The Evolution of a Science Inservicing Program

An Eisenhower funded project served as a catalyst to spark collaboration among teachers and the community.

Over 100 elementary and middle school teachers participated in a three year “Elementary Science Leaders” Eisenhower-sponsored workshop program. These teachers more than doubled the amount of time they spent teaching science in their own classrooms, distinguished themselves as teacher leaders and role models for students, and established permanent new science programs in the Montebello Unified School District. What was the essence of this unique program?

In 1990, the Montebello School District, Cal State University Northridge, and Workshops on Wheels (WOW), a professional group of widely recognized science educators and classroom teachers, received an Eisenhower Grant to implement an intensive science inservicing to elementary teachers. A critical element of the program was establishing rapport between presenters and teachers by soliciting honest input and responding to the changing needs of the participants as they experienced professional growth and classroom success in teaching (Elmore & McLaughlin, 1988). Participants were required to evaluate each and every session they attended to provide presenters with feedback regarding the level of the handouts, the pace of the program, the relevance of topics being addressed, and more. This ongoing communication between participants and presenters resulted in both structural changes and constant fine tuning of the program.

The monthly workshops were planned to be high-powered, motivational, and content rich. Each Saturday was filled with two distinct half-day workshops, offering several hands-on projects and substantive science content tailored to the specific needs of this audience. Workshop presenters did not follow a pre-determined sequence or script in order to respond to the questions, comments, interests, and prior knowledge of the audience. During the initial workshops, however, dialogue and questioning among participants were infrequent; the presenter controlled the pace of the class while teachers filled the roles of “recipients.” Gradually, however, presenters observed changes in the audience. Teachers became increasingly willing to ask questions and to relate the hurdles they encountered while implementing science lessons in their classes. They began to offer new ideas for integrating the science content with reading, social studies, or math.

By the fourth Saturday, it became impossible for the presenter to get through the materials prepared because the audience had so much to say. This was a solid indication that the program was a success. The teachers had “bought-in” as members of a learning community - they were trying the activities with their students, modifying the lessons to meet classroom needs, and sharing their experiences with other teachers; furthermore, they wanted to understand, not to just mechanically reproduce projects in their own classrooms. The message was clear: slow down! Workshop presenters and WOW leaders spontaneously met and agreed to try a new format: rather than rotate teachers into a second afternoon workshop, the morning workshop topic was extended to a full 5 hours - not in order to add more content, but to build meaning. All subsequent workshops followed this 5 hour plan - more depth, more understanding, more conversation and sharing, more finishing up projects at home, and less “covering.” In fact, subsequent workshops sometimes became 10 hour workshops, with a Part I and a Part II. Jerry Richer’s Sex Education workshop had requests for a Part III. As teachers gained ownership of the program, they continued to offer input into future workshop topics, sequences, field trips, and other aspects of the program.

Major program enhancements evolved from these conversations about classroom implementation. Teachers wanted to explore community resources and to plan field trips for their students. To demonstrate
strategies for organizing meaningful field trips, project leaders arranged "The Great Resource Expedition," a behind-the-scenes trip to educational facilities in the Los Angeles area. As teachers expanded their science teaching repertoires, they expressed a need to purchase science materials.

Science supply catalogs are not novice-friendly. How big is a #6 rubber stopper? What's the difference between wood splints and popsicle sticks? Familiarity with these materials empowers teachers by making them less dependent upon pre-assembled and often restrictive kits. Responding to these emerging needs, Workshops on Wheels leaders arranged a trip to Tri-Ess Scientific Supply, a local science supply store which allowed teachers to learn new shopping strategies.

At the completion of the three year project, the teachers who had completed the program presented a "Super Science Showcase" which featured the teacher participants in a mini-conference for the district and surrounding public and non-public schools. This was an opportunity for district teacher teams to synthesize their learning by preparing short workshops of their own in order to hone their leadership skills. Teachers received considerable recognition from their colleagues for their achievements in science education, and the Showcase served as a transition into presenting at local, state, and national science professional conference workshops. Initially, the idea met with mild resistance. Did presenting a workshop mean that you need to make up all new experiments and activities? Where do you get ideas for an original workshop? Is it OK to modify ideas from other workshops which you have attended? This was a time when these teachers needed a push, and the project staff offered organizational outlines and other suggestions to help teachers prepare for their first science workshops:

