Many academics fear a decline of the humanities in education. As an engineering dean, I am of course a fervent supporter of science and technology education. Yet the discussion has thus far presented a false dichotomy: science and technology or arts and humanities.

The two are not mutually exclusive. Not only are the arts and humanities essential, science and technology have much to learn from the way that those fields structure their education.

There is no doubt that science and technology education is key to the future. The world is increasingly incomprehensible without basic scientific knowledge. This knowledge gap will continue to widen as science and technology advance.

Without a basic understanding of how critical technologies work, we will become more and more disconnected from the systems that govern our lives. We will not be able to make rational decisions about them and their impact. Enriching science and engineering education is integral to our students’ and our society’s success—yet it cannot prosper alone.

Arts and humanities are vital to this new world. The primary reason: without a grounding in these fields, an entire range of human experiences and emotions will forever be invisible to us. Without them, we are doomed to an empty existence and a miserable old life.

The second reason is more pragmatic and has to do with solving the many problems we face. “Solving” may be a misleading descriptor; more and more, our problems come to us as dilemmas, tough irreconcilable choices: security or personal freedom, environmental protection or economic growth. There are rarely clear winners or ideal solutions.

Solving problems requires more than just developing tools to address a need. The thinking that happens before action, the crucial framing of the issues, is essential. Arts and humanities augment the analytical thinking that is the essence of science and technology.

In arts and humanities, students learn to contemplate and frame questions differently; creative and metaphorical thinking come into play. Questions are placed on a broader canvas, with context and an understanding of implications from the perspectives of individuals and groups. Not all thinking is problem driven. It is in the augmentation of possibilities—the things we never knew existed—where remarkable opportunities lie.

The boundaries between science, technology, and art will become more blurred, and each domain can be enriched by the others, particularly by appreciating their distinct thinking skills. Scientists think like scientists, probably the most organized of all. There is also humanistic thinking, with an emphasis on critical thinking, originality, and understanding relationships. While much less regulated, there is also artistic thinking, with its structure, aesthetics, and balance.

In the United States, students benefit by exposure to all three of these types of thinking for much longer than in other countries, where students make decisions early and are funneled into professions like law, engineering, or medicine. This is true in most of Europe and in South America; in the United Kingdom, specialization begins around the age of 16.

Our system promotes a solid, broad base in humanities, science, and arts. This is one of the major reasons we excel at creative thinking, innovation, and invention—skills that are the envy of other nations—but we are failing to exploit it to its fullest effect.

In science and engineering, students start by learning perfection. They re-create famous experiments with clear and predictable outcomes. When science education is at its worst, students are told to be creative only at the end. This changes abruptly; up until this point they have not been asked what they think of calculus or linear algebra, nor have they been given open-ended questions to apply the tools they’ve mastered.

Too often this can be described as absorption and production, with little critical thinking in between. For many students (those who continue the furthest), it is not until the long apprenticeship of a PhD program that they are asked to exercise creative thinking and develop novel ideas. And even this is typically within very narrow confines.

The gap between learning and doing is too long. This structure of “delayed gratification” causes the loss of talented students. Students often do not have the patience to wait for the rewards, so our pipeline has developed leaks (if students enter the pipeline at all). Science and engineering, as learned in most universities, is mostly about absorbing knowledge, but in practice people who have creative skills and the ability to ignore the traditional boundaries are the ones who rise to the top.

We can learn from the humanities, which develop original thinking skills much earlier. Creative domains from writing to the arts emphasize the “doing” and “creating” components, rather than just absorbing knowledge. Artists are asked to dissect and criticize, to express and defend opinions.

Particularly in the arts, the focus is on doing from the word go; an individual goal of perfection is a goal at the end. At its best, art does not solve problems; it creates questions. It brings the ability to think with a clean slate, to begin with broad, unstructured initial thinking, followed by painstaking attention to detail. It shows us the world under new, sometimes unrecognizable, light. Seeing things in a completely new fashion is ultimately what innovation is about.

In some places, including at Northwestern, design thinking is used to fill the learning-doing gap; half the question in design is finding the problem behind the perceived problem. Universities compete based on offerings and perceived value, and these practices are getting rave reviews.

The consumption-production balance must be altered in science and engineering. We would be wise to embrace humanities in our students’ education, but also to embrace the balance between learning and doing that arts and humanities provide. Our students must develop even stronger critical thinking skills to identify the real problems that we face and to understand the implications of their solutions. We will all benefit from it.

Julio M. Ottino
Dean, Robert R. McCormick School of Engineering and Applied Science, Northwestern University