Welcome and Introduction
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Why is scientific literacy valuable?
What is scientific literacy?
What are some barriers to scientific literacy?
Is education sufficient for remedying barriers to scientific literacy?

Recap of discussion
The Personal and Social Value of Scientific Literacy

In a democratic society, an informed public is necessary for beneficial policy decisions. Furthermore, the proliferation of scientific knowledge has direct effects on technological innovation. In United States history, the need for adequate science education has been addressed again and again. From Thomas Jefferson to President Eisenhower, and still today, science literacy is of direct concern to the effective functioning of the U.S. government. By acknowledging the importance of scientific literacy for citizenry, the increasing complexity of our scientific knowledge seems to justify this struggle lasting throughout the history of the nation, and extending to greater human history as well.

Current Issues in which Scientific Literacy Matters:
The following issues are typically heated issues whose positions are either closely tied or informed by scientific data and practices.

- Global Warming
- Evolution
- Genetically modified foods and other biotechnology
- Costs, benefits, and trade-offs of nuclear power
- Economic effects of taxation
- The effect of gun control on crime

A national committee of scientists and engineers was appointed by President Dwight Eisenhower in 1959 to consider the issue of how to use the knowledge of science and engineering “to advance social and cultural life” (President’s Science Advisory Committee, 1959, p. 1). While not using the phrase “scientifically literate” the committee saw the need for a democratic citizenry that understands science for “intelligent democratic participation in many national decisions” (p. 21) and the place of science and technology in modern life.

What is Scientific Literacy?

Scientific Literacy and science literacy are related but distinct ideas. There is a difference between understanding scientific facts and well-confirmed theories, and the ability to see the logical relationships that are established in confirmed theories. Scientific literacy also includes the abilities to identify questions, form evidence-based conclusions, and understand how human activity plays effects the world we observe.

Awareness of Scientific Results

This involves knowing what facts and well-confirmed theories scientists accept and report, or knowing what is generally accepted as a methodologically sound argument. This might amount to knowing basic facts about science, like what atoms are or what the functions of certain biological processes are.

"Scientific literacy involves the use of key scientific concepts in order to understand and help make decisions about the natural world" (PISA, 2011).

Awareness of Scientific Methods

This speaks to the ability to distinguish between real science and what may be referred to as pseudo science. In other words, this refers to an awareness of scientific methods, which involves understanding scientific processes such as observation, data, and experimentation, as well as concepts of hypothesis, theory, evidence, test, and so forth. Awareness of scientific methods should produce and ability to recognize the difference between scientific and unscientific (sometimes pseudo-scientific) investigation even when a person is not especially familiar with the scientific field in question. Without this capacity to analyze and make judgments about a method, the facts serve little purpose.

Work Cited


Philosophical Questions for the Public:

1. Why is scientific literacy valuable?
2. What is scientific literacy?
3. What are some barriers to scientific literacy?
4. Is education sufficient for remedying barriers to scientific literacy?
Political Biases and Economic Figures

Scientific debates are often framed as political ones. Many new discoveries or breakthroughs in science and technology become directly related to politics and can become very controversial issues. Once certain issues like these start having economic and political impacts, the line between what is true and what is false becomes blurred and scientific literacy becomes even more important.

Carol Brewer, a biology professor at the University of Montana, Missoula, posited that scientific literacy is "knowing enough about science to be able to judge if the story that you are being told is being told in a fair and accurate way" (Brewer, 2008). The more an issue is in the public eye, and the more the media is concerned with topics like evolution, abortion, genetically modified foods, etc., the more incentive there is for people in power, like politicians and corporations, to sway people’s opinions to line up with their own agendas.

Data and information can be made to look certain ways in order to have the desired conclusions be drawn from said data. In statistics it is possible to skew population size/representation, confidence intervals, and other variables to make data sets, and experiments appear differently. Examples of this can be seen in political media. A recent scientific paper suggests that there are discrepancies in individual’s willingness to bend truths, depending on each person’s party affiliation. (Mooney, 2012) Aside from these results, however, it is apparent that there can be strong incentives to bend the truth for political gains. This is where costs to society begin to occur in regards to scientific literacy. It is important to be able to hear all arguments clearly and discern factual and credible stories from agenda-driven and misleading ones.

