



# **THE "SCIENTIST OF THE WEEK" IN SECOND GRADE**

**How Our Classroom Benefited From Peer Instruction**

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Commissioned by The Hoenny Center  
St. Louis, Missouri  
October 2007

# The “Scientist of the Week” In Second Grade: How Our Classroom Benefited From Peer Instruction<sup>1</sup>

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## INTRODUCTION

The College School of Webster Groves has a 45-year tradition of experiential, thematic education, or “learning by doing.” We believe that fully engaging students offers the best chance for memorable learning. Creative lesson plans, hands-on materials, and inquiry-based participation are effective tools that keep student’s involvement high.

Yet if teachers are the only ones who act as the leaders/ guides/ coordinators of each lesson, we miss many opportunities that could engage students even more effectively. We second grade teachers have always designed activities that capitalize on seven and eight year olds’ readiness for greater independence and responsibility. A significant number of daily “jobs” in the classroom, therefore, have regularly been shouldered by the second graders. For example, children recycle paper, care for the class guinea pig, set up chairs, and take attendance. They also have many opportunities to interact with their peers in teaching capacities: they lead a Spanish conversation, ask questions about the calendar, quiz students about vocabulary (we call it “juicy word of the day”), recite a poem, and present riddles and jokes. These jobs are introduced slowly, modeled correctly, and reinforced daily.

Students have these jobs for a week at a time, and quickly become comfortable in front of their peers. The teachers coach them before and during these opportunities, intervening when necessary in this learning process. The children grow as confident presenters as a result of repetition, good structuring, and sensitive teacher intervention to support their teaching skills.

In light of the success of our daily job routines, we decided to make a “Scientist of the Week” job beginning in the fall of school year 2006-2007. This task would ask a student to create a science experiment to share. We hoped to take advantage of second graders’ ingenuity to meet the following goals:

- **Capitalize on curiosity.** Second graders are natural scientists—inquisitive, persistent detectives. Becoming the “Scientist of the Week” offers them the chance to explore one of their passions.

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<sup>1</sup> This report was commissioned by The Hoenny Center for Research and Development in Teaching, St. Louis.

- **Build on themes.** Our science curriculum is often tied to a theme, leading to in-depth coverage of certain sciences and less coverage of others. Because each child chooses the experiment, many more concepts can be covered over the course of the year.
- **Make connections.** The variety of experiments will give children opportunities to make connections among them throughout the year, furthering their understanding of the scientific process.
- **Communicate skillfully.** Leading a lesson requires multiple skills. We teachers can observe and assess a child’s ability to plan, communicate effectively, and lead the group.

The “Scientist of the Week” job proved to be an exceptional experience for students as well as teachers. In this paper, we will share the transcripts of science lessons presented to the class by certain students, the skills that children practiced as “the scientist,” the progressive improvement of their presentations, and which interventions we teachers tried that best guided students to become leaders in their own instruction. The lessons documented here are typical of the range of presentations in this class in terms of content and quality.

## I. Scientist of the Week—first rotation

The following are the parameters for our “Scientist of the Week” job:

- Take one of the second and third grade level resource books that describe “easy” science experiments using everyday materials. We offered these to the Scientist of the Week on Mondays.
- Choose an experiment that teaches your classmates a scientific “fact” or concept. Be ready to demonstrate the experiment on Friday.
- Bring any materials you need from home; you can also use supplies from the class.
- Last week's Scientist of the Week becomes the assistant for this week's Scientist.

Our first scientist of the week was a serious, thoughtful eight-year-old we’ll call Steven. We gave him the resource book on Monday of his week, he chose one of the experiments to demonstrate, and we acted as his assistants.

Here is a transcript that describes our first “Scientist of the Week” experience:

*Steven places several pieces of construction paper at a table. He takes a balloon and blows it up.*

Teacher, *while Steven is blowing up the balloon*: “I wonder what Steven is going to make.”

Steven, *to the adult teacher*: “I’m going to need some help.”

Teacher: “How can I help you?”

Steven: “I need this string tied from there to there.” (*Steven points to two opposite walls in the classroom. Teacher stretches the string so that it is attached about six feet off the ground across the room.*)

*Steven then assembles a “case” for the balloon out of construction paper and hangs it from one end of the string. He lets go of the blown up balloon and the “rocket” sails across the room on the string.*

Students: “Wow! Cool! Do it again.”

