NOVEMBER 2008

Return To November Archive Home

In The Classroom: Curriculum

Curriculum: Enhancing Learning Across Disciplines

By Rebecca W. Keller, Ph.D.

When the naturally inquisitive nature of children is combined with science that relates to their world, they gain problem-solving skills that work for them through their entire lives. A solid foundation for acquiring and using all types of knowledge is created when real-world science is connected to other disciplines, and an atmosphere of inquiry that is inherent in science is encouraged.

Students who learn to ask questions properly and then analyze results gain discernment and evaluation skills – known as "critical thinking" – across all areas of study. The system of discovery learned in science class teaches students how to think and provides a transferable process for learning.

To take advantage fully of its inherent analysis and problem-solving methodology, science cannot stand alone. Processes such as considering parallels, differences, timelines, and other aspects of scientific concepts should be applied to language, history, philosophy, technology, and the arts. Since learning occurs in stages that require repetition, exposure to key concepts in multiple contexts promotes internalization of those concepts, and that promotes true understanding.

Teaching math in relation to each of the four core science disciplines (chemistry, physics, biology, and earth and space) is perhaps the most important interdisciplinary connection to prepare students for our increasingly knowledge-based work environment.

In many school systems, the approach to teaching science is a "little of this, a little of that, and a lot of memorizing."Essential connections between science and math are not made until the last years of high school, if then. But elementary students can more easily assimilate – and understand – the complexities of both science and math when they have learned the basics in real-life contexts early on.

The connections between disciplines such as art and science may not be as apparent as the links between science and math, but art can be a good example of the possibilities.

Both art and science are creative endeavors. During the Renaissance, the artists and the scientists were often the same people. Leonardo da Vinci both painted the Mona Lisa and explored anatomy and engineering. Michelangelo was both a great sculptor and the architect for St. Peters Cathedral.

A quote by Sven Carlson from Science News (1987) describes well the overlap between art and science:

"Art and science will eventually be seen to be as closely connected as arms to the body. Both are vital elements of order and its discovery. The word "art" derives from the Indo-European base 'ar,' meaning to join or fit together. In this sense, science, in the attempt to learn how and why things fit, becomes art. And when art is seen as the ability to do, make, apply, or portray a way that withstands the test of time, its connection with science becomes more clear."

Another way to think about the overlap between art and science is to consider that both attempt to explain some aspect of the real world. A good artist is able to capture the depth of meaning of the world around him through various art forms, such as music, painting, prose, or dance. And with this expression of meaning, good art will usually resonate with the audience on a deep emotional level, giving depth to their experience of the world around them. Science also attempts to capture the depth of meaning of the world around us, and good science will more accurately reflect the real world and thus withstand the test of time. Even the design of a machine, such as a computer, is influenced by artistic elements.

The second major benefit science contributes to a solid educational foundation is its ability to cultivate a larger sense of discovery and inquiry. It encourages the attitude of "Why?"

Having children participate in scientific investigation, such as hands-on experiments, promotes curiosity and the ability to analyze observations. Teachers can aid this by not considering any experiment to be a failure. Rather, if the result is different than expected, use the opportunity to ask why the outcome is different.

The discovery of "buckyballs" shows how unexpected and fascinating results can be created when scientists with different experience and research objectives collaborate and ask the right questions. The following story is condensed from information on the Nobel Prize Foundation's Web site, www.nobelprize.org. It illustrates the benefits of gaining interdisciplinary connectedness and encouraging the "why factor:"

In autumn 1985, Robert Curl, Harold Kroto and Richard Smalley made the completely unexpected discovery that the element carbon can exist in the form of very stable spheres containing 60 or 70 carbon atoms when graphite is evaporated in an inert atmosphere.

" We ought always to thank God for you, brothers, and rightly so, because your faith is growing more and more, and the love every one of you has for each other is increasing." (2 Thessalonians 1:3) (Read by Max McLean. Provided by The Listener's Audio Bible.)

Powered by BibleGateway.com

Kroto is a scientist whose special interest is in red giant stars rich in carbon. For years, he had the idea that long-chained molecules of carbon could form near such giant stars. He wanted to mimic this special environment in a laboratory. Curl suggested contact with Smalley, who had built an apparatus that could evaporate and analyze almost any material with a laser beam. Starting from graphite, the team managed to produce clusters of carbon atoms. Two questions immediately arose: How are these clusters built? Does a new form of carbon exist besides the two well-known forms graphite and diamond? Because they were driven to inquire about the unexpected result of the spheres, a totally new carbon chemistry has developed.

