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Carpe Diem: Making the Most of the Teachable Moment

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Abstract

With the advent of the National Science Education Standards in 1995, many science educators will be revising school science programs by teaching to the new content standards. In terms of the quality of curriculum and instruction, classroom science programs may be improved, but an overzealous emphasis on the letter of the standards may result in losses. School science programs should include event-based science, which is dependent both upon current phenomena and upon student interest, brings spontaneity to the curriculum and facilitates student development in the affective as well as the cognitive domain.

"Dum loquimur, fugerit invida aetas: carpe diem, quam minimum credula postero" Horace[1]

Making Room for Event-based Science in the Curriculum

In the popular movie, *Dead Poets Society,*.the teacher, played by Robin Williams, captivated his students with the notion of *carpe diem*, or "seize the day". To the science teacher, seizing the day means producing a lesson on the spot in response to a question, an expressed student interest, or a news story about a science-related event in the outside world. Science-related events include periodic happenings in the natural world, such as meteor showers and solstices, as well as less predictable events, such as hurricanes, tornadoes, floods, earthquakes, volcanic eruptions, and disasters of human and ecological proportions, such as the Exxon Valdez oil spill, the Chernobyl nuclear reactor meltdown, or the Bhopal chemical plant accident.

Taking pedagogical advantage of particular occurrences isn't always easy - it requires sensitivity and flexibility, but there are few better ways of engaging students and demonstrating the relevance of science to their lives. What's more, "seizing the moment" doesn't really mean abandoning the curriculum. Many events can be related to major science concepts in the curriculum. However, with the advent of the National Science Education Standards in 1995 (NRC, 1994), some educators may become so dedicated to revising their school's science program that they follow the new content standards too rigidly. An overzealous emphasis on implementing standards-based instructional units actually may result in loss of program quality. One loss may be the spontaneity and excitement of event-based science.

There are many instances when "seizing the moment" is the very best practice in science teaching. Many times, without advance notice to the teacher, the child may bring to class her special rock specimen, or a snake skin she found, or an unusual looking beetle, or a injured animal. In fact, such sharing and collaborative inquiry should be encouraged. These are valuable "teachable moments" which often can be connected to important science concepts. By "seizing the day" when such events present themselves in the classroom, the teacher has the chance to model curiosity and other scientific attitudes.

There are many ways teachers can capitalize on the learning potential of events, as well as the things and stories children bring to school. The most important factor is the teacher's own interest in exploring the situation further. For most children, the teacher is the chief model of the scientist's response toward the new and/or unexpected.

There are a number of effective ways to respond to special instructional opportunities. One response with potential instructional payoff is to invite children to express what they already know about the event or special object. This can be done orally, but it is also an opportunity for children to write or draw. By providing diverse contexts for expression, teachers help children more easily connect new information and the scientific concepts to their prior knowledge and experience.

What children know can be a surprise - some may know a lot about the most arcane topics (e.g. Jurassic fauna), while others may have only rudimentary knowledge. By tapping background experiences and prior knowledge at the start, teachers set up an assessment baseline. With the children's knowledge made explicit, a child's conceptual development can be tracked - and this is what "authentic assessment" is really all about.

Children can be encouraged to do more than just look at those special objects brought in by their peers. Depending on the item, they can make drawings and take measurements, such as size dimensions and mass, which can be recorded in a special class science log or student notebook.

Another effective strategy is to help children construct a semantic web, or concept map, showing the relationships they know between the event or object and the relevant scientific ideas, as well as ideas from other disciplines. Figure 1 is an example of a concept map based upon the major 1995 earthquake in Kobe, Japan. This kind of map can be used to organize a unit of study for children to facilitate their conceptual development in earth science (see Howick, 1993, p. 78 for a concept map based upon 1994's Hurricane Andrew). Concept maps are good to construct both before and after studying a topic. The ways children construct their post-lesson map, in comparison to their initial map, can tell the teacher a lot about what the children have learned and what their interests are.

