Mathematical & scientific thinking in three- and four-year-olds

The preschool years, ages three and four, are a time when young children become immersed in extensive explorations of topics that interest them. Preschoolers are rapidly developing the mental abilities to think in mathematical and scientific ways in order to explore and understand their favorite topics. Preschoolers are also seeing evidence of math and science concepts in everyday life, from laying out the right number of napkins for snack to predicting and testing the direction a ball will go when it’s kicked. Examine the abilities that preschoolers are developing that help them think in more complex ways.

Taking apart and putting together

What children are doing:
Threes and fours are playing with the concepts of parts and wholes. They are fascinated by the insides of things and how the different parts make the whole thing work. They understand how to put parts together to make a whole. Everything they create becomes more complex and elaborate.

What caregivers can provide:
• Discarded small appliances and real tools to take them apart.
• Books that illustrate the insides of animals, plants, buildings, machines, etc.
• Tools for exploration (magnifiers, tweezers) and paper and pencils to record what they see.

What caregivers can say and do:
• Have a place to keep unfinished work to help children extend their exploration over multiple days.
• Model and extend children’s curiosity. (“I wonder what it looks like inside. What do you think we’ll find in there? How could we find out?”)
• Ask children to describe their thinking and decisions as they build (“What did you do next?” “What does that part do?” “What else will you need?”).

Observing changes in themselves

What children are doing:
Preschoolers are keenly curious about themselves and love seeing and talking about pictures of their younger selves. They are proud of how they’ve grown and changed. This is an opportunity to introduce measurement, charting, recording observations, and other math and science skills.

What caregivers can provide:
• Tools to measure height and weight (start with non-standard ways of measuring and then introduce standard measurement tools, such as rulers, later).
• Children’s books on growth and change in children and photos of children as babies and toddlers.

What caregivers can do and say:
• Get children excited about noticing and recording their own growth over time, rather than making comparisons with other children.
• In addition to size help children identify and record other ways that they have changed.
• Extend children’s interest in their own growth to the growth and development of other living things.
• Encourage measuring, counting, charting, and recording.
Creating representations
What children are doing:
Preschoolers are skilled and interested in recreating accurate models of things they’ve observed. Drawing or sculpting an object is often part of scientific exploration and can increase focus on details, which can spark curiosity. Even young preschoolers show an amazing level of attention, focus, and interest when representational drawing and sculpting is part of their investigation.

What caregivers can provide:
• Drawing and painting tools that support detailed drawing (colored pencils, fine-point markers).
• Firm modeling clay (instead of play dough) and tools to encourage detailed sculpting.
• An area where children can display their sculptures or take a photo of models.

What caregivers can say and do:
• Talk to children about creating models from observations and how it’s different than creating from their imagination.
• Talk to children about what they see. Comment on the details represented in their model.

Recognizing numerals
What children are doing:
During the preschool years, children make the connection that a particular written symbol – “5” – represents an amount and corresponds to the verbal word for that amount. Since there’s nothing about the symbol that looks like the amount, children learn the names and symbols for each amount through repeated exposure and use of numerals in play and everyday activity.

What caregivers can provide:
• Games that include written numerals.
• Puzzles, books, charts and other materials that link written numerals with their amounts.

What caregivers can say and do:
• Incorporate counting, verbal labels, and written symbols in everyday activity. ("How many children want strawberries on their yogurt? One, two, three, four – okay four children. Let’s write the number 4 on our chart.")
• Give children models of numerals that they can refer to, but don’t be concerned about the accuracy of their early attempts. Over time they will improve.

Keep in mind
Scientific thinking involves making predictions about what will happen next, testing those predictions and observing the outcome, recording that outcome in some way, and telling others about what’s been discovered. Mathematical thinking includes knowing numerals, counting, creating patterns, recognizing geometric shapes, measuring, and organizing numeric information using charts and graphs. Preschoolers can learn all of these skills, if those skills are embedded in activities and explorations that are centered on children’s interests and curiosity.