that address the topic of this number and operations.

Let's look at them as they appear in both the Head Start Outcomes and the Prekindergarten Focal Points. Please note that you should already have this material. It is available on the ECLKC, so I am only going to emphasize a few of the Outcomes. Number concepts are understanding whole numbers are specifically outlined by both Head Start and NTCM. Please note that this includes the understanding of number concepts and not just the writing of numerals or the saying of the number sequence.

Counting strategies, one-to-one correspondence and matching objects of two sets to compare are also noted by both groups. The variety of counting experiences that involves specific one-to-one correspondence all contribute to this Outcome. There are many of these particular comments about number and outcomes, and in fact if we go even to the approaches to learning, like in the process of problem solving, we will know that that's a mathematical Outcome...

...and it also involves interaction and discussion with peers and adults. It includes reasoning and explaining why and how a problem has been solved. Naturally, the approaches to learning domain is not limited to mathematics. Young children need to solve all kinds of problems. For example, recall the "how many are hiding problem" with Albert. Many problems can and should involve mathematics. Children's real life problems can be mathmetized. Now where can children learn about number and operations?

The answer to that is quite simple: everywhere. Think back to the opening picture of the pumpkin patch. Do you remember all the numbers and operations you needed just to get ready for the field trip? The same is true for young children. Numbers are part of their lives. We just need to mathematize these experiences in a variety of ways. Let's look at some of them. Cooking a special recipe in a home or at a center-based program involves lots of counting and understanding.

Comments and questions like, "How many cups should we use?", "Let's stir five times before we add the milk", "We might need more flour." All of those are important. One of my favorite questions to ask any group of children is, "Do I have enough?" "Do I have enough magnifiers?" "Do I have enough snacks?" "Do I have enough crayons?" "Could there be enough chairs for everyone?" That question alone requires a one-to-one matching of a group of children to the group of items.

It is also a perfect opportunity to ask a more difficult question. "How many more do I need so that everyone will have one?" The color sorting chart, red and not red, presents nice comparison opportunities. Children grab a handful of objects, classify them into groups and then compare which side has the most. Well, we are now ready to answer the "how" question. How does the teacher intentionally plan for learning number and operations?

As in the first webcast, we will discuss how the teacher plans experiences and the importance of mathmetizing language. Let's begin with the book sharing experience -- a very common, important time in any center or home setting. Five Creatures is a book by Emily Jenkins, published by Francis Foster Books.

The author tells the story about five creatures that live in a house: three humans and two animals, three with red hair and two with gray hair. Let's listen as I read the story. Then watch as children draw pictures of their own creatures from their families, label them with a cube and then compare the size of their families with their friends'.

[Video begins] Dr. Copley: Let me read a few pages because I am going to have you do some pages for a book about

you in just a few minutes. This one says, "Five creatures live in our house." They are up here at the top. "Three humans," -- that's like you. We're humans, right?Child: Yes.

Dr. Copley: "...and two cats." Let's see, let's put our fingers up. Three humans and two cats. Let's see, that's five. Let's touch our chin. Here we go. One, two, three, four, five. That's five, isn't it? Okay. So they live in a house. Three humans, two cats. In my house --in my house we have me and my husband, and we don't have any dogs or cats. So there is just two in my house, two humans.Child: I have a dog and I have a cat.

Dr. Copley: Some of you might have some others. Look at this one. There are three short people -- or three short, and two tall. There must be a mom and dad, two tall, and three short. Let's see if that makes five? Could you do that for me? Two tall people and three short. One, two, three, four, -- that's five. That's five creatures. In my house there is just two tall. So there is just one, two. Okay. Oh, look at this. This is funny.

There are three with orange hair. The mom and the little girl, and look at the cat has orange hair too. And two with gray, the dad and the other cat. In my house there is one with gray, my husband, and there is one with me, kinda brown, but kinda gray too.

Do the one that can crawl under the fridge and do the four that can get up on high stools. Let's see if it works. One, two, three, four, five. It does.

I want you to take your cubes and put them together into a tower. All right. You've got a short tower. I'm going to make my tower taller. Are you ready for my tower? Look at our towers, guys. Everybody take your tower and put it on your page. Oh, my goodness, look how tall your tower is. Make your tower now, Jacob. Everybody keep holding your tower. Look how big. Mine is very short.

Child 1: Mine is red.Child 2: Mine is bigger.Child 3: His is bigger than everybody's.Dr. Copley: My goodness, she's got a lot of creatures in her house, that's for sure. [Video ends]

Let's take a closer look at some of the children's drawings. This one is Gracie's family picture. In this photo we are putting one cube on each creature in our family. And in this one, Reuben said, "My family is very tall." And here, "My tower is taller than your tower. I have lots of creatures in my house." At the end of the process, we made four stacks of the children's pages.