[Insert Figure 1 about here: Concept map for a unit of study based upon the 1995 earthquake in Kobe, Japan]

Elementary age children are naturally curious about many natural events, such as earthquakes, severe weather phenomena, and natural disasters that affect people. Children frequently want to know more about underlying causes and factors related to such events, as well as the probability of future occurrences. One way students can investigate an event or phenomena further is to work in teams to interview relatives and other local people about their recollections of similar past events or situations. Older children could use tape recorders, transcribe, and summarize their research findings. Figure 2 shows a data collecting guide that could help children frame their study. The production of oral histories like this is what led to the success of the *Foxfire* book project.

[Insert Figure 2 about here: Black Line Master for Adult Interviews]

Integrating science across the curriculum

Events or objects often present opportunities for integrated instruction. There is a "math link" to many science-related events. In studying storms, for example, children can graph atmospheric variables, like temperature or barometric pressure, over a period before, during, and after a storm, and compare these with average figures for the period, which are usually available in the daily newspaper or on the Weather Channel.

Event-based science can be connected to reading and language arts by inviting children to locate trade books in the library that relate to the event or topic. Stories or particular excerpts from books can be read to the class, or the books can be used in interest centers for small group reading and discussion. Social studies concepts often can be connected to events like natural disasters in which the normal civil routines are disrupted and technologies such as transporation and communications fail.

The daily newspaper is a great source of information on local and global events that might have curricular connections. A classroom vertical file could be created for news clippings about events which are brought to class. Such clippings can be useful reference for student writing and project work as well.

Being on top of periodic events

Events like the solstices and equinoxes, lunar and solar eclipses, and meteor showers occur on a periodic basis and can be the basis of an "event science" lesson. While the local press and media is an adequate source of information for events like local weather phenomena, the "Farmers' Almanacs" (The Old Farmer's Almanac, 1993) are good sources of information about phases and eclipses of the sun or moon, meteor showers, and solstices, equinoxes, and cross-quarter days. For news of current events in the field of science, teacher's magazines like *Science & Children* and *Science Scope* have regular features on natural happenings. Both magazines publish monthly skycharts and announcements about events in the heavens. Other good magazine resources are periodicals such as *Science News, Discover, Scientific American*, and *National Geographic.*

The events of the real world frequently stimulate children's interest, and student interest is the ideal starting point for developing your curriculum. Eliot Wigginton sees children's interest as "the entry point" into the curriculum, an idea supported by John Dewey:

> If a teacher has all the things the kids are supposed to learn already arranged on a spectrum, then, ideally, student interest would be the entry point - the place along that spectrum where the worm enters the nut, the place where the kids get in and then branch sideways in all directions. In this situation, one has to question whether or not things need to be taught in a specific sequence. Usually they don't, and student interest can give you the starting point. Often, if you have to start teaching at the beginning of a prescribed sequence, student interest disappears before you take the first step. If it's possible to enter the sequence with an interesting topic...then the teacher can enter there and range back and forth across the curricular spectrum. John Dewey said, and I believe, that *everything* proceeds from student interest. The students' interests in various things help initiate the set of activities. Then each of those activities connects to others as new questions are generated....sooner or later, because each topic raises 10 more questions, all the material that was in the printed curriculum can be encompassed. (Knapp, 1993, p. 780).

Being Prepared - Materials to have on hand

For identifying and learning about the various objects and living things children bring to school, one excellent resource to have available is a set of field guides, such as the Peterson or Audubon series. Field guides are available on insects, birds, fossils, trees, ferns and mosses, mushrooms, wildflowers, rocks and minerals, reptiles and amphibians, mammals, and the night sky. The school library should have various field guides. Some resource suggestions are provided below.

Various instruments are useful in investigations as well. Teachers should have easy access to tools like doublet or triplet lenses (better than most magnifyers), and microscopes - and supporting supplies, such as slides, cover slips, medicine droppers, probes, scissors, and tweezers. For elementary student studies, the Brock Magiscope® is my favorite microscope -

it has superb optics, is extremely sturdy and durable, doesn't require supplemental lighting, and can be used in the field as easily as in the classroom.

Measuring devices also are useful to have on hand. These include thermometers, rain gauges, aenerometers, meter sticks, rulers, balance scales, graduated beakers or pitchers, and so forth. The class science log is also a useful tool. Children act like scientists when they make notes and measurements related to events, and accurate record-keeping can be a source of achievement for students.