- put together ideas from a variety of resources, identify themes, integrate ideas with social studies, math, language arts, and art units
- dramatize events which would otherwise be invisible - i.e., the motions of the planets, the interactions of ozone and CFC's
- turn an important but overlooked illustration in a book into an exciting three dimensional model or convert a model into one which is actually done to scale
- construct models with moving parts using materials other than paper
- create "advance organizers" and data collection charts for students to record their data in a manner which reveals patterns and facilitates drawing conclusions
- make a difficult activity accessible to a broad variety of learners by breaking up the activity into meaningful steps, adding appropriate illustrations, modifying the instructions, and allowing adequate time
- take an analogy you created to answer a student question and turn it into a model or demonstration (i.e., make a heart model actually using a pump, or a permeable membrane model using a sieve)
- start with a favorite story and build a workshop based on the science concepts embedded in the story (i.e., The Magic School Bus; The Lorax; The Best Nest)
- introduce student-generated variables to existing activities based upon student questions
- find new ways to incorporate recyclables into your activities: (there must be a use for used tennis balls, film canisters, and six-pack holders)
- magnify a micro activity into a macro activity; exaggerate what might be invisible or overlooked
- capitalize on all five senses to create a motivational classroom environment
- take an "old standby" lab activity and strip it of its "recipe format" by letting the students stumble onto the question and design experiments to solve the study using various hypotheses

The Super Science Showcase was definitely a highlight of the program, not only for the audience, but also for the teachers who developed and presented their own workshops in English and Spanish. The presenters achieved new levels of understanding as they constructed their own lessons. In fact, as the topics and workshops...
began to take form, the Showcase became a source of friendly competition, pride, and fun, as evidenced by the workshop titles: "Clever levers," "Put a charge in your lesson," "It's a Gas," "Plate Tectonics - Catch my drift," "Alas y Garras" ("Wings and Claws"). The short descriptions which follow represent portions of hand-out packets which were developed by teachers in our program for their presentations at the Super Science Showcase:

**Adding New Variables and Data Organizers**

Virginia Traslavinia at Bandini Elementary school, in her presentation "Rampin' It," capitalizes on students' interest in cars and ramps. She adds the variable of surface material to traditional car/ramp experiments, asks students to make predictions about how fast the cars will travel, and sets up tables to organize data (see Table 1).

**Compiling Activities to Develop a Theme or Concept**

Gladys Kamikawa and Alice Kaneshiro presented a comprehensive array of activities related to magnetism in their workshop "For Magnetic Personalities."

Several of these activities were student generated:

- students bring in toys which use a magnet for a class display
- students make compasses by magnetizing a needle, pushing it through cork, and floating the cork on water
- students bring objects from home to test for magnetic properties
- Students make refrigerator magnets
- students design experiments to see if magnets can pull through wood, paper, sand, water, metal, glass, or cardboard
- students write a story about a person who accidentally becomes magnetized
- students discuss what life would be like without magnets
- students design an experiment to compare the strength of magnets

**Utilizing Five Senses**

Pat Alvarez and Terry Delgado presented an extensive sampler of activities focusing on the theme of birds in their workshop "Alas y Garras" (Wings and Claws). Participants constructed and consumed edible bird nests (shredded wheat, chocolate, jelly beans), examined parts of an egg, compared types of feathers, matched claws and beaks, and tried to obtain food items with different beak types.

**Creating a Motivational Learning Environment**

Jasmine Calvo and Gina Peters created a walk-in rainforest environment for their workshop, "Look beneath the Canopy." Participants entered the workshop through an obstacle course of vegetation simulating the forest canopy, complete with sound effects, bromeliads, and rainforest animal illustrations and murals. By creating a total immersion effect, participants were highly motivated to learn about this unique environment.

**Dramatization of Concepts**

Jack Harakson used costumes and balloons to represent atoms in order for participants to act out the interactions between ultraviolet radiation, ozone, and chlorofluorocarbons. Students carry "props" to represent atoms and molecules (white balloons = oxygen atoms, green = chlorine atoms, purple = fluorine atoms, black = carbon atoms), and aluminum foil lightning-spark spears represent the energy of the sun.

**ACT I.** On stage are three pairs of O₂ (3 pairs of students each holding 1 balloon representing oxygen). Sun rays (1 student with a spear like a lightning bolt) split one of the oxygen molecules and the oxygen atoms bond to the O₃ molecules making two ozone molecules (O₃) (students regroup). An ultraviolet ray (lightning bolt) is absorbed by the O₃. Then a chlorofluorocarbon molecule, CCl₃F (5 stu-
dents with colored balloons), rises into the stratosphere. Radiation from the sun releases one highly reactive Cl atom (known as a free radical) which then "attacks" an ozone molecule, stripping it of one oxygen atom and thereby destroying the ozone. The Cl free radical spins off with one oxygen atom (chloromonoxide) which is highly unstable and breaks apart, releasing the chlorine free radical to repeat the reaction up to 100,000 more times.