Teacher: “What do you think happened, Steven?”

Steven: “The air coming out of the balloon made the rocket go.”

*Steven repeats the experiment.*

Teacher: “What made you pick this experiment?”

Steven: “I thought it looked cool.”

Teacher: “Does your experiment remind you of anything else you have ever seen?”

Steven: “Um, I don’t know.”

*Discussion with the class, led by the adult teacher, helped second graders confirm that the science principle of every action having an equal and opposite reaction can be seen with different types of rockets, space shuttles, and even day-to-day movement.*

**Steven’s experiment was visually impressive. He was able to repeat it twice and prove that “every action has an equal and opposite reaction.” He planned and organized his materials well. Steven did not provide any verbal details in the form of questions, answers or extensions. We teachers had not modeled any science experiment, however, so this was not expected. During Steven’s presentation, therefore, the teachers intervened with leading questions—I wonder what Steven is going to make? What do you think happened? Why did you pick this experiment? Does this remind you of something else you have seen?—that we hoped would be**

**modeled by students who held future “Scientist of the Week” jobs.**

The following example shows a student (we’ll name her Susan) who had another visually interesting experiment and a classroom of students who began inquiring, making connections and hypothesizing.

*Susan brings out a glass jar and shakes it.*

Susan: “These are iron filings.”

Students: “What are iron filings?”



Susan: “I don’t know.”

Student #1: “Remember, iron filings are shredded up metal.”

Student 2: “Oh yeah, this experiment reminds me of Jack’s.”

Teacher: “Susan, ask [the student] why it reminds him of Jack’s.”

*Susan asks and the student responds that Jack used iron filings.*

*Susan continues to shake the glass jar without talking.*

Teacher: “Susan, do you want to tell the kids what you’re doing?”

Susan: *(excitedly)* “There are 22 magnets in it!”

Teacher: “Let’s see the experiment again.”

*Susan shakes the jar and the iron filings cling to the center magnets.*

Susan: “There is actually a magnet in the lid, too.”

Teacher: “What questions do you have, class?”

*Susan does not call on anyone, although kids have their hands up. She is very focused on watching the jar.*

Teacher: “Susan, why don’t you call on a few friends?”

*Susan calls on a friend.*

Student: “Why did you pick this experiment?”

*Susan shrugs her shoulders, but begins to call on other friends on her own. She struggles with answering their questions.*

**This experiment was, like Steven’s, visually impressive. Teacher interventions included asking questions and other prompts to lead discussion. The teacher found it necessary to give direct suggestions to Susan about what to say and do. As an audience, the students have become good participants in their learning by asking questions and making connections.**

The next experiment is an example of a student becoming a more effective teacher during the lesson:

*Angelo brings out three types of milk, food coloring, and a dropper of oil. He begins setting up the experiment.*

Teacher: “What is in the eye dropper, Angelo?”

Angelo: “I don’t know—my dad put it in.”

*Angelo begins adding food coloring. Teacher directs children to see what happens to the colors in the first cup.*

Angelo: “This makes a cool pattern.”

*Angelo adds food coloring to the second container of milk.*

Teacher: “What type of milk is that?”

Angelo: “I don’t know.”

Student: *(reading the label)* “It looks like Vitamin D milk.”

Teacher: “What is happening with the colors?”

Angelo: “The colors are twirling.”

*Angelo adds food coloring to the third type of milk, labeled half and half.*

Angelo: “It’s not doing anything. It might take some time.”



*Angelo then adds the oil from the dropper to each container.*

Student: "What is that?"

Angelo: "I think it is oil."

Teacher: "What do you think makes each kind of milk different?"

Student: "There is more fat in some kinds of milk."

*Students conclude that the more fat content in the milk, the harder it is for the colors to mix.*

Teacher: "This experiment makes me wonder if it is important to eat less fat so that our blood can circulate better in our body."

**This student did not initiate questions or discussion without several teacher/student prompts. By the end of the presentation, however, he was calling on students to come up and view the different color patterns in the milk samples.**

These first three examples show that the students viewing the experiments were learning a variety of scientific concepts. These "Scientists of the Week" had good planning and organization skills, but weaker leading skills. The next two transcripts show two students who had stronger skills in leading a lesson, and seemed to reveal more interest and enthusiasm for their projects.

