Guest Editorial

A Point of Singularity for Technology and Engineering Education

Philip A. Reed

I attended graduate school at Virginia Tech in the late 1990's and some of my fondest memories are from the side conversations with the faculty. The faculty at that time consisted of my mentor and program leader, Jim LaPorte, and other leaders in the field: Allen Bame, Sharon Brusic, Tom Jeffries, and Mark Sanders. Bill Dugger had recently retired from the university but maintained an office in Blacksburg to work full time on the *Technology for All Americans Project* (T*f*AAP; ITEEA, 2024) and he was very gracious about hosting students at the T*f*AAP office and visiting our graduate seminars.

Lately, as I pondered about the current state of technology and engineering in the U.S., I found myself reflecting on a series of past conversations with Mark Sanders and Jim LaPorte. Mark's primary teaching area was communications, and the proliferation of personal computers coupled with the arrival of the internet in the 1990's had him wrestling with how and what to teach. Everything was going digital so quickly that he had difficulty discerning what processes, software, and equipment to focus on. Similarly, given Jim's primary teaching areas included materials and processes, manufacturing, and construction and he also knew all too well that the digital tsunami would also soon wash over those domains. Today, more than 30 years since those conversations, the tsunami comes in the form of AI - artificial intelligence.

The focus on artificial intelligence (AI) over just this past year has turned my reminiscing to the concept of singularity. Shanahan (2015) claims "a singularity in human history would occur if exponential technological progress brought about such dramatic change that human affairs as we understand them today came to an end" (p. xv). He goes on to explain (ten years ago) that advances with AI and neurotechnology/biotechnology place humanity on the verge of technological singularity. When I look at our field and contemplate how to prepare teachers, manage programs, develop curricula, conduct research, and the technology and engineering education enterprise at large, it appears we are at a point of technological singularity.

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It has been forty years since the field broadened the content base from industrial practice to technology in the United States and during that time technology has simultaneously become ubiquitous and invisible. How can our field deal with the depth and breadth of technology and engineering? In Virginia, for example, there are over 80 technology and engineering education courses, some very broad and others very technical (Virginia Department of Education, 2024).

My conversations years ago with Jim and Mark certainly provide some take-aways that apply to our current state. For example, we agreed there was not a single solution for technology and engineering education to address the digital tsunami reshaping society and that educators should avoid the trap of focusing on proprietary technologies. The most salient point that always surfaced, however, was that we educate *people* and that sound teaching and learning needed to be at the forefront, not technology. In many of my education news feeds, however, I see educators of all subjects and levels gravitating to the latest technologies (e.g., robotics, coding, AI) and in technology and engineering education I think we would be wise to continue our focus on students. Thankfully, there are recent examples of this people-first approach in the technology and engineering education literature.

Dakers (2022) provides a compelling argument that we need to abandon the craft-based approach we have used the past century and adopt an ever-evolving pedagogy model that is student centered. He further argues that technological literacy is too quantitative and rigid, instead, he offers a model that focuses more on questions and qualitative criteria to set students on a continual path of becoming ethnotechnologically literate. The model proposed by Dakers (2022) is based on a philosophical foundation as opposed to a technological foundation, which is an approach also utilized by de Vries (2016). In the end, both Dakers and de Vries are advocating for a people-first methodology that focuses on cognition and metacognition. Their logic is sound when contemplating the depth and breadth of content, practices, and contexts that encompass technology and engineering. More recently, Hacker (Hacker & Moye, 2024) expressed concerns on our over-reliance of standards and recommends a turn to more universal concepts such as design, modeling, systems, resources, and human values. Portz (2024) furthers this line of thinking when he takes a people-first approach to problem-solving and recommends:

- Using the strategy of requiring our students to frame specific questions about the problem before receiving our "help." Doing so helps us train students to think deeply to form good questions and focus on the process instead of an easy answer.
- Making them accept ownership of the problem and think more about their thinking (metacognition).

- Understanding that learning frustration is an ally and not an enemy, and not relieving our students of this learning frustration.
- Using these strategies, we teach our students to be more resilient, more self-reliant, more resourceful, and more creative problem solvers.
- But perhaps the most helpful thing of all in problem solving is having empathy for our learners. Sometimes telling a story of a problem-solving frustration from your own life or the life of a great inventor is helpful. (p. 12)

In short, AI appears to be the ultimate realization of the digital tsunami Jim, Mark, and I discussed years ago and is a point of singularity for technology and engineering education. Can you recall another technology that has caused so much speculation, questioning, and discussion across society? Rarely do we see such widespread, meaningful debate on a technology versus blind acceptance as a panacea. It seems that many recognize that AI is *artificial* intelligence and are debating how to proceed. I am hopeful that our field will continue to focus on *authentic* intelligence and proceed with a people-first approach.

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