Hands-on Science Without Borders

Thinking Globally, Teaching Locally

by Phyllis Baudoin Griffard, Ph.D.

After almost three years living in a small town in southern China, I've concluded that hands-on science has no borders. Every region has its special resources that make for memorable science experiences in the classroom and informal settings. I found this out initially when volunteering to give science lessons in our children's international school. Not long after my family and I got settled in, I offered to bring flowers into the school for children to dissect in a lesson for their interdisciplinary unit called Structures.

As a result of teaching college biology for many years, including inquiry-based courses for pre-service teachers, I had developed a habit of looking out for unusual resources for science lessons. The instinct didn't wane when I moved to China, so for the Structures lesson I happily pinched a basketful of fresh azalea, ginger, bauhinia and plumeria flowers from the landscaping in our housing complex. The security guards timidly notified me that collecting wasn't allowed, but they turned a blind eye a few weeks later when I collected from the water garden some huge snails with crunchy pink egg cases for the school's aquarium. It turns out these snails are not even worth eating, which explained why they hadn't been culled already. But they did make for a nice science center. While flowers and snails are not unique local resources, they were an assurance that our school would not need to forego having hands-on inquiry lessons just because we couldn't easily order materials from a scientific supply.

Dissecting and examining a local flower

Using local resources

In fact, living in a foreign country presents interesting resources for lessons that can't be ordered from a catalog. When my son's fourth grade class was studying the human body, pig organs I'd seen in the local market were better than the models from the supply cabinet. Their teacher, a vegetarian, accepted with reticence my offer to buy some for a guest lesson. Going early to the market, we found a pair of lungs with trachea, a jiggly liver, a stomach with intestine still attached, a pair of plump kidneys, and a couple of hearts.

Whereas I tend to first notice a specimen for its pedagogical value, the Cantonese in our area judge edibility first. A friend advised me that lung and liver should only be eaten in moderation (and her father-in-law eats too much of it), and that the intestine was especially good cooked with a local mushroom. Instead of being cooked, the organs were rinsed in bleach and packaged for hygienic probing. Suited up with food service gloves and disposable chopstick probes, the children observed how the intestines are connected, how bumpy the stomach lining is and spongy the lung is, how blood flows through the heart, and how the hard-to-collapse rings of the trachea feel like their

Pig organs found in the local butcher shop were often better resources than the models in the science cabinet at school.

own. This local resource made for a memorable lesson that would have been hard to offer back in the United States without a butcher in the neighborhood.

Monomers and polymers

A local resource of a different sort was integrated into the fifth and sixth graders' interdisciplinary unit on petroleum. Our school serves families who are here because of the construction of a new petrochemical plant. This close-to-home resource inspired a lesson on the structure of the hydrocarbons that will be manufactured there. In small groups, the students used large and small marshmallows and toothpicks to construct monomer models of ethylene, propylene, vinyl chloride and styrene. The large marshmallows represented carbon atoms, the small represented hydrogen, and raisins stood in for the occasional chlorine atom. Groups then "polymerized" the monomers into long chains. By chance, the company organized a family visit to the plant the same week—a serendipitous reinforcement of the tasty hydrocarbon lesson.

The popularity of the guest science lessons hinted to me that the children would enjoy an extracurricular hands-on science club.

The club

Each term teachers and volunteer parents at our school offer enriching informal after-school activities in weekly one-hour sessions. In the first Science and Technology Club we did the typical activities with batteries and bulbs, ink chromatography, cabbage pH indicators, crystals and borax goop.

After these sessions were offered to younger children the next term, I began to worry that I was offering some of the same experiences the children would eventually get in their classes. Thus arose a new strategy. In the spirit of "think globally, teach locally," the after-school activities I planned in the future would be on a special science topic, preferably based on something unique that China had to offer.

The Skeletons unit was inspired by a cultural quirk of Chinese cuisine: the fact that roast chicken, duck or goose is always presented beautifully to the table with head and feet still attached. Dozens of such roasted chickens are seen hanging in restaurant windows. So it was a simple matter to buy some and to boil, bake and pick the bones clean. The vegetarian Hindu children in the group weren't enthusiastic about the meat-picking part,

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Constructing marshmallow monomers that will become polymers

Markets offer a great opportunity to observe live specimens.

but the Muslim girl whose Halal household prepares their own meat had no problem jumping right in.

After eight weeks of meticulous assembly with a hot glue gun, our chicken skeleton wasn't a museum quality specimen, but it was readily identifiable as a chicken when presented at the weekly school assembly. Although I had never reconstructed a chicken skeleton before and there was a good chance it wouldn't work out well, I knew the assembly process itself would do the teaching. The students marveled at how much connective tissue there was, how neatly the vertebrae fit together, how hard it was to tell whether a bone belonged on the right or the left, how white and greasy the spinal cord was, and how the hinged joints of the wing move.

Coastal China

Last term's after-school activity took advantage of a local resource as well. We live near the coast of the South China Sea, where a wide variety of sea life is sold live in nearby fishing villages.

So fastidious about freshness are the Chinese that restaurants and markets selling seafood always keep the animals intact and alive in bubbled aquaria until they are cooked. For Sea Life, live specimens from a different taxonomic group were brought back to school each week. Among them were bivalve clams, whelks, snails, octopi, cuttlefish, prawns, mantis shrimp, crabs and, echinoderms. Half were steamed to dissect and the other half kept alive to observe in vivo. I chose unusual fish like eels and flounder over the more familiar forms. Dried seahorses, pipefish, sand dollars and sea stars sold locally for soup and trinkets were also bought for Sea Life, but the prized delicacies like shark, spiny lobster, horseshoe crab, manta ray and large octopus were not. Although these had a higher "wow" factor, I stuck to the cheaper, more environmentally responsible specimens.

Among the highlights of Sea Life were finding the ink and beak in the cephalopods, dissecting the fish eye, inserting chopsticks between fish gills, watching the crabs watch us with their stalked eyes, and observing the bivalves extending their siphons and squirting them for locomotion.

The concept map

Each week we added a new taxon to our Sea Life concept map, and the children made drawings and recorded neat facts, which they compiled into a souvenir book. As usual, some children got their hands right in while others kept their distance. Most eventually got used to the smells but I'm not sure whoever laundred their clothes did. We finished off the term with a field trip to the seafood market where they saw even more variety than I could bring back to school each week.

This term's science after school activity is Food Science. Although it doesn't feature uniquely Chinese resources other than the local groceries, Food Science gives our expatriate children another opportunity to directly experience nature, construct new knowledge, bridge gaps and address misconceptions they have about food. I'm considering another abundant local resource for a future after school activity, but I might not get the principal's permission to have the housing complex's snake catcher become a regular guest to science club, especially since he regularly finds cobras. The snake catcher may not want to share them anyway, as the snakes are a delicacy he and his wife enjoy as a perk of the job.

Offering these experiences has reinforced my conviction that hands-on science lessons can happen anywhere. When children like ours are far from their home countries and don't always appreciate what they consider quirks of our host country, these stimulating activities give them experiences they would be unlikely to have in their home countries.

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