Braden: "This is what is going to happen. I'm going to take this tube and make the water go from one bowl to another. It's called a siphon."

*Braden demonstrates this:*

Student: "How did that happen?"

Braden: "When I suck on the tube, it creates water pressure."

Student: “How hard do you need to suck?”

Braden: “I found out how hard to suck on the tube because the first time I did it, my shirt got all wet.”



Student: “Do it again.”

Teacher: “I notice that the empty bowl is lower than the one filled with water.”

Student: “What if the empty bowl is higher? Will it still work?”

Braden: “I’ll try it.”

*Water did not flow unless the empty bowl was lower than the filled one.*

Braden: “So you have to have one container below the other container for the siphon to work.”

Teacher: *(To the class)* “Have you ever seen a siphon being used?”

Braden: “My swimming pool—we empty it with a siphon.”

Teacher: “If you run out of gas, you can transfer it from one car to another with a siphon.”

**This experiment was well planned and executed. The student clearly explained what was going to happen, demonstrated it, was open to trying it a different way to compare results, and made a connection to how siphons work in the world. This strategy helped the class to focus by giving expectations, predictions, and definitions. Prior to his experiment, teachers noted that students often did not understand how to explain the materials or the process. A couple of times, parents accompanied their children to their “Scientist of the Week” experience. The students would look to their parents to demonstrate, explain and even field questions. We recognized that if parents played a big part in preparing for the**

**experiment, the student had weaker leading abilities. Interestingly, no parent came to “watch” after the Winter Holiday. We attributed this to students accepting greater responsibility for their work, as well as relishing the chance to teach their peers.**

The next student, Joe, planned and led a great science lesson, but the outcome was not what he expected.

Joe: “Does anybody know what a geologist is?”

*Takes answers from students and agrees with the student who says it is a scientist who studies rocks.*



Joe: “My great-grandpa, who is dead now, used to study rocks. And now I’m interested in them.”

Joe: “Although there are millions of rocks, there are three main types: sedimentary, igneous, and metamorphic.”

*Shows samples of each type, and explains how they are made. Hands out handout with information about each type of rock.*

Student: “Why is it that when lava cools and hardens it looks like a crystal?”

Joe: “It is a metamorphic rock and it can look that way.”

Joe: “I have a geode that I am going to crack. You can’t hit it too hard or else it breaks into thousands of little pieces. It’s in a sock.”

*Joe attempts several times to crack it. Teacher tries with other materials to crack it unsuccessfully. Joe takes the geode home and brings it back to school so kids can see the crystals.*

**This student started off with a question to build background knowledge for the group. He taught the kids about different types of rocks in a lecture format. Despite the rock’s inability to crack at school, he followed up with the group the next day and showed that the “geode” had a very condensed center.**

## II. Scientist of the Week—Second Rotation

Most of the students had a chance to be “Scientist of the Week” a second time during the school year. With their background knowledge as the scientist, in addition to observing 23 other models and listening to the teachers' comments and questions, children showed significant improvement in the organization and execution of the lessons. The examples that follow describe three such experiences.

One example was the second experiment that our first “Scientist of the Week” taught. “Steven” created a model of the lunar cycle—a cardboard box with various size holes cut in it, a flashlight and a tennis ball. He accomplished the following: a) He shared handouts that showed “a better example” of how the cycle works. b) He then explained how he would shine a flashlight through the holes. c) He asked students to come up two or three at a time to see the different phases of the moon. This represented true progress from the first experiment, when he was silent as he demonstrated. Steven planned a great lesson, explained it, took questions, and provided good teaching materials and activities for the children.

Here is a transcript of another child’s experiment:

Carla: “This experiment is from a book titled, Make Invisible Messages Appear. I am going to start by folding this paper towel into a wad (which means to fold where you can have the corners out.)”

*She assembles her materials.*

Carla: “This is a plastic bowl. I am going to put grape juice in. I have a paper, spoon, water, and baking soda. I am going to mix the baking soda in the water or else it will stick to the bottom. Now I will write ‘HI’ on the paper with the baking soda/water mixture.”

*She demonstrates this and blows on the paper until it dries.*

Carla: “Now I am dipping the wad of paper towel in the grape juice and going over the ‘HI’. The invisible message will appear.”

