Museums as inquiry role models

One way to bridge the gap between informal and formal science is to broaden students’ science contexts by taking them to museums. Parents often ask how they can take advantage of museums or science resource centers within their community. In actuality, they want to know how their children’s attention can be focused on learning while visiting the museum. Science museums have a unique advantage over many classrooms in that they are stocked with rich resources. Museums generally include displays, hands-on activities, and the freedom to explore and learn at one’s own pace. In addition, the museum experience may provide students with appropriate stimuli to generate questions that will further inquiry. Inquiry requires students to have background knowledge to frame appropriate questions for study. The issue is not just a matter of problem solving; rather, it’s one of problem posing.

Observing people at the museum

It is amazing what we can learn about parent and child interactions while observing them at museums. As museums place greater emphasis on high tech exhibits, we are surprised to see children revert back to the traditional displays of the large mammals, birds, fish, and reptiles. When we ask students why they were interested in these exhibits, most state that “The most interesting animals are the ones that are extinct, and are the largest mammals,” “We can’t always see the animals that well at the zoo because they might not be out,” “The animals at the museum aren’t moving, so you can observe them longer,” or “There were parts of the animal in the museum that you can see up close” (e.g. the size of the paws, claws, mouth, and teeth of bears). Upon further prodding, students indicate that they are able to observe all the characteristics of an organism (such as their size, shape, teeth, claws, and body segments).

On our continued visits to science museums, parents and children are often seen engaging in exhibit investigation and participating in hands-on activities. We notice that some parents seem comfortable guiding their children through the museum, enjoying and making the most of the informal science learning opportunities available. Other parents, however, could probably use some assistance. As teachers, we can provide parents with the inspiration, guidance, and necessary tools to add enjoyment, excitement, and adventure to family museum trips.

By preparing parents for museum visits, teachers can help create a field experience that can serve as a motivator for upcoming science units. Primarily, teachers need to convey to parents the techniques they practice every day in the classroom. Just as with a classroom lesson, a successful museum visit requires preparation, guidance during the lesson, and follow-up.

Preparation for learning

Gathering an audience may not be as difficult as you think. Teachers can present workshops on helping parents or other group leaders (e.g. 4-H club leaders) make the most of museum visits by contacting their parent-teacher organizations. This provides teachers with the opportunity to increase communication between home and school, while at the same time promoting their science program. One important way to prepare parents with the opportunities mentioned above is to provide them with an outline of the topics you plan to cover during the school year. Knowing the students’ curriculum helps parents choose which museums to visit and gives them time to prepare for their visits. By linking informal learning with a curriculum topic, parents encourage students to make real-world connections. This makes seemingly abstract science concepts relevant and facilitates learning.

Another important means by which you can prepare parents is by sharing what you know about regional and national museums. Identify the museum’s education specialist and ask about developmentally appropriate programs for students. Request educational materials that the museum provides about its programs, and prepare study guides tailored to your curriculum. In our experience working with parent groups, some feel apprehensive about teaching their children science content. In addition, some state that the designs of most museums are too complex to investigate without a plan. Teachers can solve this problem by developing units of investigation or focus questions that recognize science as a human activity. A general museum guide for parents

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Obtain a floor plan of the museum
The more detailed the plan is the better. If sufficient detail is not provided, try the Internet, contact a museum resource person, or make a personal visit to determine which exhibits are displayed and how they are arranged. With the floor plan, you can explain the general layout of exhibits and the reason for their arrangements, but be aware that exceptions may be found for some classification systems due to new discoveries in science, divergent theories, outdated exhibits, or limited resources. An example follows:

Systems, order, and organization
Have students determine a rule, pattern, or reason used to create the hall, exhibit, or display.

Examples
Living organisms may be arranged from cells, tissues, organs, organisms, populations, and communities. Physical systems may be arranged by the complexity of matter from particles, atoms, and molecules. Just as the solar system is arranged in a specific manner with the terrestrial planets closest to the Sun and gaseous planets farther away from the Sun.

Planning the visit
Suggest to parents that they involve their children in planning the museum visit. Children who actively participate, and don’t feel like they are being dragged to a museum against their will, are often more apt to be engaged in learning. For example, children can perform a search on the Internet at home or in the library to identify available museum programs, to find out the fees for various exhibits, and to determine hours of operation. If students are searching the Internet, have them tell parents when they come across interesting resources. For example, some Internet sites have online exhibits and science activities the family can examine before the trip to the museum. Additionally, museum staff can often answer science questions submitted via e-mail. Lessons and teaching plans can also be accessed at most websites. In addition, students and parents who find it difficult to visit a museum in person may take a virtual tour of many interesting museum websites (see Internet resources for examples). “Ology” means “the study of,” and on the American Museum of Natural History’s website you can explore and learn about many interesting “ologies,” including genetics, biodiversity, herpetology, ornithology, ichthyology, entomology, astronomy, archeology, and many others. Of course, these are not the only museum websites available. The Association of Science-Technology Centers Incorporated (ASTC) has more than 400 museum members located in the United States and around the world (see Internet resources for additional websites on museum exhibits).

Museum visit follow-up
Parents should encourage children to talk to their teachers, friends, and relatives about their adventure at the museum. Many of these museums even have after-school and summer programs to further
Foster or promote knowledge
(information identification and recall)
• What did you see at the science exhibit?
• Describe the science activity you completed.

Foster or promote comprehension
(ability to organize and select facts)
• What is the main point of the science exhibit?
• What is the main goal of the science activity?
• Explain the meaning of ___________________.

Foster or promote application skills
(use of facts, rules, and principles)
• Describe how A is related to B.
• Why is this fact, rule, or principle important?
• If this is done to X, what will happen to Y?

Foster or promote analytical skills
(understanding of relationships)
• How are the two exhibits the same?
• In what ways do the two exhibits differ?
• What are the elements of the science activity?
• What is the relationship of X to Y?

Foster or promote synthesis skills
(ability to join ideas together to form the big picture)
• What do you think would happen if __________?
• What would you include in a new science exhibit?
• Predict what would happen if you were to combine X with Y.
• Identify a solution for ____________________.

Foster or promote evaluation skills
(ability to form opinions, judgments, or decisions based on evidence)
• What criteria would you use to assess the exhibit?
• How would you decide about changing an exhibit?
• What do you think about ________________?

The school-museum connection
Informal science learning environments can provide students with the opportunities to engage, explore, explain, elaborate, and evaluate topics related to science. Integrating formal experiences with informal science-related experiences may assist in increasing students’ scientific literacy. The importance of linking informal experiences outside of school with formal instruction in school has been highlighted by the National Science Teachers Association (NSTA) in the 1998 Informal Science Education Position Statement. NSTA supports the development of associations between institutions of informal learning and schools as a way of meeting the goals stated in the National Science Education Standards. Teachers who are interested in investigating or forming collaborations with community-based learning environments may find the Museums and Public Schools Initiative (MAPS) website useful in developing a comprehensive education plan linking informal and formal learning (see Internet resources).

Internet resources
The American Museum of Natural History—ology.amnh.org/index.html
Exploratorium, San Francisco, California—www.exploratorium.edu
The Computer Museum, Boston, Massachusetts—www.tcm.org
Association of Science-Technology Centers Incorporated—www.astc.org
Museum of Paleontology at the University of California at Berkeley—www.ucmp.berkeley.edu/diapsids/dinosaur.html
Museums and Public Schools Initiative—www.museumsandpublicschools.org

References