Chapter 12

Teaching Controversial Topics Such as Evolutionary Theory

Tips and Tools

Cristine H. Legare and David M. Buss

We are psychology professors at the flagship public research university in our state, The University of Texas at Austin. One of the core missions of this university is to educate the residents of the state of Texas. As faculty members and educators, we take that responsibility seriously.

The students at UT Austin come from every region of the state. Our state is highly diverse along many dimensions—ethnically, linguistically, religiously, socioeconomically, and politically. As a result, the intellectual diversity represented by students at UT Austin is substantial. We view this diversity as a strength and strive to make all students feel welcome and included in our classes.

Our students vary in the amount of exposure they have had to beliefs that differ from their own; they vary in their exposure to science. Many are still in the process of learning about different perspectives and developing their own views. Many have had little exposure to, or experience with, discussing controversial topics.

We both teach evolution in our psychology courses, which range from human cognition and culture to human sexuality. Teaching evolutionary science illustrates the challenge of teaching a conceptually difficult and controversial topic.[1] Evolution by natural selection is deceptively simple in theory, but it turns out to be one of the more difficult scientific concepts for students to understand; it requires the integration of subject expertise and skilled teaching methods for students to learn it effectively.[2] Students regularly misunderstand what evolution is and how it occurs. This is especially true for

students living in a state like Texas, which has largely omitted evolutionary theory from K–12 education, largely due to ideological and religious objections. One of the implications of the omission of evolution from biological science curricula is that students often do not understand what evolution is, and thus cannot effectively assess why it is viewed by some as controversial. Students must have an accurate understanding of what evolution is to develop educated perspectives about how it is applied to explain human cognition and behavior.

In our courses on how evolutionary theory illuminates human nature, we've developed several teaching tools. One is to start with nonhuman animal examples. Animal examples help students think beyond their own species-centrism. Most species have predators that they have to defend against to survive. People can readily see that a porcupine's quills, a skunk's malodorous spray, and a turtle's hard shell are adaptations to defend against predators. These examples also illustrate the principle of natural selection. Turtles whose shells are a bit thicker and skunks whose spray is a bit more noxious to predators are more likely to survive long enough to reproduce, so their descendants inherit the qualities that led to the survival success of their parents. People then start to grasp the concepts of *variation* (individual differences in turtle shell thickness) and *differential reproduction* (turtles with thick shells leave more descendants than those with thinner shells)—the essence of Darwin's theory of natural selection.

By using animal examples, we illustrate that many adaptations are not invariantly expressed, but rather have evolved to be *context-contingent*, activated by specific features of the environment. Cats commonly grow longer fur in the winter, an adaptation to keep their bodies warm and insulated, but grow shorter hair in the summer when bitter cold does not pose a survival challenge. This example also hits home the core of natural selection—variation (individual cats differ in their ability to shift from short to long hair depending on the season) and differential reproduction (cats that survive the winter reproduce more), causing evolutionary change (cats in the next generation are descendants of the subset of cats that have better season-dependent hair growth abilities).

Once students start to understand the logic of adaptation and natural selection in animals, the next step is to shift to humans, beginning with the human body. Again, we begin by focusing on challenges of survival, such as adaptive problems of food selection or dangers that come from abrasions to the human skin. It's relatively easy to highlight evolved food preferences for substances rich in calories and food aversions to ingesting substances containing toxins—preferences for sweet things such as ripe fruit and aversions to ingesting bitter objects. Abrasions to the human skin caused by repeated friction activate the ingenious adaptation of a callus-producing mechanism,

the ability to grow thicker skin in the precise locations of repetitive friction. This example also has the benefit of highlighting that many adaptations are context-specific, functioning to be activated only when confronted by specific environmental challenges.

While most people can comprehend evolution by selection in non-human animals and many can grasp that the same principles apply to the human body, by far the biggest hurdle comes from showing that precisely the same principles apply to the human mind. We point out that the mind is housed in the brain, and the brain is part of the body (a rather important part), so there is no reason to think that the brain has been exempt from evolutionary processes. A relatively easy example provides an entry point—*the behavioral immune system*. Just as humans have a physiological immune system (e.g., white blood cells called leukocytes that destroy disease-causing organisms) to fight off pathogenic dangers to the body, humans have a behavioral immune system that functions to avoid contact with those disease vectors to begin with. We have evolved the emotion of disgust, which causes us to be repelled by contaminated foul-smelling food; and we recoil from other humans who show symptoms of coughing and sneezing—two common disease vectors. This example highlights that those human emotions (e.g., disgust) and behaviors (e.g., avoiding contaminants)—adaptations housed in the brain—are also products of evolution by natural selection.[3] These fundamentals provide a much-needed scaffold for discussing a larger array of psychological adaptations—those for mating, parenting, cooperation, aggression, negotiating status hierarchies, and many other recurrent challenges of group living.

Teaching tools that follow this logical progression makes it easier to grasp the core evolutionary concepts of adaptation and natural selection. With these core building blocks in place, students are now primed to comprehend that variation and differential reproduction depend not just on survival success, but also on reproductive success. They are also prepared to reason about the brain as the product of evolution by natural selection, and thus to consider all of the implications of applying evolutionary theory to understanding human cognition and behavior.