*Carla reveals the message and asks if anyone else would like to try. She patiently pairs children to come up and leads them through the experience by repeating the directions of writing the message, dipping the paper towel, and waiting for the results.*

Student: “How does that happen?”

Carla: "The baking soda acts as a barrier to the paper towel, and the grape juice makes it show up."

**Carla cited a resource to open her lesson, an impressive introduction that no other child had used. She was methodical in her demonstration. She not only explained what she was doing but also told why as she went along. Carla was particularly careful to make sure everyone had a turn and that, in their turn, they experienced success. As pairs of classmates attempted the experiment, Carla watched carefully, suggested more liquid if the message didn't appear, and affirmed, "Good!" when they saw their words. We teachers did not intervene at all.**

This last example represents a student who led a complicated lesson without teaching interventions:

*J.R. sets up several candles and other materials. Because of the use of fire, the teachers did assist in lighting them.*



J.R.: "Do you think I can put these candles out without putting anything on them?"

*He then mixed together vinegar and baking soda and poured the gas over the candles, which went out.*

J.R.: "How do you think the candle went out?"

*He takes several guesses.*



J.R.: "What does fire need to burn?"

*More guesses from the audience, including "oxygen," "carbon dioxide," "air." J.R. explains that the gas produced by the baking soda and vinegar mixture interfered with the oxygen that the candle needed to burn.*

J.R.: “Now I’m going to show you something else. (*With a lit candle, he heats up a spoon and places it on a chunk of dry ice. It makes a high, squeaking noise.*) “Why do you think this happened?”

*As J.R. takes guesses, he is sensitive to incorrect responses. He replies to his classmates, “Yes, that is partly true,” and “But why is the sound so loud?”*

J.R.: “The spoon is actually vibrating and making the squeaking sounds because it is so hot and it is in contact with something so cold.”

**J.R.’s first experiment of the year was very simple. This second one involved several steps and a couple of different scientific concepts. His leading skills were exceptional—he commanded attention with good opening questions and took guesses and questions, leading the students to other discoveries.**

### III. SUMMARY OF INTERVENTION TYPES

In addition to improving our science curriculum, the “Scientist of the Week” project helped us track some of the assistance we teachers gave students and assess the effects of these interventions on the growth in their teaching skills.

- A. **Planning:** We gave students help in planning for their presentations by:
- Giving the resource book to the “scientist” at the beginning of their week.
  - Asking them which experiment they chose and checking in with them midweek (At times, parents would ask questions to clarify expectations. We would remind parents that their children needed to be in charge of the experiments.)
  - Explaining the parameters for The Scientist of the Week job—the student’s responsibilities and duties.

Comment: Even before the first rotation was over, the students became more proactive in making these choices. For example, some children preferred searching for their own experiments via the Internet or library. Often, children would like to keep what they were doing “secret” until the big reveal on Friday.

- B. **Organizing:** We helped them to organize their presentations by:
- Clearing an area of the classroom so they could set up their materials.
  - Providing each student with an “assistant” (this was the child who had been the scientist the week before).

Comment: We found that parents needed some coaching about how to help their children plan and organize without taking over the project too much. When parents were overly involved, the “product” looked more sophisticated than what is developmentally expected of a second grader. Furthermore, the child was less confident in the execution of the experiment, often admitting “I don’t know” when

asked about choice of experiment, materials needed, and scientific concept studied.

**C. Leading the class:** While they were giving their presentations, we:

- Modeled an interested learner role for the class.
- Interjected prompting questions for both the Scientist and the class, especially in the first rotation.
- Asked the class about what they were noticing.
- Asked the class to predict outcomes.
- Asked the scientist to repeat the experiment.
- Asked the class to brainstorm about connections to other experiments.
- Especially in the first rotation, we suggested what the Scientist could say, ask, or do next.

Comment: As we sought to increase the student's independence, we modeled guiding questions for the second graders. The most successful teacher interventions/questions (assessed as successful by watching whether the children started to use them) included:

1. What do you think the scientist is going to do?
2. What just happened?
3. Why do you think it happened?
4. Does this experiment remind you of anyone else's experiment this year? Why?
5. Does this experiment remind you of anything you have seen in the world?

