

## DEAR EDITOR

I very much enjoyed the Materials Matters opinion piece, “Perspectives on the craft of scientific research: A conceptual organizational framework for creating research pedagogy” by Frank Zok in the August 2020 issue of *MRS Bulletin*. The topic is a welcome departure from the more typical, yet valuable, *MRS Bulletin* articles. My own background in industry and government does not qualify me to opine on pedagogical methods, despite, of course, having been on the receiving end as a student.

One aspect of Zok’s excellent presentation reflected in his Figure 1 (Knowledge Hierarchy) that struck me as a minor omission was how “prospects for social or economic benefit” enter the picture. Granted, research and researchers are supported directly or indirectly by those who expect and deserve a return on their investments. I would venture a guess that most sponsors do not include an increase in the storehouse of scientific knowledge that may or may not be useful one or more generations from now, as an adequate return. If I were in front of a classroom full of wide-eyed future materials researchers, I would want to alert them to the inherent backpressure from sponsor expectations, a connection missing in the Figure, not to discourage pursuit of knowledge for knowledge’s sake, but to warn of the dissipative forces afoot when engaged in that pursuit. Clichés abound, such as “mortgaging the future” or “eating the seed corn,” that warn of this near-term focus. I hope every generation of researchers to come learns to recognize and to accommodate, but not to abjectly surrender to, it.

**Elton Kaufmann**  
Naperville, Illinois

## AUTHOR’S RESPONSE

Dr. Kaufmann’s letter raises a question of age-old debate: Should utility be considered in assessing the value of knowledge? The arguments depend, in part, on the field of study. In engineering disciplines in particular, the issue is moot: The pursuit of knowledge here is driven not by mere curiosity of how the physical world works but by technological need, especially that which yields social or economic benefit. The goal of creating knowledge that has utility—whether or not ultimately realized—is integral to the pursuit. I concede, however, that in the broader science disciplines, a resolution to the debate is less clear-cut.

As a practical matter—but by no means a central argument in the debate—the reality of modern times is that essentially all research funding in the sciences comes with expectations of return on investment in some form; the pursuit of knowledge for its own sake is a rare luxury. Graduate students who have ambitions of pursuing careers in academia and who will become future leaders in the knowledge creation enterprise should become well aware of this reality. It is incumbent on today’s educators to demonstrate to their students how to navigate the competing interests in this domain by identifying research avenues that simultaneously meet sponsors’ expectations of return on investment and their own goals of knowledge creation and transmission of knowledge creation skills.

**Frank Zok**  
Distinguished Professor, Materials Department  
University of California, Santa Barbara