Nelson's Response to Black

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Source: BioScience, 56(4) : 286

Published By: American Institute of Biological Sciences

URL: https://doi.org/10.1641/0006-3568(2006)56[286:NRTB]2.0.CO;2

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Black correctly notes that many biologists have argued against teaching creationism in the science classroom. This may be changing. Alberts (2006) states: "I believe that intelligent design should *be taught in college science classes.... It is through the careful analysis of why intelligent design is* not *science that students can perhaps best come to appreciate the nature of science itself" (emphases in original).*

*Black suggests that my enthusiasm for Verhey's results might not be justified. Verhey compared two pedagogical approaches: one teaching only evolution and the other comparing creationism and evolution. Quite helpfully, Black's letter led to the discovery of several errors, now corrected. Fortunately, the original conclusions remain strongly significant. Black suggests refining these by comparing only changes toward greater acceptance of evolution. Testing these appropriately (i.e., excluding the students who could not have changed toward greater acceptance of evolution) yields a difference that is suggestive but not conclusive (*p = *0.094, two-tailed;* p = *0.059, one-tailed). The immense amount of work with misconceptions in science (below) might make a one-tailed assumption more appropriate. Importantly, all 9 students who shifted toward evolution with comparative pedagogy started in one of the three more conservative positions (positions that reject large parts of evolution), as did only 1 under the evolution-only pedagogy. Thus, with comparative pedagogy, almost 50 percent (9 of 19) of the most religiously conservative students became more accepting of evolution, shifting to a modal position of theistic evolution.*

Advocates of theistic evolution typically accept the full array of evolution. Although the data are only suggestive, statistically, for the smaller numbers available for this narrower comparison, the effect size is quite large and important and is concordant with much research on changing conceptions in science. I still find this notable, if not powerful, evidence that Verhey's pedagogy produced "extensive change toward more scientifically viable views."

Black also suggested that a number of possible confounding variables were present. I agree, but find them quite unlikely to have spuriously led to Verhey's results. Differences in learning outcomes among instructors using similar, traditional pedagogies are small compared with the differences between pedagogies (Hake 1998, Sundberg 2003). Importantly, deeply held prior ideas are typically unaffected by instruction in science that does not directly engage them (Bransford et al. 2003, Duit 2006).

The evolution-specific literature suggests several scientifically rigorous ways to compare evolution with alternative conceptions (e.g., Sinclair and Pendarvis 1998, Nelson 2000, Alters and Nelson 2002, Alters 2005, Scharmann 2005, Wilson 2005).

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