2007 AAAS/Subaru Essay Writing Competition for K-12 Educators, Finalist Essay

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CSI Comes to SES

Who did it? That was the question that fifth graders in my class at Sunderland Elementary School in Sunderland, Massachusetts were charged with answering last spring. Prior to the activity, I'd been fortunate to have participated in a regional technology grant, *Connecting with the Connecticut*, that budgeted for the purchase of a digital camera, a laptop computer, and four new Pasco GLX Xplorers handheld computers and pH probes.

Anxious to put them in the hands of my students, I searched the Internet to find ideas for practicing taking pH measurements. My goal was to design a lesson based on the Massachusetts State Science and Technology curriculum standards that would integrate the use of my new equipment, permit students to "do as scientists do," learn new content, and have fun.

One site that inspired me was Providence Science Outreach (http://www.brown.edu/Departments/Swearer_Center/Projects/PSO/) from Brown University's Swearer Center program. It outlined a lesson called "Crime Scene," which used both chromatography and pH along with other tests. The lesson was quite involved and would take more time than I had in my schedule, so I decided to adapt bits and pieces of it to fit my needs and grade level.

Keeping with the mystery theme, I planned a crime scene where both liquid and written evidence was left behind. I created a note written with a specific (non-permanent) black felt marker written by the criminal. I bled the ink to unveil its chromatography pattern and let it dry. Next, I selected a specific liquid (Sprite) that belonged to the suspect and ran my own pH test on it. I recorded the data on paper and placed it and the note in a container I labeled Evidence Box. Then I designed an investigators' recording packet for student teams to record their pH data and staple the chromatography samples.

I chose four more liquids (lemon juice, water, antacid, mouthwash) and markers to represent additional suspects' evidence. This meant I would need five tables for students to test samples of liquids (in cups) and inks (from markers). Also required were strips of filter paper (cut from coffee filters), bowls of water for dipping the strips, and cups of water for rinsing the probes. I added an older model PDA Palm Pilot and pH probe (which required an additional sensor unit) to my new equipment and set up the stations.

When the students entered class that morning, I told them a crime had been committed and that they would work in teams to help solve the mystery. I explained that they would need to use some new tools to help them in their work and proceeded with a short lesson on the pH of acids and bases and a review of lesson procedure and use of equipment. Team membership was assigned and I had no complaints.

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Although all the units had been charged the night before, one handheld failed to work successfully, so another older PDA Palm Pilot needed to come to the rescue. Soon, all was flowing smoothly. Enthusiasm was high; engagement was prevalent! I was able to circulate about the room and listen in, snap photos, and assist as needed.

As each team completed their testing, they were able to look at the evidence in the box and compare it to their data. They selected which suspect they thought had committed the crime and submitted it on a "Who did it?" sheet to me.

We ended in a group share where the real criminal was revealed and test results were compared. We discussed variations in test results and brainstormed possible reasons for these differences. They were able to express that saturation levels on filter paper, time differences for pH testing, different equipment, and overall differences in technique may have accounted for some of the inconsistencies.

Though the students gained specific knowledge about acids and bases as well as chromatography patterns from this investigation activity, there were several inherent outcomes which reflected the science and technology goals of the Massachusetts State Curriculum Frameworks. Some were apparent during the activity process; others were achieved post-activity through reflective discussion. These included: formulating questions and making predictions; using appropriate tools and technology; recordkeeping of data; conducting trials and comparing results; observing patterns in data and creating reasonable explanations for results, as well as communicating findings.

Reflecting on this experience, I found students were able to enact the "habits of scientists," expand technology skills, and increase content knowledge of both pH and chromatography while having a great time. I can truthfully say I experienced all of those things, too. It was well worth the extra preparation time and handheld practice sessions.