Evolutionary theory is controversial, in part, due to misunderstandings about it. One is the misunderstanding that it's a theory of *genetic determinism*—the erroneous notion that genes determine human behavior with no input from the environment. Instead, evolutionary theory is an interactionist paradigm that invokes environmental causation at every step of the way—from the environments that are responsible for selecting adaptations, to the development of those adaptations over the lifespan, to their activation in the current environment. A second misunderstanding is the *naturalistic fallacy*, which assumes that what exists ought to exist in a moral sense. In fact, people decide that many products of evolution by selection should not exist, and we

design interventions to ameliorate them. Examples include parasites dangerous to humans and adaptations for aggression; in both cases, interventions have been highly successful, as rates of violence have plummeted over the past few hundred years.[4] What ought to exist—a matter of values—should not be conflated with what does exist.

Another source of controversy is whether evolutionary theory is fundamentally incompatible with certain religious beliefs. In some cases, evolutionary theory is indeed fundamentally incompatible with beliefs such as the creation of all life forms in six days by a higher deity. Many people, however, easily reconcile their religious beliefs with evolutionary theory by positing that a higher deity created the laws of natural selection, and then let that natural causal process play out over millions of years.[5] Rather than telling students what they should believe, we present the range of positions regarding reconciling evolutionary principles with religious beliefs (or not) and let them decide for themselves.

It has been our experience that students in our courses enjoy the opportunity to engage in open dialogue about intellectual topics, including controversial topics such as evolution. We incorporate debate and discourse into our courses, as core activities central to our educational objectives. Facilitating respectful discourse based on evidence and critical thinking is an essential function of university education, and necessary for protecting and promoting an educated and democratic civil society.

We strive to develop critical thinking in our students in several ways. One way is to create a classroom environment that facilitates diverse opportunities for interaction and participation. We use critical thinking activities such as debates, problem-based group activities, thought-provoking films and videos, discussions about current events, and whole class discussion formats as tools to promote active participation. For example, we often assign students to groups on different sides of a controversial issue in evolutionary social science and have students work collaboratively to present the diverse perspectives to an audience of their peers. Following the in-class debate, we ask students to write a critical analysis of the issue by incorporating empirical data on the topic. To provide opportunities for students to develop analytical writing skills, we design creative writing assignments for students. To support empirically based appraisals and critical thinking, students contrast and compare scientific and popular media sources on an important educational issue such as evolution, review both, and come to an informed conclusion.

What are some key lessons that can be drawn from trying to teach students who have different political and religious beliefs, and come from diverse socioeconomic and ethnic backgrounds? One lesson is that active engagement is crucial. Learning occurs best when students actively grapple with the material rather than being passive recipients of lectures. A second is to

recognize that students come to controversial topics with some beliefs already formed, such as misconceptions about the logic of evolutionary theory or the belief that it contravenes their religious teachings. This recognition requires a respectful, rather than dismissive approach. Some popular science educators, for example, denigrate religion as antithetical to science generally and to evolutionary science specifically. We have found that this stance alienates more than it educates. Genuine respect works better. A third lesson is that controversial topics need to be tackled head on. We believe that most students welcome and appreciate dispassionate discussion of scientific logic, cogent arguments, and high-quality evidence, even about hot-button topics. We have had success with these techniques in reaching and teaching students who come from a state as diverse as Texas.

NOTES

1. Cristine H. Legare, John Opfer, Justin T.A. Busch, and Andrew Shtulman, "A Field Guide for Teaching Evolution in the Social Sciences," *Evolution and Human Behavior* 39 (2018): 257–268.

2. Karl S. Rosengren, Sarah K. Brem, E. Margaret Evans, and Gale M. Sinatra, *Evolution Challenges: Integrating Research and Practice in Teaching and Learning about Evolution* (Oxford University Press, 2012).

3. Coren L. Apicella, Paul Rozin, Justin T.A. Busch, Rachel E. Watson-Jones, and Cristine H. Legare, "Evidence from Hunter-Gatherer and Subsistence Agricultural Populations for the Universality of Contagion Sensitivity," *Evolution and Human Behavior* 39 (2018): 355–363.

4. Steven Pinker, "Zoom Out, and You'll See People are Improving," *The New York Times*, May 31, 2016, https://www.nytimes.com/roomfordebate/2012/02/26/are-people-getting-dumber/zoom-out-and-youll-see-people-are-improving.

5. Cristine H. Legare, Evelyn M. Evans, Karl S. Rosengren, and Paul L. Harris, "The Coexistence of Natural and Supernatural Explanations across Cultures and Development," *Child Development* 83 (2012): 779–793.

REFERENCES

Apicella, Coren L., Paul Rozin, Justin T.A. Busch, Rachel E. Watson-Jones, and Cristine H. Legare. "Evidence from Hunter-Gatherer and Subsistence Agricultural Populations for the Universality of Contagion Sensitivity." *Evolution and Human Behavior* 39 (2018): 355–363.

Legare, Cristine H., Evelyn M. Evans, Karl S. Rosengren, and Paul L. Harris. "The Coexistence of Natural and Supernatural Explanations across Cultures and Development." *Child Development* 83 (2012): 779–793.

Legare, Cristine H., John Opfer, Justin T.A. Busch, and Andrew Shtulman. "A Field Guide for Teaching Evolution in the Social Sciences." *Evolution and Human Behavior* 39 (2018): 257–268.

Pinker, Steven. "Zoom Out, and You'll See People are Improving." *The New York Times*, May 31, 2016. https://www.nytimes.com/roomfordebate/2012/02/26/are-people-getting-dumber/zoom-out-and-youll-see-people-are-improving.

Rosengren, Karl S., Sarah K. Brem, E. Margaret Evans, and Gale M. Sinatra. *Evolution Challenges: Integrating Research and Practice in Teaching and Learning about Evolution* (Oxford University Press, 2012).