The discipline of architecture and design enters the picture, because these scientists got a clue to the structure of the newly discovered carbon clusters from a spherical building designed 18 years earlier by architect R. Buckminster Fuller. "Bucky" had used hexagons and a small number of pentagons to create the "curved" surfaces of his geodesic dome.

Kroto's team assumed that their cluster of 60 carbon atoms - C60 - consists of 12 pentagons and 20 hexagons with carbon atoms at each corner. They called the new carbon ball, C60, buckminsterfullerene. In colloquial English the carbon balls became "buckyballs."

The three scientists earned the 1996 Nobel Prize in Chemistry.

To encourage a love of learning and provide critical thinking skills that enhance learning across all disciplines, look for educational materials that bridge subject matter, teach critical thinking skills, and encourage a mindset of discovery.

Rebecca W. Keller, Ph.D. was a research assistant professor working in molecular biology at the University of New Mexico before making the decision to become a home-school mom. After searching for a science curriculum that taught solid science concepts in a manner understandable for youngsters, she started a company, Gravitas Publications, and developed a series of textbooks, lab workbooks, and teacher manuals.

Product Roundup

Principle Approach from FACE
What makes the Principle Approach curriculum from the Foundation for American Christian Education different? It is a methodology that teaches mastery of language, to articulate subjects, and causes the child to produce. It is designed around the "Christian Idea of the Child." It puts God at the center revealing His heart for a child, shows the teacher how to draw out what God has distinctly placed in them in contrast to just pouring knowledge in. It is based on the foundation that each child is an individual and has a purpose. It is seeing education as the source for learning to see God in everything.
www.face.net

Exploring Creation with Physical Science from Apologia
The Exploring Creation with Physical Science 2nd Edition from Apologia Educational Ministries offers many new features that will benefit both teachers and students. Students will continue to enjoy Dr. Wile's conversational writing style with updated information making the content more clear and relevant. Visual learners will enjoy the added color and extra video content available on the Multimedia Companion CD-ROM. Both teachers and students will benefit from additional practice work. Teachers will also have the added benefit of quarterly, semester, and year-end test to help prepare their students for the cumulative testing they will receive in college.
www.apologia.com

QualityCore from ACT
Improve course rigor and college readiness in your high school core courses with QualityCore, an instructional improvement program from ACT. QualityCore shows teachers the characteristics and best practices of rigorous courses, identifies the course-specific skills that lead to college readiness, and provides ways to measure student progress toward and attainment of those essential skills, so that all students have the opportunity to graduate high school prepared for college and careers. QuailtyCore offers end-of-course assessments, aligned formative assessment tools, and research-based models of rigorous instruction for 14 high school core courses.
www.qualitycore.org

Motivation Reading from Mentoring Minds
Developed by educators, Motivation Reading provides extensive supplemental reading practice for grades two through five. The student edition for each level contains twenty-five reading passages, with paired sections as an integral component of the fourth- and fifth-grade levels. Each level reflects a diversity of fiction and nonfiction passages related to curricular content in science, social studies, music, and art. Each unit contains: multiple choice questions, open-ended critical thinking questions, a journal entry, a study tip, a creative thinking activity, homework, and parent activities.
www.mentoringminds.com/reading

Gourmet Learning's Lesson Maker
Gourmet Learning's new Lesson Maker is poised to make superheroes out of ordinary teachers. The Lesson Maker, a Web-based reading tool, allows teachers to access a specific reading skill across grade levels. Differentiated Instruction has long been a key element of the successful classroom, but without facilitating tools, teachers have struggled to implement it. Lesson Maker will allow teachers to call up specific skills using their own search criteria and print lessons and activities they need when they need them.
www.gourmetlearning.com

Trampoline

Give your students a jump on learning with Trampoline, learning programs to nurture and inspire young minds. Each program introduces new worlds of knowledge to your classroom without the need for specialized training or additional staffing. Perfect for children Pre-K through 5th grade, the programs' modular design provides you with the framework necessary for even the youngest of learners to get a jump on learning in areas of Foreign Language, World Cultures, Art History, Music, Etiquette, and Sports.
www.trampolinelearning.com