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How Can We Help Students Really Understand Evolution?

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How Can We Help Students Really Understand Evolution?

Public understanding of science in the United States leaves much to be desired. Scientists frequently put the blame for this shortcoming on literal readings of religious texts, dubious political motivations, or the mistaken assumption that conflicting views deserve equal emphasis. A more powerful alternative explanation is available, however. Postsecondary science educators commonly ignore strong, long-standing evidence on the effectiveness of their teaching methods. Consequently, most college graduates lack tools for rationally comparing conflicting ideas and deciding which arguments, scientific and otherwise, are well-founded. Some of these graduates become business, governmental, and religious leaders; teachers; and doctors and other applied scientists. Public rejection of sound science is not primarily the result of some facet of popular culture. Rather, it is the predictable result of ill-founded pedagogical choices.

Such ill-founded approaches rely mainly on didactic presentation and overemphasis of the dry facts of content, to the exclusion of effectively teaching the nature of science. In contrast, methods that require frequent student-to-student discussion, structured by appropriate materials, produce large gains both in content learning and in sophistication of understanding. Furthermore, the naive conceptions that students often hold when they enter the classroom typically persist despite intensive scientific instruction in contrary viewpoints. However, when students make direct comparisons of their naive misconceptions with scientifically better-founded schemes, change is frequent. Naive views predominate publicly as a predictable consequence of pedagogical choices that ignore them.

Steven Verhey's article (p. 996) provides powerful evidence. Strong emphasis on evolution alone produced almost no change in students' conceptions. In contrast, discussions comparing "intelligent design" with mainstream evolution, with a focus on the nature of science, produced extensive change toward more scientifically viable views.

How can we reconcile Verhey's effective pedagogy with the strong stance taken by AIBS (and myself elsewhere) against requiring the teaching of intelligent design or creationism in high-school science classes? "Teaching" means two different things in the public argument. Advocates of teaching intelligent design or creationism along with evolution assume that each alternative will be taught as equally valid (or that evolution will be critiqued and the alternative will not). That is clearly wrong, factually and morally. Verhey's approach, like those shown to be effective in physics, helps students compare alternative views. If intelligent design is presented, it must be critiqued scientifically. For example, Michael Behe's claims would be paired with Kenneth Miller's marvelous critiques. Verhey shows that such an approach appreciably increases acceptance of evolution. My experience is that it enhances understanding of the strength of the scientific support for evolution even among students who continue to reject evolution on religious grounds. The trick is to use such an approach in ways that are simultaneously scientifically rigorous and sufficiently respectful of students' initial attitudes and religious views. This may be difficult in high-school classes in many communities, especially since college science classes have prepared so few of the teachers to do it well, and so few of the parents and politicians to understand and support it. Hence, it would be quite inappropriate to require such comparisons in high school. But it is time for college and university classes to more effectively help future teachers and other leaders understand why there is no contest scientifically between creationism and evolution. Didactic assertions will not achieve this. Active comparisons by students will.

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