**D. Assessing learning:** We helped the students assess their classmates' learning by:

- Modeling questions such as, "What do you think just happened? Why do you think that happened?"
- Modeling the kinds of responses a teacher can give students that welcome more questions ("That is a good guess. Do you have any other ideas?")
- Brainstorming about other experiments that could build on the one just seen, answering questions that children were still wondering about.

Comment: We found that some students' experiments built on ideas from previous weeks. For example, one child built a "circuit." A few weeks later, another child built a circuit that rotated a fan. Similarly, several students used baking soda and vinegar to do a variety of "mini-eruptions." These chemical reactions caused balloons to fill, volcanoes to flow, and rockets to fly.

**E. Reflecting for improvement:** When a student's presentation was over, we helped them reflect on the experience by:

- Asking them about the experience, and urging them to share this with their parents.

- Designing a “Writer’s Workshop” with the prompt that students write about the three most memorable experiments of the year and what they learned from them.

Comment:

We found that many of the "Writer's Workshop" reports connected the learning with the Scientist of the Week who demonstrated the concept. We also found that the students successfully recalled the science concepts they learned from their fellow students at least at the success rate of concepts taught by other means. They were able to write in great detail about their fellow classmates' experiments that had been visually memorable and well executed.

As one might expect, the presenters' varied personalities really came through in this experience. As the weeks passed, each scientist became more comfortable in the teacher role. All the children took greater ownership of the project between their first and second presentations. One child, who barely said a word while his mom led his first experiment, opened his second experiment with, “Okay, everybody, watch and learn.” We were pleasantly surprised how students quickly integrated leading questions, affirming responses and mature connections through this exercise. A few of the 24 students were “natural” teachers—planning, presenting and assessing with confidence during the first rotation. Others, who were less comfortable in front of the group, gained the skills necessary to make Scientist of the Week a favorite part of the curriculum. They eagerly modeled what other students did effectively.

#### **IV. CONCLUSIONS**

Our pilot year for “Scientist of the Week” confirmed teaching concepts that we have always used, yet taught us several new ones.

Here's what we assumed, based on our experience and the students' success over the years with other class jobs:

- Children are natural scientists and enjoy taking responsibility for a “job.”
- They love to “show and tell” these experiments.
- Students are strong “show-ers” and better “tell-ers” when they own the experiment.
- Repeated and frequent opportunities to lead small discussions and present material to the class (juicy word, joke of the day, poem of the day, calendar questions) are critical to the students' growth in leading a more complex lesson like Scientist of the Week.
- Our interventions, as always, varied with the situation and each student's particular skill level. Creating a safe space for growth for all students, affirming what was done well, and guiding children to strengthen certain skills were especially important in these activities.

Here are some new things we learned from our pilot year with "Scientist of the Week":

- The higher the level of parent involvement, the less able the child is to explain the concept and lead the lesson.
- When a student is "Scientist of the Week" two times during the year, s/he is significantly more prepared the second time around to lead more complex lessons with strong leadership skills, especially in framing questions, affirming answers, and exploring new ideas.

For this school year, we will again integrate the "Scientist of the Week" job into our curriculum. We will adjust the parameters in the following ways:

- Teachers will model the first experiment, helping children understand all parts of lesson plan design and delivery.
- Teachers will explain to parents the importance of lesson ownership by their children to build competence and confidence. We want the parents involved, however, and will likely need to suggest ways to be helpful and engaged without dominating the process, perhaps by asking questions about the project and taking the role of a learner along with the child.
- Students will keep a science journal, noting the name of the presenter, science concept taught, an illustration of materials, and a depiction of the process.

At the end of the first rotation, we will ask the students to reflect in writing on the experience with the following guiding questions: What did you like about being Scientist of the Week? What will you do differently in the second rotation? What did you learn by leading the science lesson? What science ideas/concepts did your classmates learn from you? What science did you learn from others?

Our goals in beginning the "Scientist of the Week" job were met thoroughly. Not only did the children eagerly look at the calendar to count down how many more weeks before they could be the Scientist, but also we discovered what valuable resources we have when students become teachers. Watching the children confirmed that seven and eight-year-olds are highly motivated to make sense of the "magic" of science. Behavior management, often an energy drain for a teacher, was rarely an issue when students held their classmates' attention. We will continue to support other opportunities for children to lead the way in their instruction.

Webster Groves, Missouri  
October, 2007