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Personal and Social Perspectives

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Developing Student Understanding

Item 1 [Peter Tuddenham](#) Oct 22, 2004 19:42

Developing Student Understanding

K-4

<http://books.nap.edu/html/nses/6c.html#sp>

Students in elementary school should have a variety of experiences that provide initial understandings for various science-related personal and societal challenges. Central ideas related to health, populations, resources, and environments provide the foundations for students' eventual understandings and actions as citizens. Although the emphasis in grades K-4 should be on initial understandings, students can engage in some personal actions in local challenges related to science and technology.

Teachers should be aware of the concepts that elementary school students have about health. Most children use the word "germs" for all microbes; they do not generally use the words "virus" or "bacteria," and when they do, they do not understand the difference between the two. Children generally attribute all illnesses to germs without distinction between contagious and noncontagious diseases and without understanding of organic, functional, or dietary diseases. Teachers can expect students to exhibit little understanding of ideas, such as different origins of disease, resistance to infection, and prevention and cure of disease.

Children link eating with growth, health, strength, and energy, but they do not understand these ideas in detail. They understand connections between diet and health and that some foods are nutritionally better than others, but they do not necessarily know the reasons for these conclusions.

By grades 3 and 4, students regard pollution as something sensed by people and know that it might have bad effects on people and animals. Children at this age usually do not consider harm to plants as part of environmental problems; however, recent media attention might have increased students awareness of the importance of trees in the environment. In most cases, students recognize pollution as an environmental issue, scarcity as a resource issue, and crowded classrooms or schools as population problems. Most young students conceive of these problems as isolated issues that can be solved by dealing with them individually. For example, pollution can be solved by cleaning up the environment and producing less waste, scarcity can be solved by using less, and crowding can be solved by having fewer students in class or school. However, understanding the interrelationships is not the priority in elementary school.

Central ideas related to health, populations, resources, and environments provide the foundations for students' eventual understandings and actions as citizens.

As students expand their conceptual horizons across grades K-12, they will eventually develop a view that is not centered exclusively on humans and begin to recognize that individual actions accumulate into societal actions. Eventually, students must recognize that society cannot afford to deal only with symptoms: The causes of the problems must be the focus of personal and societal actions.

5-8

<http://books.nap.edu/html/nses/6d.html#sp>

Due to their developmental levels and expanded understanding, students in grades 5-8 can undertake sophisticated study of personal and societal challenges. Building on the foundation established in grades K-4, students can expand their study of health and establish linkages among populations, resources, and environments; they can develop an understanding of natural hazards, the role of technology in relation to personal and societal issues, and learn about risks and personal decisions. Challenges emerge from the knowledge that the products, processes, technologies and inventions of a society can result in pollution and environmental degradation and can involve some level of risk to human health or to the survival of other species.

The study of science-related personal and societal challenges is an important endeavor for science education at the middle level. By middle school, students begin to realize that illness can be caused by various factors, such as microorganisms, genetic predispositions, malfunctioning of organs and organ-systems, health habits, and environmental conditions. Students in grades 5-8 tend to focus on physical more than mental health. They associate health with food and fitness more than with other factors such as safety and substance use. One very important issue for teachers in grades 5-8 is overcoming students' perceptions that most factors related to health are beyond their control.

Students often have the vocabulary for many aspects of health, but they often do not understand the science related to the terminology. Developing a scientific understanding of health is a focus of this standard. Healthy behaviors and other aspects of health education are introduced in other parts of school programs.

By grades 5-8, students begin to develop a more conceptual understanding of ecological crises. For example, they begin to realize the cumulative ecological effects of pollution. By this age, students can study environmental issues of a large and abstract nature, for example, acid rain or global ozone depletion. However, teachers should challenge several important misconceptions, such as anything natural is not a pollutant, oceans are limitless resources, and humans are indestructible as a species.

Although students in grades 5-8 have some awareness of global issues, teachers should challenge misconceptions, such as anything natural is not a pollutant, oceans are limitless resources, and humans are indestructible as a species.

