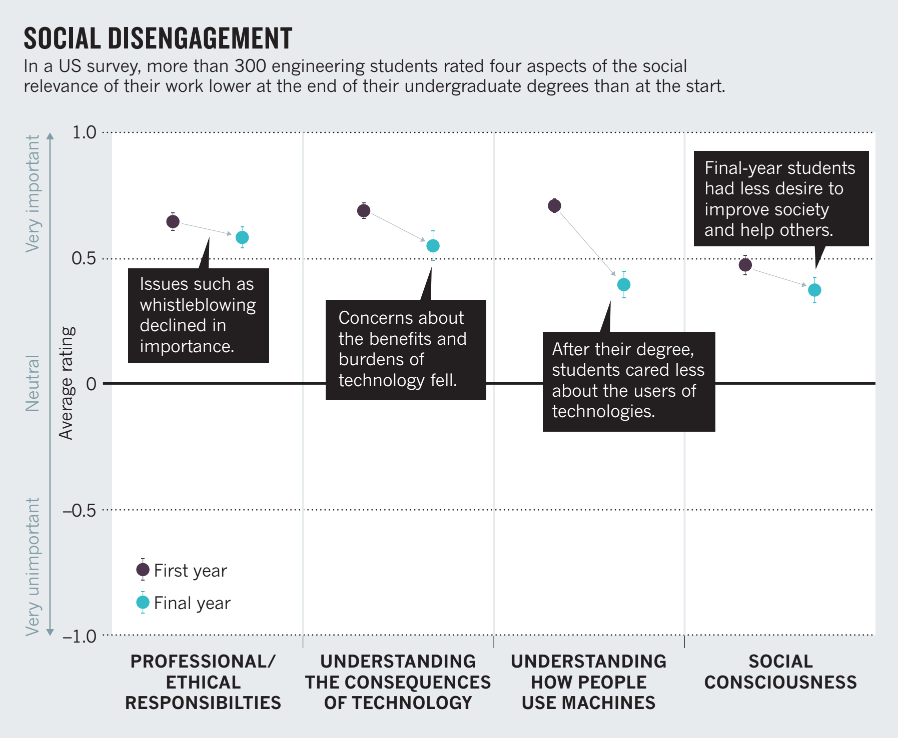

of their work as a core professional skill.

This culture of disengagement is a concern because most STEM problems have cultural and political issues built into them[3–5]. The early design of safety airbags in cars, for example, was subject to gender bias. In 1993, the US National Highway Traffic Safety Administration dictated to manufacturers that the rate of force for airbag deployment had to be strong enough to protect an unbelted, average adult male. Car designers did not test their airbags on dummies of the average weight and stature of women or children; injuries and deaths followed[6].

A graduate student designing technology to read emotion in faces told me another story. On demonstrating the equipment to local school students, he realized that the method of recording changing expressions by reflecting light off faces did not work for people with dark skin. The technology had tested fine for everyone in the lab, but they were all light-skinned. “We didn’t think to try it out on others who didn’t look like us,” he said.

The culture of disengagement also makes it more challenging to achieve equality within STEM. Discussions of power, exclusion, and inequality of women, lesbian, gay, bisexual, transgender and racial- or ethnic-minority individuals are typically seen as tangential — best left to diversity workshops and the like. But by standing aloof, we validate the existing power structures and unequal status quo.

My study[1] examined four attitudes among engineering students: the importance to them of their professional and ethical responsibilities (such as whistleblowing), of understanding the uneven consequences of technologies (such as nuclear technologies and the Internet), of understanding how people use machines, and of the desire to improve society and help others. Although most students rated these issues as ‘important’ rather than ‘unimportant’, they weighted them as more neutral in each subsequent year of their degrees (see ‘Social disengagement’).

“Public-welfare concerns should be incorporated into marked homework and exam problems.”

The more-neutral scores lingered or worsened between graduating and entering the engineering workforce.

The findings suggest that this is not a simple tale of ‘growing up’ and losing naivety. It is clear that the curricular emphasis of engineering programmes had a significant effect on students’ public-welfare beliefs. Students in programmes that played down the policy implications of engineering, for example, expressed less personal concern with professional and ethical responsibilities in the surveys.

PUBLIC WELFARE MATTERS

The diversity of educational approaches represented by these four universities suggests there is a broader problem across engineering education — and perhaps STEM in general. All four institutions require ethics courses and education in non-STEM subjects. Two of the colleges expressed commitments to producing ‘well-rounded’ engineers. It is not that these schools neglect engagement, but that wider culture instils in students the idea that social issues are not central to engineering.

I argue that the culture of disengagement in STEM is propped up by three ideological pillars. The first is depoliticization, the belief that science and engineering are ‘pure’ spaces free of political and cultural concerns[7]. Second is a technical–social duality, the assumption that technical knowledge and competencies have more value than social ones[8]. The third pillar is meritocracy, the belief that scientific professions are unbiased, with fair systems of advancement[7,9]. All three of these ideologies need to be challenged in the classroom and beyond.

What must be done? Public-welfare concerns should be incorporated into marked homework and exam problems. Rather than asking students to estimate the volume of an abstract pond, for instance, as one engineering programme does, students could work out the quantity of toxic materials produced by a plastics plant. This could open up discussions about possible effects on the community’s water supply, about whether toxin levels were dangerous and, if so, how best to inform the community about potential dangers.

I believe that if even 10% of homework and exam questions required students to reflect on the social ramifications of research and results, scientists and engineers could reverse the slide into disengagement[10]. ■

Erin A. Cech *is assistant professor of sociology at Rice University, 6100 Main Street, Houston, Texas 77005-1892, USA.*
e-mail: ecech@rice.edu

1. Cech, E. A. *Sci. Technol. Hum. Val.* (in the press).
2. Schneider, J. *Eng. Stud.* **2,** 1–4 (2010).
3. Knorr Cetina, K. *Epistemic Cultures: How the Sciences Make Knowledge* (Harvard Univ. Press, 1999).
4. Barry, B. E. & Ohland, M. W. *Sci. Eng. Ethics* **18,** 369–392 (2012).
5. MacKenzie, D. *Inventing Accuracy: A Historical Sociology of Nuclear Missile Guidance* (MIT Press, 1990).
6. Pacelli, L. *J. Contemp. Health Law Policy* **15,** 739–756 (1999).
7. Cech, E. A. In *Engineering Education for Social Justice: Critical Explorations and Opportunities* (ed. Lucena, J.) 67–84 (Springer, 2013).
8. Faulkner, W. *Soc. Stud. Sci.* **30,** 759–792 (2000).
9. Young, M. *The Rise of the Meritocracy* (Transaction, 1994).
10. Lucena, J. (ed.) *Engineering Education for Social Justice: Critical Explorations and Opportunities* (Springer, 2013).

CORRECTION

Owing to an editing error, the Comment piece by Amy W. Ando in ‘The Endangered Species Act at 40’ (*Nature* **504,** 369–370; 2013) wrongly stated that the ESA protected the American bison (*Bison bison*). The plains bison has never been listed under the act.