

YOUR BELIEFS VS. THE FACTS

Bias and self-deception are fierce foes of science. That's why evidence-based debate is so vital.

By Thomas W. Martin Tempe, Ariz.

Twenty years ago, as a college freshman, I knew precisely what it meant to be scientifically literate. In fact, I held an objective measure in the palm of my hand, courtesy of E.D. Hirsch. His book, "Cultural Literacy: What Every American Needs to Know," was a bestselling paperback, and conveniently listed thousands of names, terms, and phrases with which every educated person – he informed us – should be familiar.

After plodding through the entire list during the course of an afternoon, I smugly discovered I could easily define each item of scientific vocabulary. Fuzziness about literary examples such as "Aeschylus" caused me no discomfort, but inability to rigorously describe "aerobic respiration" in the biochemical sense (not the superficial, then-popular Jane Fonda sense) would have induced severe nerdish embarrassment.

The wrong kind of scientific literacy

Today I teach science and its history at an honors college and am naturally far less confident about how to measure scientific literacy. The students who enter our program possess not only the expected high SAT scores, but also perfect or near-perfect scores on a battery of Advanced Placement exams, particularly in the basic sciences.

A noticeable portion of those students also believe in the literal truth of certain ancient accounts of Earth's history that, to put it bluntly, directly contradict mountains of well-established data from geology, climatology, and biology. Without rehashing the ongoing culture wars surrounding this topic (and certainly without berating my own students), this serves as a useful place to begin tackling the notion of "scientific literacy."

We frequently hear the refrain that if America simply raised the level of science courses, taught our children more subjects, and/or gave them more hands-on lab work, it could ensure the production of a citizenry capable of understanding an increasingly complex world. They would then be prepared to make the difficult choices of the 21st century.

However, my incoming students' technical mastery already exceeds what even the most rosy-eyed optimist could realistically dream for America (or the globe) as a whole. In other words, even if a citizenry were to achieve an impressive degree of scientific literacy – construed as raw conceptual competence – it would still be entirely possible for those same citizens to routinely subordinate scientific evidence to their own deeply ingrained cultural suppositions.

Evidence blindness

More important, the phenomenon of "evidence blindness" is hardly restricted to inexperienced students, or even to ideological segments of the general population. To varying degrees, it can be found across the spectrum, including some very striking examples in the realm of professional science itself.

As noted last year in Seed magazine, leading disciplinary practitioners who feel threatened by unorthodox new findings will sometimes band together to suppress such information, with the explicit intention of blocking its appearance in scientific journals.

While these luminaries undoubtedly convince themselves they are merely upholding the integrity of their fields, the truth is that they (in quintessentially human fashion) are often more interested in preserving cherished beliefs than in encouraging potentially disruptive discoveries.

Over the past few decades, growing evidence from cognitive science has revealed significant limits on the ability of individuals to criticize their own viewpoints. Even the most analytically gifted and experienced among us are susceptible to bias and self-deception to an extent that we (fittingly enough) generally fail to appreciate.

As psychologist Daniel Gilbert puts it in his book "Stumbling on Happiness," "Each of us is trapped in a place, a time, and a circumstance, and our attempts to use our minds to transcend those boundaries are, more often than not, ineffective."

The reason science does manage to be astonishingly effective is not because large groups are automatically wiser or less prone to self-deception than individuals. History adequately demonstrates that, if anything, the opposite is more nearly the case.

Science works because its core dynamics – not its methods or techniques per se – are rooted in pitting intellects against one another. Science eventually yields impressive answers because it compels smart people to incessantly try to disprove the ideas generated by other smart people.

The goal of science is to find those ideas that can withstand the long and hard barrage of evidence-based argument. That lesson must be experienced anew by the members of each generation, irrespective of their careers.

Mastery of scientific concepts and theories is a necessary starting point, but it serves only as a prerequisite to joining the never-ending dialogue. Students must learn firsthand how to both imaginatively create new hypotheses and dispassionately critique them.

Many commentators have rightly implored us to make certain that young people encounter the "thrill" of discovery. While this is undeniably desirable, it is arguably even more crucial that they experience the agony (if only on a modest scale) of having a pet hypothesis demolished by facts.

Several current presidential candidates have insisted that they oppose the modern scientific account of Earth's natural history as a matter of principle. In the present cultural climate, altering one's beliefs in response to anything (facts included) is considered a sign of weakness.

Students must be convinced that changing one's mind in light of the evidence is not weakness: Changing one's mind is the essence of intellectual growth.

By encouraging students into evidence-based debates with one another, this mode of interaction, like any other, can become habitual. After being consistently challenged by their peers, most students eventually see that attempts to free themselves from facts are a hollow, and fundamentally precarious, form of "freedom."

Value in criticizing ideas

In an era in which we tremble at offending the sensibilities of our neighbors, students must comprehend that it is not only possible but absolutely vital that we criticize one another's ideas about reality firmly yet civilly. They must do this despite clear cases of prominent scientists falling into petty, acerbic (and therefore counterproductive) exchanges.

The responsibility for fostering scientific literacy of this sort – that is, literacy construed as an ongoing commitment to evidence over preconception – falls upon all of us in our discussions both formal and informal, both public and private. When scientific celebrities fail to set a good example for students, it is especially incumbent upon the rest of us to set them back on the proverbial right track, rather than to reflexively hasten their derailment.

We do our children no favors by going easy on them – or, more to the point – allowing them to go easy on each other. Nature has a way of being far tougher.

If we can create environments in which they can safely have small epiphanies in the light of evidence, they will be motivated to share those lessons. They will then be scientifically literate in the sense that scientific discourse will continue to endure and flourish. And that is the sense that ultimately matters.

• Thomas W. Martin is an honors faculty fellow at Barrett Honors College at Arizona State University in Tempe. This was the winning essay of the Second Annual Seed Science Writing Contest, published in *Seed* magazine, Issue 12, September/October 2007.

JULY 12, 2010, 6:12 AM

Facts Are Stubbornly Rejected Things

Today's idea: Facts don't necessarily have the power to change our minds. In fact, quite the opposite, cognitive research shows.

Psychology | “Whenever the people are well-informed, they can be trusted with their own government,” Thomas Jefferson wrote in 1789. But you might want to rethink that axiom, recent University of Michigan research suggests. It “found that when misinformed people, particularly political partisans, were exposed to corrected facts in news stories, they rarely changed their minds,” writes Joe Keohane in The Boston Globe.

He explains the cognitive studies reviving longstanding concerns about voter ignorance:

Wikipedia/David Monniaux

In reality, we often base our opinions on our *beliefs*, which can have an uneasy relationship with facts. And rather than facts driving beliefs, our beliefs can dictate the facts we choose to accept. They can cause us to twist facts so they fit better with our preconceived notions. Worst of all, they can lead us to uncritically accept bad information just because it reinforces our beliefs. This reinforcement makes us more confident we're right, and even less likely to listen to any new information. And then we vote.

It's rather like The Onion headline says: “Area Man Passionate Defender of What He Imagines Constitution to Be.” [The Boston Globe]