



Are we accidentally teaching students to mistrust science?

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Almost 60 years ago Jawaharlal Nehru speaking about the future of India's economy and society observed that it is "science alone that can solve the problems of hunger and poverty, of sanitation and literacy, of superstition and tradition, of vast resources running to waste, of a rich country inhabited by starving people... The future belongs to science and to those who make friends with science." There is little doubt that Nehru's 1960 claim was an exaggeration; nevertheless, now in the year 2020, one could easily conclude that Nehru has been vindicated for the most part, not thinking specifically about India, but generally for all of us.

Vaccines developed through medical science have nearly vanquished childhood diseases. The application of genetic science and biotechnology has led to the development of a rice strain that for the first time contains Vitamin A thus opening up the possibility for significantly reducing Vitamin A deficiency amongst those who suffer this deficiency the most. We have learned so much about the evolution of humans that we can now confidently say that all of humanity is one large biological family.

But, it is also true that the growth and application of scientific knowledge has brought problems. Our industries and our population put pressure on our environment, especially the atmosphere. On the other hand, through climate science we have discovered the problem and know much about the cause – which means we have scientific knowledge that can inform policy in response to our environmental problems.

Nehru, I should think, would be pleased but he likely would also be shocked to learn that many people in 2020 dissent from the science I have described. All of the above have strong scientific support and yet there are dissenters.

There are people who argue that vaccines are dangerous and parents who think this do not want their children vaccinated, putting their children and those in contact with them at risk. There are people who think that GMOs are inherently dangerous to both the environment and to one's health, and thus should be banned. There are people who are adamant that humans have not evolved from earlier ancestral forms; thus, they want to restrict the teaching of evolutionary science. And, there are people who do not think that human impact on the environment is a problem and so they resist policies intended to reduce human impact on the environment.

What these dissenters have in common is that they do not trust some part of science that the science community considers settled. There are many reasons for such lack of trust, and there is considerable research literature addressing the phenomenon. Amongst the many possible reasons, what intrigues me is the dissent that challenges well-supported science as "just a theory," as in, "evolution is just a theory" where the dissenter is implying that the science could well be wrong and so we don't really need to pay attention to it.

Such a view of what "theory" means, of course, indicates a misunderstanding of the scientific use of the concept of theory. The thing is, we as science educators may not be faultless; after all, a major

tenant of the nature of science that we teach our students is that "scientific knowledge is durable, but can change in light of new evidence or changes in perspective." We teach that scientific knowledge is tentative and because we do, a major scientific journal has sounded an alarm:

Perhaps a more pressing criticism of the way NOS is taught in schools is that it encourages rather too much doubt over scientific ideas. Many findings, after all, are well established and, indeed, taken as such by professional scientists who use them as shoulders to stand on. Not all science is tentative, and researchers should not be shy about saying so — both to those in schools and to those in charge of schools. (Nature, 2017, p. 149).

Giving serious attention to what concerns the editors at Nature, we science educators should realize that some in the public will conceivably conclude from the tentative nature of science that some science can be wrong regardless of how well-

established the science community considers that science to be. As science educators, we thus may find that we have been too effective at teaching this particular aspect of the nature of science.

Clearly, here is an agenda for science education research that needs to be pursued. We need a much better understanding of how students interpret and apply the idea that scientific knowledge is tentative vis-à-vis the durability of scientific knowledge. We need better approaches for teaching the tentative nature of science in light of scientific durability; as well as teaching the reverse, that is, teaching the durability of scientific knowledge in light of the inherent tentative nature of knowledge. This is an agenda we must take seriously if we are to avoid later finding that our teaching about the tentative nature of science actually undermined confidence in science... that we have accidentally taught students to mistrust science.

Editors. (2017). School daze: As US states turn the screw on science education, researchers everywhere should pay more attention to how their subject is presented. *Nature*, 543, 149.

Nehru, J. (1960). Science Quotes by Jawaharlal Nehru. Dictionary of Science Quotations Scientist Quotations Index. Retrieved from https://todayinsci.com/N/Nehru_Jawaharlal/NehruJawaharlal-Quotations.htm

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