Little research is available on students' perceptions of risk and benefit in the context of science and technology. Students sometimes view social harm from technological failure as unacceptable. On the other hand, some believe if the risk is personal and voluntary, then it is part of life and should not be the concern of others (or society). Helping students develop an understanding of risks and benefits in the areas of health, natural hazards--and science and technology in general--presents a challenge to middle-school teachers.

Middle-school students are generally aware of science-technology-society issues from the media, but their awareness is fraught with misunderstandings. Teachers should begin developing student understanding with concrete and personal examples that avoid an exclusive focus on problems.

9-12

<http://books.nap.edu/html/nses/6e.html#sp>

The organizing principles for this standard do not identify specific personal and societal challenges, rather they form a set of conceptual organizers, fundamental understandings, and implied actions for most contemporary issues. The organizing principles apply to local as well as global phenomena and represent challenges that occur on scales that vary from quite short--for example, natural hazards--to very long--for example, the potential result of global changes.

The organizing principles apply to local as well as global phenomena.

By grades 9-12, many students have a fairly sound understanding of the overall functioning of some human systems, such as the digestive, respiratory, and circulatory systems. They might not have a clear understanding of others, such as the human nervous, endocrine, and immune systems. Therefore, students may have difficulty with specific mechanisms and processes related to health issues.

Most high school students have a concept of populations of organisms, but they have a poorly developed understanding of the relationships among populations within a community and connections between populations and other ideas such as competition for resources. Few students understand and apply the idea of interdependence when considering interactions among populations, environments, and resources. If, for example, students are asked about the size of populations and why some populations would be larger, they often simply describe rather than reason about interdependence or energy flow.

Students may exhibit a general idea of cycling matter in ecosystems, but they may center on short chains of the cyclical process and express the misconception that matter is created and destroyed at each step of the cycle rather than undergoing continuous transformation. Instruction using charts of the flow of matter through an ecosystem and emphasizing the reasoning involved with the entire process may enable students to develop more accurate conceptions.

See the example entitled "Photosynthesis"

Many high-school students hold the view that science should inform society about various issues and society should set policy about what research is important. In general, students have rather simple and naive ideas about the interactions between science and society. There is some research supporting the idea that S-T-S (science, technology, and society) curriculum helps improve student understanding of various aspects of science- and technology-related societal challenges

9-12 Personal and community health

Item 2 [Peter Tuddenham](#) *Oct 22, 2004 19:44*

9-12 Personal and community health

Response 2:1 [Tina Bishop](#) *Oct 26, 2004 18:06*

I would like to see concepts and topics related sources and effects of marine pollution, such as toxins and pathogens included in this area of the standards. If students are shown the relationship of marine pollution to their own well-being, they may feel more closely connected to the ocean and develop a greater sense of responsibility for preserving it.

Response 2:2 [Gene Williamson](#) *Oct 28, 2004 14:13*

I agree with Tina (2:1). We have had several beach closures on the Oregon coast due to elevated bacterial levels in the water. This is a problem that has developed only recently, or at least only been detected recently. The nearshore ocean is making people sick.

5-8 Personal health

Item 3 [Peter Tuddenham](#) *Oct 22, 2004 19:44*

5-8 Personal health

Response 3:1 [Susan Snyder](#) *Oct 26, 2004 13:29*

Content topics: drugs from the sea, importance of plankton in its production of oxygen, importance of good water quality

Response 3:2 [Tina Bishop](#) *Oct 26, 2004 20:18*

Susan,
I agree with a focus on connections between ocean health and human health.
Diseases caused by polluted water is another topic.

K-4 Personal Health

Item 4 [Peter Tuddenham](#) *Oct 22, 2004 19:44*

K-4 Personal Health

Response 4:1 [Gene Williamson](#) *Oct 28, 2004 14:15*

Somewhere in personal health we have to introduce the safety issue. Waves, logs, critters, rip currents all are potential health hazards, and K-4 is probably not too early to introduce them. They can be expanded at upper grades.