ACT II. On stage are two ozone molecules, and other students acting as plants and animals. A Cl free radical ravages another ozone molecule in the stratosphere, allowing a few ultra violet rays to approach: one is absorbed by the remaining O₃. The others proceed to zap the plant, the fish, and other creatures (see Figure-1).

A program such as this would not have been possible without extensive support and coordination from Montebello Unified School District personnel. District administrators were present at all workshops and activities, and generously augmented Eisenhower funds so that teachers could obtain materials for their classrooms. The direct communication between district personnel and principals contributed to a cohesive program which guaranteed that teachers would have ongoing support and leadership opportunities at their own school sites. Because the district was willing to risk and make a real commitment to science education, the Eisenhower program became a focal point of district efforts at every level, and was tightly coordinated with other district reforms such as the compensatory education program.

During the summer of 1993, as a direct result of this program, the Montebello Unified School District piloted a Summer Science camp at two schools where teachers had an opportunity to create and teach new science lessons in classrooms. Project leaders were constantly on hand during preparation and implementation to offer support and feedback. The enormously successful program served over 400 youngsters and will be replicated at multiple sites around the district during the upcoming summer and during session breaks.

The linkage of this project to the university provided a constant press to elevate the intensity and depth of the program, and participating teachers enjoyed attending motivational and stimulating labs on campus, such as sea urchin egg fertilization and DNA extraction. The university partnership was based upon a long term positive relationship between Montebello schools, Workshops on Wheels, and Dr. Steve Oppenheimer, well known for his advocacy of science education and his respect for classroom teachers. Nobel laureate Francis Crick graciously accepted the role of honorary chair of the program, and delivered three unforgettable lectures to the teacher participants.

The monthly Saturday workshops were presented by experienced professionals, coordinated by Workshops on Wheels. Leaders designed and monitored workshop content on an on-going basis to achieve a program which met and challenged the changing needs of program participants. These presenters came directly from the classroom, and brought expertise both in content and in understanding elementary learners and classroom realities. All presenters are deeply committed professionals who skillfully incorporate current pedagogy into

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**FIGURE 1**

Dramatization of Concepts

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\begin{align*}
 F - C - Cl + UV & \rightarrow Cl\cdot + F - C - F \\
 Cl & \quad Cl \\
 F - C - F + UV & \rightarrow Cl\cdot + F - C - F \\
 Cl & \quad Cl \\
 Cl\cdot + O_3 & \rightarrow ClO + O_2 \\
 ClO\cdot + O & \rightarrow Cl + O_2 
\end{align*}
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their lessons as they communicate their passion for teaching science.

The philosophical premises behind these workshops were derived from the California Science Framework (California Department of Education, 1990) and from the notion that:

whatever factors, variables, and ambience are conducive for the growth, development, and self regard of a school’s staff are precisely those that are crucial to obtaining the same consequences for students in a classroom (Sarason, 1990).

Activities are carefully selected to enhance understanding by integrating concepts both within and beyond the sciences. Presenters model for teachers ways to elicit student misconceptions, to generate student questions and experimental designs, and to make science relevant to the students’ interests. Making take-home projects motivates students to discuss and share the ideas they have learned in class with their families, building understanding as well as public relations. Whenever possible, models are three-dimensional, to scale, incorporating parts. The workshops are designed to provide an overview of the big ideas common to all domains of science, and are not restricted to specific grade level units.

Teachers were encouraged to participate in this program in teams composed of several teachers from the same school. This enabled teachers to collaborate with other interested teachers on an ongoing basis, and to share anything from ideas and materials to carpools and launchers. The result was a cadre of enthusiastic science teacher leaders at each campus, who evolved into a true community of learners. On a preliminary participant profile, the typical teacher in this program had taught for 13 years, had taken two college science courses as an undergraduate, and was spending approximately 1 hour per week teaching science. At the conclusion of the program, time spent teaching science had more than doubled. Teachers reported integrating science with other curricular units on frequent occasions, and many had moved from a text-based curriculum to one which increasingly utilized hands-on discovery and experimentation.

As the program approached the end of its three year cycle, teachers in this unique district realized they had only grazed the surface; they wanted more science classes, more rigor...three more years! A core group of 54 teachers was ready to sign on the dotted line for a new, intensified series of classes which would lead to a Master of Arts in Science Teaching. With another remarkable show of support from the Eisenhower Program of the California Postsecondary Education Commission, the newly-funded program includes offering this Masters Degree program through Cal State University Fullerton, an annual Super Science Showcase, Summer Science Camps, and an opportunity for a second group of 100 science teachers to participate in a new version of science workshops, perpetuating the challenge to “perform at the boundaries of our abilities in ways that test and push back personal limits” (Education, 1983).

Literature Cited


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