



SCIENCE DISSECTED

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Wanted: Scientifically Literate Members of Society

Another election season passed and we had the opportunity to vote for candidates who will make decisions on issues that are rooted in science. Although each elected position has varying influences at the local and national levels, decisions will need to be made regarding many science-related policies. The voters and candidates need to consider questions such as, *Will the renewable energy initiative bring more jobs to Nevada? Should the government mandate insurance companies to cover cancer screenings? What are the advantages and disadvantages of storing nuclear waste at Yucca Mountain? Will climate change data be manipulated to support a partisan agenda? Should federal funds be used to support new lines of embryonic stem cell research? Should genetically modified meat be labeled in the grocery store? Will individuals on a school board force their religious views into the biology curriculum? Will endangered species or energy consumption be made a priority?* When faced with the variety of decisions that will be made, elected official should be capable of making informed decisions on the issues that will impact this country. As citizens, we might feel less than influential in selecting the candidates that run for office; but as teachers, we have the power to prepare our students to be informed voters and become scientifically literate members of society.

A scientifically literate individual is someone who has an understanding of scientific concepts and can use that knowledge to make informed decisions about science-related issues. According to the National Education Standards (1996), *“Scientific literacy means that a person can ask, find, or determine answers to questions derived from curiosity about everyday experiences. It means that a person has the ability to describe, explain, and predict natural phenomena. Scientific literacy entails being able to read with understanding articles about science in the popular press and to engage in social conversation about the validity of the conclusions. Scientific literacy implies that a person can identify scientific issues underlying national and local decisions and express positions that are scientifically and technologically informed. A literate citizen should be able to evaluate the quality of scientific information on the basis of its source and the methods used to generate it. Scientific literacy also implies the capacity to pose and evaluate arguments based on evidence and to apply conclusions from such arguments appropriately.”*

Throughout their schooling, students acquire a basic understanding of the natural world by relating the big ideas that were taught in their Earth science, biology, chemistry, and physics courses. Instead of recalling a collection of facts, students should be able to apply concepts. Furthermore, students should understand the process of science and that scientific ideas can be modified over time if new information is discovered. A common technique used by science teachers is to teach students to challenge the validity of claims. For example, if you see your favorite baseball player wearing a Phiten necklace, does that mean that you should buy one to improve your athletic ability? A student should evaluate the evidence and decide if athletic performance will improve with additional practice or by wearing a necklace that claims to emit particles that balance energy flow throughout your body.

Unscientific America

- ◆ For every five hours of cable news, less than a minute is devoted to science.
- ◆ 46% of Americans reject evolution and think that the Earth is less than 10,000 years old.
- ◆ The number of newspapers with weekly science sections has shrunk by two-thirds over the past decades.
- ◆ The public is polarized over climate change— an issue where political party affiliation determines one’s views.

From: <http://www.unscientificamerica.com/index.php>

A study released in February 2009 by the California Academy of Sciences revealed that most American adults are unable to pass a basic scientific literacy test. (A summary of the results of the survey are shown to the right.) Although most of the participants in the study did not answer the questions correctly, approximately 4 out of 5 American adults stated that science education is “absolutely essential” or “very important” to the healthcare system (86%), the economy (77%), and the global reputation of the United States (79%). Using the technique mentioned in the previous paragraph, how valid is the claim in this survey that only 21% of Americans are scientifically literate because they can answer all three questions correctly? One might argue that in order to develop a well-substantiated argument concerning topics such as climate change, evolution, or stem cell research, an individual should be able to recall basic scientific facts, have the ability to apply these facts, and evaluate the quality of evidence supporting the argument and counter arguments.

California Academy of Sciences Survey Results

- ◆ Only 53% of adults know how long it takes for the Earth to revolve around the Sun.
- ◆ Only 59% of adults know that the earliest humans and dinosaurs did not live at the same time.
- ◆ Only 47% of adults can roughly approximate the percent of the Earth's surface that is covered with water.
- ◆ Only 21% of adults answered all three questions correctly.

From: http://www.calacademy.org/newsroom/releases/2009/scientific_literacy.php

Despite the profession that our students choose, we need to help prepare them to make informed decisions related to science topics. This will require relating material in your classroom to real world examples and highlighting current science headlines. Also, emphasize cross-curricular connections to show that science influences other fields just as other areas, such as politics, influence science. Ohio State University completely revamped their introductory biology course by shifting from a cookbook laboratory approach to more inquiry-based methods. Professor Steve Rissing stated that his, “overarching goal is to teach students to be independent and objective thinkers, to create a group of scientifically literate citizens who can intelligently discuss multi-faceted issues such as stem cell biology, evolution, genetically modified organisms and the like.” The students who participated in this inquiry driven curriculum scored higher on their exams compared to students who learned through a direct instruction method. In addition to participating in modified labs, the students were also required to read and analyze the applications of science related articles from the New York Times. When asked about the results of the study, Dr. Rissing said, “My job isn't to prepare these students for med school. . . . My job is to help the students attain a level of scientific literacy so that they can contribute to a serious discussion on these larger issues.”

Teachers know and accept that not all students will pursue science careers, but when students graduate from high school, they should understand that science is a dynamic process. Students should also realize that the current choices that are made regarding policies will impact energy consumption, natural resources, the environment, and the overall health of future generations.

Related Sources:

National Science Education Standards- http://www.nap.edu/openbook.php?record_id=4962

American Adults Flunk Basic Science- http://www.calacademy.org/newsroom/releases/2009/scientific_literacy.php

Scientific Literacy Happens When Students Think for Themselves- <http://www.sciencedaily.com/releases/2007/02/070221093213.htm>

Unscientific America: How Scientific Illiteracy Threatens Our Future- <http://www.unscientificamerica.com/index.php>

Phiten Products Website- <http://www.phitenusa.com/default.aspx>