9-12 Population growth

Item 5 [Peter Tuddenham](#) *Oct 22, 2004 19:45*

9-12 Population growth

Response 5:1 [Gabrielle Johnson](#) *Oct 27, 2004 18:19*

Estimating current populations and the food required to sustain them. for example look at local village in a remote part of the world and apply average world population growth to them, estimate how the village will change with time and what challenges will need to met with an increasing population: housing (impact local forests), sewage and trash (sanitary/health issues), food (can the region sustain them), what might be the impacts on the environment?

Response 5:2 [Francesca Cava, Nat. Geo. Society, Santa Barbara, California](#) *Oct 31, 2004 08:59*

How do demographics relate to population growth -- what is the impact of the movement of populations to coastal areas?

5-8 Populations, resources, and environments

Item 6 [Peter Tuddenham](#) *Oct 22, 2004 19:45*

5-8 Populations, resources, and environments

Response 6:1 [Robin Goettel](#) *Oct 25, 2004 19:17*

I have also worked with teachers to help their students master this standard using the topic of aquatic invasive species. This subject matter has been amazingly effective, in my experience, at illustrating the important connections between species population changes and their effects on aquatic resources. By teaching how people can play an important role in preventing future spread and new introductions, we can encourage personal and social responsibility that is the underlying goal of this standard.

Response 6:2 [Peter Tuddenham](#) *Oct 25, 2004 21:29*

thank you Robin, this is precisely the kind of response we want here. Thank you.

Response 6:3 [Susan Snyder](#) *Oct 26, 2004 13:50*

Content topics: Oceans are providers of goods & services (eg. fisheries, transportation). Oceans are barriers & conduits for trade and transportation (eg. Panama Canal, Intercoastal waterways.) Ocean resources are a focal point in shaping political & geographic policies (eg. ocean management at local to global scales, EEZ, fishing & whaling rights, global oceanic interdependence.)

K-4 Characteristics and changes in populations

Item 7 [Peter Tuddenham](#) *Oct 22, 2004 19:46*

K-4 Characteristics and changes in populations

Response 7:1 [Gabrielle Johnson](#) *Oct 27, 2004 18:14*

Examine phytoplankton/zooplankton dynamics. Daphnia and chlorella are both easy to grow and examine in the classroom.

Response 7:2 [Bob Stewart](#) *Oct 30, 2004 14:33*

What happens if we eat all the fish in the ocean? or kill all the sharks or whales? Zooplankton mow the sea just like we mow lawns. What happens if we disrupt the zooplankton, Fish eat zooplankton, etc.

9-12 Natural resources

Item 8 [Peter Tuddenham](#) *Oct 22, 2004 19:46*

9-12 Natural resources

Response 8:1 [Gene Williamson](#) *Oct 28, 2004 14:19*

The need for resources balanced against the potential environmental damage caused by an extractive (taker) society.

5-8 Natural hazards

Item 9 [Peter Tuddenham](#) Oct 22, 2004 19:46

5-8 Natural hazards

Response 9:1 [Susan Snyder](#) Oct 26, 2004 13:40

Content topics: hurricanes, tsunamis, global climate change, atmospheric ozone depletion and its effects on plankton and other marine organisms

K-4 Types of resources

Item 10 [Peter Tuddenham](#) Oct 22, 2004 19:47

K-4 Types of resources

Response 10:2 [Sarah Schoedinger](#) Oct 26, 2004 23:05

The oceans provide us with oxygen, food, energy and medicine. The oceans allow worldwide transportation. The oceans are a place for recreation.

[This is taken from your survey responses for this grade band.]

Response 10:3 [Bob Stewart](#) Oct 30, 2004 14:36

They really don't provide us with medicine as far as I know, it is still mostly a hope, with a few medicines in the pipeline.

Oil and gas comes from the ocean.

Oceans are a nice place to play-swim, surf, boat. Do you want to swim in a polluted ocean?

9-12 Environmental quality

Item 11 [Peter Tuddenham](#) Oct 22, 2004 19:47

9-12 Environmental quality

Response 11:1 [Francesca Cava, Nat. Geo. Society, Santa Barbara, California](#) Oct 31, 2004 08:57

How can environmental quality be maintained/enhanced?

