

Dr. Jennifer Jipson: Children's experiences with science begin years before they encounter science in classroom settings, and they continue both in and out of classroom settings throughout life. In my work, I've focused specifically on better understanding how parents and children engage in everyday conversations about science. In conversations with parents, children may have opportunities to develop what can be thought of as scientific literacy. They may begin to learn the language of science; for example, concepts such as gravity or metamorphosis.

They may learn about the kinds of causal explanations that are used in scientific theories. For example, the day/night cycle results from the rotation of the earth. And they may become familiar with the kinds of procedures that are used to answer scientific questions such as testing hypotheses and controlling variables. But in addition to learning about science-related topics and processes, children may also learn whether asking these sorts of questions is valued in their community and about how to begin to find answers.

I've been particularly interested in a form of communication that my colleagues and I call "explanatory conversations." Such conversations often include episodes of question-asking and explanation generation, and seem to be an important setting in which children learn about the issues that they find puzzling and interesting. Taking a close look at what children talk about with their parents serves as a window into the topics that they find interesting.

A recent study found that when actively engaged with an adult, three- to four-year-old children ask an average of 76 information-seeking questions per hour. This is more than one question a minute and shows just how motivated preschool-aged children are to make sense of the world around them. When we look at the topics that children at this age are concerned with, we find that they're fascinated by many phenomena that adults would categorize in the fields of biology and physics and other scientific disciplines.

For example, preschool children often seek information about complex scientific phenomena, such as how machines work, where babies come from, why does the moon change shape, and why don't robots grow? What's more, these questions are not indicative of fleeting curiosities.

Children persist in asking questions until they receive or discover a satisfactory answer. So asking questions is one way in which children are inviting others into their world of exploration and experimentation, and although parents do sometimes miss opportunities to enter this world, they often accept them. If the parent bites, and enters the child's world of scientific problem-solving, they can help children to extend their investigations and consider new ways of thinking about the things that interest them.

When we look closely at what parents say to children, we find that parents rarely articulate complex scientific principles, but this does not mean that parents are not contributing to their children's science learning. One thing that parents seem to do is provide bits and pieces of explanatory information about particular events as children experience them.

For example, while playing with a crystal growing kit, one parent offered, "It's a rock that grows." Then she paused. "Well, it doesn't really grow because it's not alive. But it adds more and more of the rock to it." So although the parent didn't actually explain the process of crystal creation, and probably could not have -- and neither could I -- her explanation may have been very powerful in helping her child hone in on the biological nature of the concept of growth and the types of things that rocks are or are not.

There's reason to believe that this level of explanation is more helpful to children than those that are packed with detail after detail. In fact, like adults, children can be prone to explanatory satiation, or explanation overkill. Taking a more piecemeal approach may allow children to gradually accumulate their understandings to develop a broader understanding of a phenomenon. Whenever I talk about parent-child conversations about science, I'm undoubtedly asked whether parents provide misleading or incorrect information.

The answer is of course. But I'd argue that the accuracy of particular comments may be less important than a discourse

style that helps children figure out how to ask and find answers to questions. Even incorrect explanations may help children to explore their own ideas about a topic and to further their understanding in the long run. Of course, I'm not suggesting that parents make things up.

Children respond quite well when parents admit that they do not know something, as long as they pair it with some suggestion about ways that the child might find the answer. Parents can support children's science learning without intentionally focusing on instruction. Just by attending to children's spontaneous questions, by commenting on their actions, and creating environments rich with experiences, parents may be making powerful contributions to their children's emerging scientific literacy.

If this approach to fostering learning sounds familiar, it should. It's remarkable that across groups of parents with very different educational and cultural backgrounds, we've generally seen a tendency for parents to respond to their children's curiosity in ways that are suggested by child development experts and practiced by early childhood educators. They contextualize new concepts and experiences by relating them to familiar topics, and they follow their children's lead by taking their questions as an invitation to reflect on and discuss complex phenomena.

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