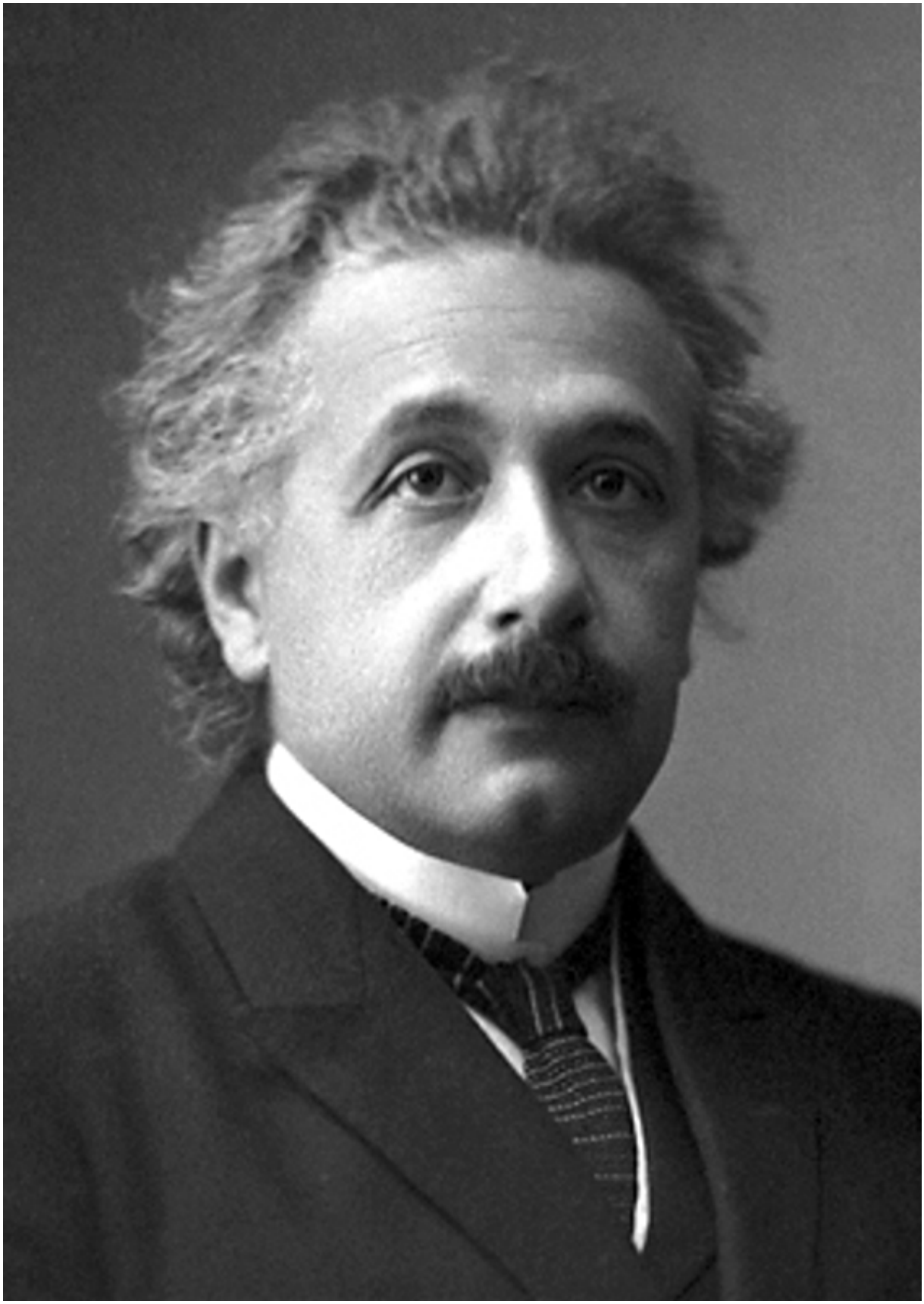
Guest Blog

Are Our Scientific Heroes Too Heroic?

Revealing the struggles that lie behind ultimate success can motivate students better—from grade school to grad school

By Brenda Yang on July 20, 2016



Einstein's official portrait for the 1921 Nobel Prize in Physics. Credit: The Nobel Foundation

I just finished my first year as a PhD student—and surprise!—none of my experiments worked. One way I could think about my current situation is that I'm not smart enough, I don't belong in my program, and I should keep my head down in case anyone discovers this awful secret. But I've been on the other side too: I used to be a high school science teacher. And I've seen enough students put their head down, play the jester, or find brilliant reasons to visit the restroom. They say, with their body language or out loud, "Why try if I'm going to fail anyway?"