- What is the role of marine protected areas?
 - Analysis of regional ocean issues and problems (ie, overfishing, introduction of exotic species, pollution)
-

5-8 Risks and benefits

Item 12 [Peter Tuddenham](#) Oct 22, 2004 19:48

5-8 Risks and benefits

Response 12:1 [Susan Snyder](#) Oct 26, 2004 13:35

Content topics: Risks: resource competition, overfishing, loss of habitat, spread of non-indigenous species, agricultural runoff, shoreline impacts, water quality. Benefits: ecotourism, economic development, sustainability, careers, ocean resources--fishing and mining.

K-4 Changes in environments

Item 13 [Peter Tuddenham](#) Oct 22, 2004 19:48

K-4 Changes in environments

Response 13:1 [Francesca Cava, Nat. Geo. Society, Santa Barbara, California](#) Oct 27, 2004 09:57

Physical processes drive global systems in which oceans are fundamental.

- The hydrologic cycle—relationship to the ocean (e.g., evaporation, transpiration, condensation, etc.)
- Ocean influence on weather and climate (e.g., connections to the water cycle)

Response 13:2 [Lynn Whitley](#) *Oct 28, 2004 04:11*

Changes in shorelines (e.g. effects of tides, beach transport, erosion).

Since this is "Personal and Social Perspectives," what about changes in environment due to human influences (development, pollution affecting habitat)?

Response 13:3 [Bob Stewart](#) *Oct 30, 2004 14:37*

How have people changed the environment? Plastics such as rings used to hold soft drinks, abandoned fishing nets, lost fishing lines, trash on the beach, etc.

9-12 Natural and human-induced hazards

Item 14 [Peter Tuddenham](#) *Oct 22, 2004 19:48*

9-12 Natural and human-induced hazards

Response 14:1 [Gene Williamson](#) *Oct 28, 2004 14:21*

Land use planning, or lack thereof, in the coastal zone.

Response 14:2 [Francesca Cava, Nat. Geo. Society, Santa Barbara, California](#) *Oct 31, 2004 08:52*

The ocean and bodies of water are modified by human activities, largely as a consequence of the ways in which human societies value and use Earth natural resources and human activities are also influenced by the ocean physical features and processes.

- Human influence on a global scale (ie, global warming, tragedy of the commons)
- Ocean influence on a global scale (ie, climate, ocean health/human health relationships)

5-8 Science and technology in society

Item 15 [Peter Tuddenham](#) *Oct 22, 2004 19:49*

5-8 Science and technology in society

Response 15:1 [Susan Snyder](#) *Oct 26, 2004 13:56*

Content topic: There are many interconnections among atmospheric, terrestrial, and ocean issues (eg. waste disposal, global climate change, point and non-point source pollution.)

Response 15:2 [Gabrielle Johnson](#) *Oct 30, 2004 19:34*

natural products from the ocean might fall under this

how are they discovered, harvested, etc.

Use of algal products in food production: algins, carageenan, etc.

K-4 Science and technology in local challenges

Item 16 [Peter Tuddenham](#) *Oct 22, 2004 19:49*

K-4 Science and technology in local challenges

Response 16:1 [Francesca Cava, Nat. Geo. Society, Santa Barbara, California](#) *Oct 31, 2004 08:55*

Why are there beach closures; where do the storm drains lead to, etc?

9-12 Science and technology in local, national and global challenges

Item 17 [Peter Tuddenham](#) *Oct 22, 2004 19:50*

9-12 Science and technology in local, national and global challenges

Response 17:1 [Gabrielle Johnson](#) *Oct 27, 2004 18:13*

Use of GIS to examine changes with time.

Remote sensing to make long-term predictions in climate change and examine changes in the earth system due to rainforest clearing, ozone depletion, erosion, etc.

K-12 Other topics

Item 18 [Peter Tuddenham](#) *Oct 22, 2004 19:50*

K-12 Other topics
