



## **Teach Your Child to Wonder** by Mary Budd Rowe

*Kids are natural scientists – to stimulate their interest, just share their curiosity*

It was a strange sight: a man, standing before a fountain, watching the falling water and tilting his head from side to side. Drawing closer, I saw he was rapidly moving the fingers of his right hand up and down in front of his face.

I was in seventh grade, visiting Princeton University with my science class, and the man at the fountain was Albert Einstein.

For several minutes, he continued silently flicking his fingers. Then he turned and asked, “Can you do it? Can you see the individual drops?”

Copying him, I spread my fingers and moved them up and down before my eyes. Suddenly the fountain’s stream seemed to freeze into individual droplets. For some time, the two of us stood there perfecting our strobe technique. Then, as the professor turned to leave, he looked me in the eye and said, “Never forget that science is just that kind of exploring and fun.”

Nearly half a century later, I’ve spent an entire career trying to impart Einstein’s words to adults and children all over the world: science is exploring, and exploring is fun.

Sadly, far too few schools make the subject appealing. Science courses introduce more new vocabulary than foreign-language classes do. Textbooks are as dull as dictionaries. As a result, too many children think that science is only for people as smart as Einstein.

The irony is that children start out as natural scientists, instinctively eager to investigate the world around them. Helping them enjoy science can be easy – there’s no need for a lot of scientific jargon or expensive lab equipment. You only have to share your children’s curiosity.

Try these six simple techniques:

1. *Listen to their questions.* I once visited a second-grade classroom in rural Florida to talk about science as a career. The children asked me “textbook questions” – about schooling, salary, whether I liked my job. When I finished answering, we sat facing one another in silence. Finally I said, “Now that we’re finished with your lists, do you have questions of your own – about science?”  
After a long pause, a boy raised his hand. “Have you ever seen a grasshopper eat? When I try eating leaves like that, I get a stomachache. Why?”  
This began a barrage of questions that lasted nearly two hours.  
“What makes tears?”  
“Where do little spiders get all the stuff to make their webs?”  
“Am I just a bag of blood? Whenever I cut myself, I see blood.”  
You may not know the answers to your child’s questions. It’s all right to say, “I don’t know, but maybe we can find out.” Then you can explore the questions together.  
Occasionally your child may begin the exploration without you. One mother found her three-year-old dropping eggs on the kitchen floor. “These balls don’t bounce,” the girl reported. A sense of humor helps.
2. *Tell stories, don’t recite facts.* Even if you know the answer to a child’s question, resist the impulse to respond quickly, leaving no opening for discussion. That reinforces the misconception children often get in school that science is merely a set of facts stored in the heads of grown-ups. Science is about explaining.

On a flight to Europe several years ago, I sat next to a sixth-grade boy who watched me use my calculator to analyze some data. "When you're finished, where are you going to look up the answers?" he asked.

"No book has an answer to the problems I'm working on," I said. "It's up to me to find the answers."

"Then will your teacher tell you you're right?"

"No," I replied. "I'll show my results to other people, and I'll explain my answers, and we'll talk it over."

"And then will your teacher tell you if you're right?" he persisted.

"No, I'm afraid not."

He sighed sympathetically. "Some teachers are like that, you know."

For this boy, the world was full of right and wrong answers. He didn't realize that science is not just facts, but the meaning that people give to them – by weaving information into a story about how nature probably operates.

The best way to respond to a child's question is to begin that process of story-making together. If she asks why it's dark at night, try, "Let's think what is different about night that would make it darker than day." If he wonders where bees live, say "Let's watch, and maybe we can see where they go." Always be ready to answer, "Let's find out."

3. *Give them time to think.* Grown-ups are notorious for expecting quick answers. Studies over the past three decades have shown that, after asking a question, adults typically wait only one second or less for a response – no time for a child to think.

When adults increase their "wait time" to three seconds or more, children respond with more logical, complete and creative answers.

I once conducted a lesson in air pressure by pushing two rubber toilet plungers together until all the air was driven out and they were tightly suctioned. Two children had to tug mightily to separate them.

"How come you need so much force to pull them apart?" I asked.

After several minutes, a boy named Ron said, "The air is trapped in there and it finds a hole, and it all goes out. That's what makes a popping sound." He went on to demonstrate his misconception, but I didn't say anything yet.

Another student, Margaret, then revealed what she'd been thinking: "No, it's because all the air is out of the plunger." She pushed it down on the floor until it stuck, showing that once the air was forced out of the cup, the air pressure was less on the inside than on the outside.

Rather than telling children what to think, give them time to think for themselves. If a child gets the answer wrong, be patient. You can help when it's needed by asking a few pointed questions.

4. *Watch your language.* Once you have a child engaged in a science discussion, don't jump in with "That's right" or "Very good." These verbal rewards work well when it comes to encouraging good behavior. But in conversing about science, quick praise can signal that discussion is over. Instead, keep the ball rolling by saying, "That's interesting" or "I'd never thought of it that way before," or coming up with more questions or ideas.

Never exhort a child to "Think!" It doesn't make sense – children are always thinking, without your telling them to. What's more, this can turn a conversation into a performance. The child will try to find the answer you want, in as few words as possible, so he will be a smaller target for your disapproval. Also avoid asking "why" questions. Most children are accustomed to hearing "why" when their behavior is criticized: "Why is your room so messy?" "Why can't you behave?" Instead, I use "How come?"

Watch a child's language too. Question marks at the end of responses – "The sun?" – mean he's no longer discussing the subject. He's only trying for the "right" answer.

5. *Show, don't tell.* Real-life impressions of nature are far more memorable than any lesson children can extract from a book or a television program. Let children look at their fingertips through a magnifying glass, and they'll understand why you want them to wash before dinner. Rather than explaining what mold is, grow some on a piece of bread. Rather than saying that water evaporates, set a pot of water to boil and let them watch the water level drop.

In more than 150 American cities, science museums offer abundant opportunities for hands-on learning. "Whisper dishes" demonstrate how sound waves travel; whirling stroboscopes illustrate principles of visual perception like those that Einstein showed me at the fountain. If you take your children to a museum, don't manage the itinerary. Let them lead the way, and explore what interests them most.

6. *Go fly a kite.* Everyday activities can provide fascinating lessons in science. Kids can learn a great deal about physics and engineering simply by flying a kite.

Try making your own with lightweight wood, string and paper. By the end of an afternoon's "experiment", your children will get a basic lesson in scientific cause and effect. They'll discover how wind direction and intensity shift at different altitudes. And a kite has a built-in reward system: the more you improve it, the higher and more gracefully it flies.

Kite-flying isn't the only activity with such rewards. Build a go-cart to see how design affects speed. Plant flowers to see the effect of water and sunlight. Build a miniature skyscraper with blocks to see what styles are most stable.

When buying toys, blocks of all kinds – from traditional wood to plastic snap-togethers – are great for construction projects. Choose toys with working parts. Even better, look for toys that kids can safely take apart and put back together again.

By sharing your children's curiosity, you can give them a valuable lesson that extends far beyond the realm of science. They will learn that it pays to persist, to experiment, in the face of difficulties.

And they will clearly see that learning is not drudgery or something that happens only in school. Learning is something to be enjoyed every day – for a lifetime.

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Rowe, Mary Budd. "Teach Your Child to Wonder". *Reader's Digest*, May 1995.