Science Adventures at the Local Museum

By Janet Kelly, Ranae Stetson, and Angiline Powell-Mikel

“Doing science in a nonstructured environment inspired me to set up a small space in my classroom where students can do science on their own,” wrote a preservice teacher after a semester-long experience at the Fort Worth Museum of Science and History. To promote science learning outside the traditional classroom and encourage prospective teachers to use community resources and materials, Texas Christian University and the museum have collaborated to promote informal science education during the preschool and elementary years. The college classroom provides the contextual framework for science conversations and active investigations, while the museum, as the infor-
nal learning environment, acts as the springboard for discussions and inquiry-based explorations with preK and elementary students.

This university–museum partnership reflects the growing national recognition of using informal science education environments. Because nontraditional learning environments promote active learning and foster interest among students, both the National Science Education Standards and the National Science Teachers Association (NSTA) support informal science education (National Research Council 1996; NSTA 2001). “The school science program must extend beyond the walls of the school to include the resources of the community,” states the Standards. The Museum of Science and History offers an environment rich in resources where participants—including prospective teachers from the university, practicing teachers, and elementary students—can learn science without the constraints of the traditional classroom setting.

This five-year university–museum collaboration continues to expand and evolve. Currently, two primary focus areas are offered to preservice teachers: 1) the early childhood education experience, which uses the Museum Preschool Program; and 2) the elementary education experience, which concentrates on exploratory activities in science and mathematics in the museum’s Hands-On Science Facility.

Museum Preschool Program

For more than 50 years, the Fort Worth Museum of Science and History Preschool Program has provided children with an exciting, informal science education. Three-, four-, and five-year-old children energetically explore the natural and physical sciences, history, anthropology, art, music, and literature. They visit the planetarium, collect “Moon” rocks, and handle many space artifacts. Children study animals and their habitats and observe visiting live animals such as desert tortoises, python snakes, armadillos, opossums, alligators, frogs, and screech owls. This is the environment in which early childhood education majors at the university begin their training as classroom teachers.

The first education course early childhood majors take at Texas Christian University is Introduction to Early Childhood Education. Unlike most traditional courses, this class meets for six hours a week, with three of those hours spent at the museum preschool working with children attending the program. Typically each museum classroom has two teachers who volunteer to mentor the preservice teachers during the entire semester.

The museum teachers are highly qualified individuals who not only have the educational background, experience, and aptitude for working with preschool children, but also the ability to provide age-appropriate science-learning experiences that build on children’s natural interest in the world. Working beside such positive role models, the preservice teachers can study how children learn and how effective teachers successfully teach science to young children.

The preservice teachers develop an extensive child study and keep daily application logs detailing information about the concepts they have learned. An example of one preservice teacher’s log entry detailed the introductory study of mammals, in this case the armadillo:

When the children came into the room, the teacher had a taxidermic armadillo on display that she asked each child to examine . . . She talked about how they [the armadillos] were mammals because their young were born alive, drank their mother’s milk, and had fur. All the children formed a circle, and the teacher talked about what to expect from the real armadillo brought from the zoo. She reminded them to sit still because the animal might come up to them and smell their shoes. The children were to use their “one museum finger” to touch it. Then the animal handler let it [the animal] down and put two huge worms out in front of it. The armadillo smelled them and grabbed them with its tongue. The children were amazed! (Fitzpatrick 2000).

Extensive reflection and feedback from this working partnership solidifies for the preservice teachers the notion that young children have a deep, natural interest in nonfiction topics related to their world (Katz and Chard 1995). Many times the junior- and senior-level education students report an increase in their desire for further scientific exploration about a topic they are working on with the preschoolers.

The Hands-On Science Facility

The museum’s Hands-On Science Facility showcases educational innovations for the K–6 age group. The environment contrasts with the traditional “don’t touch” approach still used in many museums. The informal learning environment has been well received by educators as the “in place” to take students for active adventures in science.

Elementary preservice teachers take an elementary science methods course conducted in two different locations to impress upon them the impact their physical environment has on learning. The university classroom constitutes the formal environment, while the Hands-On Science Facility serves as the informal site. Four three-hour visits are made to the museum during each semester.

The first visit includes a presentation on the exhibits and available resources, a tour of the museum, and a discussion on ways that future teachers might benefit from the numerous museum offerings. Visits two and three place preservice teachers with elementary students from area public and private schools. The preservice teachers and elementary students are paired together in
what Martin and Reynolds (1996) call “side-by-side learning” as they delve into inquiry-based science explorations that align with the science content discussed and examined each semester in the methods course. For example, in the study of microbes, the experience at the museum includes an epidemic village inquiry. In this exploration students test different “body fluids” from a city’s population to determine the how, why, and where of the spreading epidemic. In other museum visits, preservice teachers and children transform into spelunkers and examine the intricacies of light.

It is not unusual for both groups (preservice teachers and children) to share an “ah-ha” moment, such as when they create white light from red, green, and blue lights; or when they happen upon “bats” and “bat dung” in the simulated cave explorations. One preservice teacher expressed surprise at the knowledge level of one of her elementary partners. She reported: “The student knew more than I did about light. His predictions on color were on target every time.”

As part of the methods course, the preservice teachers are challenged to develop a science learning center for the classroom that they field test at the museum. The learning centers consist of three to five hands-on experiences about a specific topic, such as whales, honey bees, weather, recycling, or volcanoes. Traveling in groups of three and four, elementary students rotate through the various centers and perform the hands-on activities created for them. The session is very popular with preservice teachers because it provides them with opportunities to observe, interpret, and evaluate the effect their learning center has on the elementary student.

### Mathematics in Hands-On Science

As a part of their science and mathematics education courses at the university, preservice teachers also meet at the museum for mathematics explorations. They use museum exhibits, games, activities, and literature to foster student interest in mathematics. These teacher-student interactives help preservice teachers achieve a better understanding of elementary students’ mathematical abilities.

For example, preservice teachers read *Grandfather Tang’s Story* (Tompert 1990) to the elementary students at the museum. Afterward, both the elementary and university students are given sets of tangrams and animal templates (from the story) and are challenged to construct animals with the tangrams to cultivate visual and spatial skills. Preservice teachers also use magic squares to encourage students to find the correct placement of number cards so that the sum of the diagonals, rows, and columns is 15.

Preservice teachers discover the diversity of academic skills and learning styles among young learners through these teaching strategies. They experience firsthand how some learners may not be accomplished in computation but may excel at finding patterns or developing game-winning skills. Equally important, preservice teachers frequently discover that adaptability is a critical component of effective teaching as they adjust to meet individual student needs.

### The Proof Is in the Students . . .

In postcourse surveys, preservice teachers frequently praise the museum’s dynamic learning environment. From the Museum School to the Hands-On Science Facility, preservice teachers have been enormously impressed with their museum experiences. One preservice teacher commented: “I never thought I’d like science or mathematics, but the atmosphere at the museum put me at ease. Plus, I got to work with children doing science and mathematics. And, really . . . that’s what it’s all about.”

“Learning science is something that students do, not something that is done to them” (*National Science Education Standards* 1996), and certainly the museum provides the appropriate stage for hands-on, minds-on science exploration. The local science and history museum represents an outstanding example of an informal learning environment that permits free exploration and discovery to encourage learning and foster curiosity.

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### Resources


