

“The world has changed in such a way that science literacy has become necessary for everyone, not just a privileged few; science education will have to change to make that possible.” (AAAS xvi)

## The Importance of Science Literacy in Modern Culture

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Valuable results of scientific pursuits constantly surround us. These results, which include understandings of the harmful effects of smoking, the ability to use antibiotics to cure some diseases, and the ability to launch and use satellites for world-wide communications, are more than simply accumulations of facts about the world. Instead, these ideas and concepts have great explanatory and, often, predictive power. By having a scientific understanding of the world in which we live, we have some power to predict and control our environment (Bybee 26).

A scientifically literate person has acquired the ability to hold a scientific worldview, engage in scientific inquiry, and appreciate the scientific enterprise. A scientific worldview involves perceiving a largely understandable world, seeing scientific knowledge as durable but subject to change, and knowing when scientific inquiry is appropriate – and knowing that science does not claim to have all the answers (AAAS 2-3).

Scientific inquiry is a process of making sense of the world and developing explanations of the natural world (Cartier, et al. 4) often through the use of models. It is a scaffolded endeavor, integrating scientific content and disciplinary procedures; as such, inquiry will look different in a biology class, or an earth sciences class, or in a physics class because scientific methodology itself is different in those disciplines. The methodologies

reflect the needs and structure of the discipline; someone who is scientifically literate should be able to understand and identify the roles of differing methods.

The scientific enterprise plays a monumental role in contemporary society; in fact, it may be the modern era's defining feature. Residents in these times run the risk of being powerless if they fail to understand science as a complex social activity, run by humans. Scientists are not isolated; they exhibit the same biases and social tendencies as other humans. No scientific research is ever completely objective. However, these scientists agree to certain rules of ethics and conduct, so that the amount of bias and conflict in the results is minimized (AAAS 10-12).

“If the goal of ‘understanding for all’ is to be achieved, then the science education community must recognize that understanding in science develops through practice and that we must design classrooms where realistic practice can happen.” (Cartier, et al. 11)

Because of the nature of science, acquiring such an understanding requires much more than simply memorizing facts or reproducing experimental methods. Instead, students must build new understandings on what they already know, modifying their current conceptions when necessary, by engaging in some form of generative scientific inquiry into authentic questions (NRC 116-119).

Teachers have a daunting task ahead of them: to provide students with such experiences in a meaningful way. For example, the National Science Education Standards point out the relevancy of studying Lake Erie's pollution in Cleveland and earthquakes in Los Angeles (31). Such examples illustrate that students don't assimilate understanding in

isolation of what they already know; furthermore, they will be more likely to transfer knowledge gained in these studies to their everyday lives. When a Cleveland resident learns about the water cycle and waste management in terms of the nearby lake, she is going to be more likely to address everyday issues such as waste disposal in a meaningful way, instead of simply appealing to authority (such as her community's laws).

One challenge for teachers, then, is to transform the classroom culture from a traditional one wherein the students look for affirmation of a right answer from their teachers to one which "empowers the students to determine for themselves whether they have offered an acceptable explanation" which is supported by their evidence and through their inquiry, rather than an authority (Cartier, et al 8).

**"In the long run, no scientist, however famous or highly placed, is empowered to decide for other scientists what is true, for none are believed by other scientists to have special access to the truth." (AAAS 7)**

Getting beyond the demands of authority is one of the true powers of scientific literacy. Someone who is scientifically literate is able to interpret, criticize, and evaluate claims that he hears. He will know how to research relevant data, examine evidence, and draw appropriate conclusions - because theories are judged by their results (AAAS 9).

Thus, scientific literacy is also generative. One is not limited to the facts and knowledge that she acquired in high school; rather, as she ages and as stronger scientific theories replace weaker ones, she will be able to use her scientific skills to understand the changes. She can also make observations and run small experiments for her own benefits - such as determining whether playing music for her plants causes any change in growth - based on processes that she learned throughout her school years. This is a necessary skill

for citizens to have so that they avoid advertising traps and political ploys. Moreover, because of the sheer amount of available knowledge in this age, a citizen without scientific literacy would have no basis for discerning the valuable from the worthless.

One of the great hopes is that by providing all people with a working understanding of science, they will be able to benefit personally, through their access to individual fulfillment and enjoyment and through their agency to make informed decisions. Then, society at large should be able to benefit from judgments concerning shared resources such as air, water, and forests (NSES 11).

“The world looks so different after learning science. ... These are beautiful things, and the content of science is wonderfully full of them. They are very inspiring, and they can be used to inspire others.”(Feynman, 1966)

The scientific worldview is a lens through which blurry facts about the world come into sharp focus. It is not enough for us to have scientific content knowledge. As long as we remain unaware of the usefulness of the knowledge, how it was obtained, and how it can be critically examined, that knowledge is just a blur without value. By embracing scientific inquiry and committing ourselves to instituting our students with the understanding of the roles of science and the benefits that authentic scientific investigations can provide, we can hope to equip them for a future where they are empowered and able to explore and challenge what they see.

“Above all, the great potential benefit to students requires that we act now. There is no more important task before us as a nation.” (NSES 9)

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