Other useful tools to have accessible include a variety of containers to hold the ever-developing classroom collections (e.g. dishwashing tubs, empty coffee cans, magarine tubs, 35 mm film canisters, baby food jars and jars for caterpillars, other insects and spiders). A rock hammer and cold chisel could come in handy in looking inside rocks (and should always be used with safety goggles). An empty aquarium with a screened top should also be available to house temporary visitors from the Animal Kingdom. Garden trowels and other digging tools are useful for studying plants and soil organisms.

Questions to stimulate inquiry

Certainly, a variety of resources are required to support student investigations. Another key to children's success in learning science is the teacher's skill in mediating the experiences of the day. It is important for the adult to demonstrate curiousity and collaborative inquiry. Questions that stimulate inquiry will vary by the occasion. For example, during or after a big storm, an elementary teacher might ask the children, *How long did the storm last? How big was the storm* ? *Did the storm behave in a typical way?* (prevailing winds are west to east) *How are storms different? In terms of storm damage, what was the role of the built environment* (e.g. levies, dikes, bulwarks, river channels, filled wetlands, paved over land, buildings)? For a brought in object, a teacher might ask, *Where did you find it? How do you think it got there? What do you know about it?*

Educational researchers have found that in terms of the effectiveness of teaching strategies, the use of questioning is number one (Wise, 1994). Overall, questions that stimulate children's thinking include the following:

- attention focusing questions - *Have you noticed...?*
  - encourages observation of things that need to be noticed
- problem posing questions - *Can you find a way to...?*
  - provides achievable challenges
- measuring, counting, comparison questions - *Which is more...?*
  - provides opportunities for adding precision in observing
- theorizing questions - *Why do you think...?*
  - promotes consideration of multiple variables, contexts and/or frames, and the "big picture"
- action questions - *What happens if...?*
  - facilitates the discovery of a relationship between an event and what subsequently happens.

Good questions hold and focus children's attention and facilitate thinking, and that's essential as children construct and reconstruct their scientific knowledge.

Conclusion

The coming National Science Education Standards (NRC, 1994) can foster positive improvements in school science programs. As schools move to revise and renew science in the curriculum, educators should bear in mind the value of event-based science in the curriculum. Science programs should include event-based science, which is dependent both upon current phenomena and upon student interest. By "seizing the moment," teachers bring spontaneity to the curriculum. Also, by engaging student interest, they facilitate student development in the affective as well as the cognitive domain. Event-based science is an important component of the science teacher's instructional repertoire. With experience, teachers can take advantage of the unexpected while remaining faithful to the science curriculum envisioned by the National Standards.

RESOURCES

Federal Emergency Management Agency (FEMA: 500 C St., Washington DC 20472)

McDonald Observatory News (RLM 15.308, The University of Texas at Austin, Austin, TX 78712 - source for astronomical events such as eclipses, meteor showers, etc.)

National Weather Service (NOAA: Disaster Preparedness Office, 6060 13th St., Silver Spring, MD 20910)

National Hurricane Center (1320 South Dixie Highway, Rm 631, Coral Gables, FL 33146)

Natural Hazards Research and Application Information Center (Institute of Behavioral Science, #6, Campus Box 482, Univ. of Colorado, Boulder, CO 38039)

U.S. Geological Survey (Public Inquiries Office: 302 National Center, Reston, VA 22092)

Field guides, such as:

Menzel, D. H. (1964). *A field guide to the stars and planets.* Boston: Houghton Mifflin Company.

Raymo, C. (1982). *365 starry nights: An introduction to astronomy for every night of the year.* N.Y.: Simon & Shuster.

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Figure 2: Black Line Master; Interviewing

Name of Interviewer ______________________________ Date: ________________

Person Interviewed ____

Address ____

Phone/FAX/e-mail ____

Date of Birth: ______________________ Place of Birth: _____________________

Years resident (of state/region/locale)______________________________________

Relationship to Interviewer ____

Biographical information ____

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Event/phenomena discussed:____

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Notes and information ____

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[1]"While we're talking, time will have meanly run on: seize the day, not relying in the slightest on the future."