Beyond the Fizz

Getting Children Excited about Doing Real Science

Steve Spangler

No one cared that it was cold outside. Mrs. Schmidt's second-graders could hardly wait to see what would happen next. Giggles and laughter bounced from child to child as the group positioned themselves around the 2-liter bottle of diet soda.

In a whispered voice, one boy asked, "Do you really think she's going to do it?"

"Sure . . . she'll do it, but you have to get ready to run," said the girl standing next to him.

Mrs. Schmidt removed the roll of Mentos mints from her pocket and loaded them into a small tube attached to the top of the soda bottle. The only thing that kept the mints from falling into the soda was a plastic pin tied to a piece of string.

"Are you ready?" she asked.

"Yes!" shouted the students, who could barely contain themselves. "Three . . . two . . . one . . . Go!"

In a fraction of a second, Mrs. Schmidt pulled the string, the mints fell into the soda, and a giant soda geyser shot up everywhere. It was raining Diet Coke! As soon as the soda started to spray, the children scattered.

They screamed, "That's awesome . . . do it again!"

When Mrs. Schmidt recaptured their attention, she told the children, "This is just a one-time experiment. I don't have any more soda, but wasn't it cool?"

As she and the children walked back to the classroom, Mrs. Schmidt thought she had hit a home run with her exploding soda experiment. It was hands-on, and the fun factor was huge.

But was there the science in this "experiment"? Why did the soda explode? Did the children understand the cause and effect? Were they involved or only watching a show?

Mrs. Schmidt believed she had presented a great science lesson with the soda geyser activity. In her mind, she had done an exciting, hands-on activity, and her students had had a blast. But when we consider the activity on a deeper learning level, we identify the most important missing element—children's engagement in the act of doing science. How could Mrs. Schmidt turn this attention-getting demonstration into a science project?

Add the elements of wonder, discovery, and exploration

The key to engaging children in doing real science is to understand the difference between a *science demonstration* and a *hands-on science experiment*. Demonstrations performed by the teacher typically illustrate a science concept. But science experiments give children the opportunity to pose their own "What if . . . ?" questions, which inevitably lead to controlling a variable—changing one aspect of the procedure or the materials used to perform an experiment.

Children want and need opportunities to ask questions, make changes, create hypotheses, and compare the results of a new experiment with those of the first demonstration. A demonstration captures children's interest, and Mrs. Schmidt's students were ready, even pleading to explore, ask their own questions, test changes to the procedure, formulate new ideas, and make their own big discovery.

Mrs. Schmidt could use the children's response, "That's awesome . . . do it again," to invite them to try it themselves

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and help them create new experiments. Demonstrations may be one-time events, but experiments lead to questions, which lead to making changes and trying the experiment again. It's a wonderful cycle of critical thinking called *scientific inquiry*, and you don't need a PhD in rocket science to pull it off.

Great demonstrations lead to even greater questions

Effective science teachers use captivating science demonstrations to grab the children's attention and stimulate their natural curiosity. Great demonstrations spark children to ask, "How did you do that?"

Research shows that students retain science concepts much longer when they witness an engaging demonstration that provokes an inquisitive response and challenges them to figure out why (as discussed in Liem 1991, 8–11). If the science demonstration serves its intended purpose, children come alive with a stream of questions. Teachers can then help the young scientists turn their questions into an unforgettable learning experience.

Do some real science

The only way to better one's skills as a teacher is to test techniques with your students. Mrs. Schmidt started with a fantastic science demonstration showing how the pits on the surface of the Mentos mints helped to pull the carbon dioxide gas out of the soda. The giant soda geyser had more than enough *Wow!* factor to pique the children's curiosity and could provoke lots of "What if . . . ?" questions.

Listen to the children's questions

This first step is crucial in creating a child-centered experience. The children need to take ownership of their questions and to have a vested interest in finding an answer. The teacher might need to begin with a probing question like, "If we did this again, what would you like to do differently and what do you think would happen?" Encourage the children to work in small groups to come up with questions, such as,

- What would happen if we used only one mint? What if we used the whole roll of Mentos?
- Does it work with other kinds of soda? What about other kinds of candy?
- What will happen if we shake the soda?

Each question could turn into a long list of experiments. The teacher can lead the children in discussing each question in an effort to narrow down the choices and help the children focus on one main question. Otherwise, diet soda and chewy mints will cost a small fortune.

Use the scientific method

Introduce children to the scientific method and outline its parts: hypothesis, materials, experimentation, data collection, and conclusion.

Hypothesis. After considering all of the children's questions, say that the group wants to find out if one Mentos mint works as well as seven. Here's the hypothesis: Seven Mentos mints dropped into a bottle of soda will make the geyser shoot up higher than if we just drop in one mint. Think of the hypothesis as just a starting place. There will be plenty of follow-up questions as children conduct more and more tests, but make sure that they can answer the hypothesis at the very end of the project.

Materials. Gather the needed materials—soda and Mentos. Purchase four packages of Mentos and seven two-liter bottles of soda, making sure that the brand is the same to avoid introducing any variables. Here's a helpful hint: use diet soda; it's not sticky!

The experiment. The number of Mentos is the one variable, so make sure that everything else in the equation stays the same. This is called the *fairness test*, and once children see the principle in action, they will put it to good use. Make sure all of the bottles of soda are stored in the same place (cold soda might erupt differently from warm soda!). In each experiment, use the same method for dropping the Mentos into the soda.

Data gathering. The children will need a way to measure how high the soda geysers shoot up into the air. One method could be to use an outside wall of a nearby brick building as your testing site. Set the bottles of soda next to the brick wall and drop in the Mentos mints. It's easy to count the wet bricks and to use this scale as a way of recording the height of each geyser. For example, let's say the test using two mints made the soda shoot up 13 bricks, while the test using three mints reached 16 bricks. This is a simple way to establish a scale, and diet soda washes off easily.

Conclusion. Some children enjoy analyzing the data as much as performing the experiment. In the example of the seven bottles of soda, there will be seven pieces of data to examine. Using a bar graph, it's a simple matter for the children to chart the results and answer their initial question: Does the number of Mentos released into the soda make a difference in the height of the geyser? The data shows that the soda geyser shot up higher using seven mints compared to the trial when only one mint was dropped into the bottle.

A final tip is to let the children do the talking as they interpret results. Help them use and discuss science terms, such as *variable, reactant, catalyst, chemical reaction, data, analysis,* and so on. Let each child share his or her own interpretation/discovery, and work with the children as a group to arrive at the big discovery, based on real data and real science.

Beyond the fizz

Mrs. Schmidt's primary goal in sharing the soda geyser with the class was to excite the children about science, and she did. In the hands of an effective teacher, cool science demonstrations like the amazing soda geyser can open the door to journeys filled with wonder, discovery, and exploration. By using the power of inquiry to create unforgettable learning experiences, primary teachers can further children's sense of wonder and their own—*right after* turning each other into a soaking mess from flying soda. The children will be talking about soda geysers at the dinner table for years to come . . . and hopefully all the ideas about science that they learned.

Reference

Liem, T.L. 1991. *Invitations to science inquiry.* 2nd ed. Chino Hills, CA: Science Inquiry Enterprises.

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