We had a stack for people who had a short tower and only two creatures in their house, a stack for people who had three creatures in their house, a stack for children who had four creatures and finally a stack for those people who had five our more. We were so proud when our books were published. Did you see the types of experiences the children had after they heard the story?

The specific book is important, but less important than the related experiences which followed the reading. Drawing pictures of your family or the creatures that live in your house is certainly not a new idea in any Head Start class, but this had a different perspective.

Rather than just explain the pictures, children used a one-to-one correspondence placing one cube on each creature, then the number quantity was connected to lengths as children stacked their cubes. When they returned to the group to share their pictures, they were so excited to compare their towers with their friends'.

Then the pictures were grouped by towers. Books were made so they could be reviewed over and over again -- a math experience with many math outcomes intentionally planned from a shared reading experience. Well, now we are ready for the third part of our session. What else? Remember, this is your opportunity to respond to my questions or to ask your own. Also joining us for today's Q and A session is William Choper-Siegel. Willa. Sorry, Willa. Willa?

Willa: Thank you, Juanita. Our phone lines are now open. Please do not use your speaker phone and once you ask your question on the air, please hang up, but wait until you get to ask your question. If you experience a long wait time, you may prefer to submit your question online or by fax. So let's take the first question now. We're going to do an e-mail

question by Rayanne in New York. Rayanne's question is, "When we see with only one child, is that teaching instruction or assessing what the child knows, assessing the child's progress?"

Dr. Copley: This is a question that's frequently asked and one that's very important. One of the purposes of assessment is to be able to tell you how to instruct, and in the tape you saw me asking assessment questions initially. But I hope you heard me also scaffolding some of their words. For instance, remember the little boy who said 11 but it wasn't quite 11. Also if you remember, I kept asking Ileana to continue to count.

Assessment and instruction in my mind go together. I assess, I can also instruct and they just really work well together.Willa: Thank you, Juanita. Our second question is an e-mail question this time from Tony in Missouri. Tony asks, "How can I help bring number and operations into books or stories that are not about math?"

Dr. Copley: Well, as you saw, the book that we used in Five Creatures actually had math in it. However, the author really didn't write it for math. In fact, if you look through the whole book, you would see that it really wasn't a number book. But I think more importantly is the problem that we did on how many people are hiding, because really, that could be just a story about a child that had been lost or another way.

But again, looking at adding numbers to a story is really quite easy. You can talk about how many there are in the story and even change part of the answer or the story itself as you talk about it. Lots of different ways to do it. And I think one thing that's very important for you all to know is that Sonoma State, who is one of our groups that is working with us here, will be working on putting a lot of those stories, making them mathmetized if you will. So, those will be on the web site.

Willa: Thank you. Another e-mail question this time from Shelly in Maryland. Thank you for the videos and stories. We have seen you with groups of children. Are there strategies that have children work in pairs?

Dr. Copley: In fact, probably most of the time I have children work in pairs. You see me teaching small groups -- that's my main intentional teaching time -- but most of the time when they are working at playing games or doing activities or communicating their story like you saw on the creature activity and the where you are hiding, they are working with pairs.

They are working with a partner, telling their story and sharing the information. So I really would say I use all kinds of combinations. We certainly do some math in circle time, but it is very appropriately done. Willa: Thank you. This one was faxed in from Suzy in Washington. Are there developmental sequences in number and operations?

Dr. Copley: Researchers have really done so much work in this area, and especially in number and operations, and there are many resources that give you a developmental continuum or trajectory as sometimes it's called -- for example, counting all the objects one-to-one or counting to find the quantity for very young prekindergarten children, it may be from one to four.

Near the end of prekindergarten one to 10, being able to count them correctly and accurately and really understanding that quantity, and as they get on into first grade, of course, we're looking at one to 100. These resources that talk about the developmental continuum are on -- will be on the web site because we'll have a list of the many resources that are possible.

Willa: Okay, thanks, Juanita. We have a question through the telephone lines from Randy in South Dakota. Randy? Randy: Hello. Is it a good first step or a waste of time to have children count in sequence without understanding any quantity?

Dr. Copley: Good question, Randy. I find that the sequence is actually a verbal memorization-type of task, and so certainly just like you would sing maybe the alphabet song or sing some of the number songs or practice that -- there is nothing wrong with having children sing that sequence or memorize it and go over that sequence. I do think together, though, you need to be talking about quantity.

So it's not -- you first of all learn how to count and then you do quantity. It's not that at all. It's, you do it together, so even the very young child who is one year old, you're maybe counting as you say, "First I'm going to tie your shoe and then I'm going to do this." Or, "Let's eat first one cookie, then two cookies and then three cookies, even though that is not healthy snack." So don't do that one.