Many of these students have what Stanford Psychologist Carol Dweck calls a "fixed mindset": they believe their abilities are innate and static. As a result, they tend to view struggle as an indictment, an indicator of what they lack. This contrasts with students with a "growth mindset," who see that effort shapes what they can do. As a teacher, I saw how students' beliefs about why they are struggling can have a startling impact on their motivation and behavior. Now a student again, I see this effect in myself too. So, here's a second way I can think about my first year: I haven't succeeded yet, but I'll get there. From watching senior students in my program and listening to more established scientists, I know these bumps and doubts are par for the course (and even have a name: imposter syndrome).

Unfortunately, K-12 students often don't see the process that goes into success in science, technology, engineering, and math (STEM) fields. They tend to think of scientists as innately talented people who are unusually smart, often male and White, and who solve problems easily and alone. There is a reason students hold these beliefs: we like to celebrate successes, and present our scientific heroes accordingly. Most science textbooks have limited information on scientists themselves: one describes Albert Einstein as "the most powerful mind of the twentieth century…He was the most different from any other men." These portrayals reinforce the idea that in order to do science well, you must be extraordinary. So in moments of struggle when more effort is crucial—trouble balancing a chemistry equation or my year of halting psychology experiments—fixed mindsets about what it takes to be a scientist undermine what students are capable of.

Researchers at the Teachers College at Columbia University and the University of Washington recently published a study that took aim at these limiting beliefs. They reasoned that reading stories about scientists' struggles could help confront students'

beliefs that STEM fields require special ability more than consistent effort. They had a diverse group of close to 500 high school students read stories about Albert Einstein, Marie Curie, and Michael Faraday. One group of students read about the scientists' achievements, including how Einstein was *Time*'s man of the century, Curie understood 5 languages, and Faraday was one of the world's great experimental scientists.

A second group read about intellectual struggles. For instance, one passage described how months of experimenting sometimes ended up nowhere for Faraday. And a third group read about these scientists' life struggles: poverty, sexism, religious prejudice, and more. Although students in the three groups started with the same average grades, those who read about the scientists' intellectual or life struggles showed improved performance in their science classes over 5 weeks and felt more connected to the scientists they read about.

The authors note this effect was modest, and notably, primarily seen in students academically struggling to begin with. These results support the authors' idea that discussing failures "may help students interpret their difficulties in science classes as normal occurrences, rather than a reflection on their lack of intelligence or talent or science."

This research suggests that sharing the process behind achievement can shift student performance, especially for low-performing students. Another way to motivate students when things get tough is to make it personal. Catherine Aguilar, who coaches more than 30 educators in predominantly low-income communities, explained that when students see a teacher from their same community, she sees a "homegrown impact" where "students feel they can do the same thing, but only if teachers talk about their journey and their story."

The idea of making the failures that precede success more transparent isn't new: writer and playwright Monica Byrne published a detailed "anti-resume," revealing that she had only received three percent of the 566 submissions she'd ever applied for. However, the study discussed here is one of the first is to put these ideas to the test empirically, with promising first results.

When I read research like this, I think about why I stopped teaching to start graduate school. I had some information about how my students perceived, me, and themselves, but ultimately, I was one person, in the dark, making guesses about the best way to combat forces such as poverty, abuse, and students' own toxic beliefs about their capabilities. This study and others like it are shedding light not only on the creeping mindsets that hold us back, but also how simple, humanizing stories can change them. One day, I hope my own research can do this too—and I know my failed experiments will help me get there.

References

Lin-Siegler, Xiaodong et al. "Even Einstein Struggled: Effects of Learning about Great Scientists' Struggles on High School Students' Motivation to Learn Science." *Journal of Educational Psychology* 108.3 (2016): 314–328. *CrossRef*. Web.

ABOUT THE AUTHOR(S)

Brenda Yang

Brenda Yang (@brendawyang) is a Ph.D. student in Psychology and Neuroscience at Duke University, where she is beginning to run successful studies on memory errors and the influence of narrative fiction on our lives. She loves octopuses!