Examples of this can be seen in the recent documentaries concerning energy and the environment. The movies Windfall and Gasland describe the costs and benefits of wind energy and natural gas, respectively, and both focus on communities caught up in the green energy hype and now face less than desirable conditions (i.e. unclean tap water). People are enticed by energy companies to sign contracts to approve construction of giant windmills or fracking rigs and are not readily made aware of some of the costs associated with these kinds of things. While there are many relevant factors, scientific literacy plays a large role for people in this situation. Where they need to make an important decision and all of the relevant/needed information might be hard to ascertain and there is a special interest group trying to influence your decision for their gain by potentially giving you false or questionable information.

Respecting Personal Convictions

It has been a general tenet of western democratic societies that there are some area of one’s life and conscience in which government (democratic or not) should not interfere, and religion is perhaps the most prominent sphere for such freedoms. It is not possible to deny that many (though not all) religious views conflict with scientific ones. Can societies enforce scientific literacy, for example, through public schooling while respecting personal convictions? Are there ways of fostering scientific literacy without enforcing it that are fair? Is it fair to everyone when those who avoid scientific literacy receive equal say in public policy?

Psychological and Sociological Disposition

“‘It is difficult to get a man to understand something when his salary depends upon his not understanding it.’—Upton Sinclair.

Confirmation Bias

Science literacy might have less to do with education than appears at first blush, and more to do with the tendencies in people to favor evidence or conclusions that are consistent with currently held beliefs or hypotheses. This notion, or confirmation bias, is even more prevalent in scenarios where beliefs in question are emotionally or politically charged (i.e. evolution and abortion).

On this note, political affiliation is a better predictor of responses to questions about the threatening effects of a warmer climate than education level. A recent study shows that highly scientifically literate individuals who already endorse a view opposing the immediate threat of global warming are more skeptical of climate change risks.

Analogously, beliefs about what controversial policies like the Affordable Care Act (Obamacare) actually mandate is greatly correlated with political affiliation. What is not mentioned, however, is that discussion about whether particular mandates are good or bad does not typically show this relationship. You can ask a Democrat or a Republican if it is good or bad that insurance companies can deny clients for preexisting conditions, and most will agree that it’s bad. At the same time, the two might disagree about whether Obamacare actually accomplishes this.

Concern with livelihood

In some cases, eschewing scientific beliefs might be a matter of economic livelihood or social acceptance. Examples of this are detailed below: scientific issues are often tied to political platforms—platforms that typically characterize beliefs in social circles. In some scenarios, however, the concern might be a monetary one..
This informational handout was prepared by Kyle Beloin, Coren Frankel, and Colin Towne, the NAU Hot Topics Café Student Research Directors. Both Kyle and Coren have double majors in philosophy and political science, and Colin a major in Economics at Northern Arizona University.
A Deeper Look Into Scientific Literacy

In his article, *Scientific Literacy: New Minds for a Changing World*, Paul DeHart Hurd proposes that a scientifically literate person is one who:

- Distinguishes experts from the uninformed.
- Distinguishes theory from dogma, and data from myth and folklore. Recognizes that almost every fact of one’s life has been influenced in one way or another by science/technology.
- Senses the ways in which scientific research is done and how the findings are validated.
- Uses science knowledge where appropriate in making life and social decisions, forming judgments, resolving problems, and taking action.
- Distinguishes science from pseudo-science such as astrology, quackery, the occult, and superstition.
- Recognizes the cumulative nature of science as an “endless frontier.”
- Recognizes scientific researchers as producers of knowledge and citizens as users of science knowledge.
- Recognizes gaps, risks, limits, and probabilities in making decisions involving a knowledge of science or technology.
- Knows how to analyze and process information to generate knowledge that extends beyond facts.
- Recognizes that science concepts, laws, and theories are not rigid but essentially have an organic quality; they grow and develop; what is taught today may not have the same meaning tomorrow.
- Recognizes when a cause and effect relationship cannot be drawn.
- Understands the importance of research for its own sake as a product of a scientist’s curiosity.
- Recognizes that our global economy is largely influenced by advancements in science and technology.
- Recognizes when one does not have enough data to make a rational decision or form a reliable judgment.
- Distinguishes evidence from propaganda, fact from fiction, sense from nonsense, and knowledge from opinion.
- Recognizes there is much not known in a science field and that the most significant discovery may be announced tomorrow.
- Recognizes that scientific literacy is a process of acquiring, analyzing, synthesizing, coding, evaluating, and utilizing achievements in science and technology in human and social contexts.
- Recognizes the everyday reality of ways in which science and technology serve human adaptive capacities, and enriches one’s capital.
- Recognizes that science–social problems are generally resolved by collaborative rather than individual action.
- Recognizes that the immediate solution of a science–social problem may create a related problem later.
- Recognizes that short- and long-term solutions to a problem may not have the same answer.