But simply counting is something they have to memorize that verbal sequence. So, I count, and we talk about quantity at the same time.Willa: Okay? Thank you. This question came in from Elizabeth in New York and she wants to know, "How old are the children in these clips?"

Dr. Copley: The clips that you are seeing are in sites that I work in. Some of them are part of a Head Start site, some are part of just a prekindergarten site. They are all either three or four. I would say most of them are four in those particular ones. There are certainly some settings and some pictures you'll see children younger, but primarily they're where I work.

Willa: Thank you. Okay, we have a question from Newton in Louisiana. Newton wants to know how many math experiences should teachers plan for each day?

Dr. Copley: Teachers obviously should do a lot of intentional planning to teach mathematics, but I will guarantee that no matter how many situations you plan for, there are going to be so many other times that you can teach number and operations or mathematics. So you will plan intentionally to teach some, but please be on the lookout for all of the possibilities. I will tell you that even in making the video clips where I planned intentionally to do something, they change a great deal when I just listen to children.

Willa: Ok, thank you. This is from Jeanette in Texas. And Jeanette wants to know, "In the transition to school, in what grade can children do operations without manipulatives?"

Dr. Copley: Well, I am an old, if you will, middle school teacher. And in middle school I used manipulatives when I was talking about geometric concepts or algebra. Those were very important. Manipulatives, the objects, are important for children to be able to see things. Think back to the example of the cube numbers or the square numbers that I showed you.

Children, even when they understand square numbers or cubes, need to be able to see things that way, touch them and feel them, so I would never say there is a time where you just don't need them. With that said, there is a time when children need to have fluency with procedures and understanding basic facts as sometimes people say.

It is recommended that by the end of second grade they know how to add and subtract by being able just to repeat the basic facts. So, five plus three, for instance, they know automatically that that is eight. But again manipulatives, depending on the purpose, you would need to use them all the way through. And, of course, with young children, they are going to need them.

Willa:Ok. We have Connie on the line from the District of Columbia.Connie: Hello. I'm calling... the activities that you depicted were shown with four-year-olds. Can we incorporate these activities with three-year-olds?

Dr. Copley: Yes, and let me say that again there were some that were three-year-olds. But, yes, definitely. There are variations on the theme. So for instance, I'm trying to think of an example right now, but counting is something that can be done in a variety of ways. Certainly, knowing number quantity. The quantities one, two and three are so important at the age of three. You saw how many times I asked them how old they were. That number three is just a real important number for a three-year-old.

In our play settings ï¿½ for instance, I have a wonderful story about children playing, and we had a little center called the flower shop, and the children had plastic flowers and tissue paper, and they were delivering flower bouquets to people just as they would if they were in a flower shop. And one of the three-year-olds in there made all of his bouquets with three flowers.

It was just delightful to watch how he shared that. Again, three- and four-year-olds -- two-year-olds, many of the things that you do just in fun, in counting, in playing throughout the play, you know, you can definitely adapt those.Willa: Thank you. And our last question is from Luke in South Carolina, and Luke wants to know how can children learn through play about number and operations? I think you have given us some good ideas.

Dr. Copley: I've kind of already started on that. I will say that young children can, in their play, if you just watch, you can add so many things. So, for instance, when we had a restaurant and they were playing restaurant, I simply took a little pad because I was the waitress, and I joined their play, and I took their order by writing it down. I made sure that we had enough things for everybody in there. There are just so many opportunities, and I know from your experiences that you are going to be able to do a lot more.

Unfortunately, this is all the time we have for questions today. Please know that we will put questions with answers on the webcast so that you'll see those. Right now we've talked about many things during this webcast. As we conclude, I'd like you to think about the following question: What one thing could you do tomorrow to help teachers facilitate the learning of number and operations?

I look forward to being with you again in January as we address the critical area of geometry and spatial sense for young children. And with that, I'm going to turn things over to Willa. Willa?

Willa: Thank you so much, Nita. This concludes the second of our six webcasts emphasizing Mathematics in Head Start settings. Our series will start again in January 2008 when we take a closer look at geometry and spatial sense. That webcast will take place the third week of January. In the meantime, please feel free to send any successes or suggestions you have to the e-mail address you see now. Also, please visit the ECLKC for additional information on our series, including the Q and A's, recommended readings and more.

Now, before we sign off, we have one final number problem for you. By now, most of you have watched two webcasts, so we'd like you to estimate the number of people it takes to produce a webcast such as this. Use your best number sense. We'll see how close you are in January. Thanks for watching and for all you do to support young children and their families.
-- End of Video --

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