

over perceived enemies or rivals. Remember that the money, although originating with the taxpayers, is ultimately doled out at the discretion of politicians.

With this in mind, we may answer a question that Mehta did not actually ask: When, exactly, did science cease to be a vocation? The answer is World War II, which spurred the notion that science could not only win a war but maintain a permanent technological, and hence economic, advantage. That sort of thinking created the factory mentality in which well-rounded intellects, as Mehta notes, are now actively deselected. The job market presently favors those who stay in the same academic discipline, finish their studies in record time, and thus bring the least perspective—and maturity—to the job. Generalists are not wanted; familiarity with the programming code of the day is now more important than being able to think outside the box.

Mehta also notes the “stifling of merit by politics,” the small-scale corruption of winks, nods, and handshakes that no one wants to acknowledge. Ultimately, she concludes that physics “became a business with very small stakes.” But in that she is dead wrong. Physics, as a largely tax-funded and multibillion-dollar enterprise, became a business with truly enormous stakes: the very supremacy of the old colonial nations. And therein lies the problem.

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Mehta replies: I thank both authors for their thoughtful responses and appreciate the interdisciplinary span of their ideas.

Ramesh Gopalan’s point, about people taking the underlying physics of everyday gizmos for granted, is well made. The “marketplace of ideas” to which he refers puts technology on a far higher pedestal than the basic physics behind it. In my opinion, the way to fight that attitude is not by speed (physicists will never overtake engineers in that regard!), but by innovation. Physics needs to come back to its status as an art and a philosophy, where space is made for originality of thought, rather than sticking to the assembly-line mentalities I’ve alluded to in my article.

Lance Nizami’s letter spells out possible reasons for these assembly-line mentalities—although I’m not convinced that international political competitiveness is the only cause of such academic philistinism, or, indeed, that

physics across the globe could lay claim to being a big-stakes business, as it might be in relatively developed countries. However, his letter certainly provides an interesting perspective.

Finally, I plead guilty to being understated, both for reasons of personal preference, and because it leaves space for interesting discussions such as these by Gopalan and Nizami.

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Fine points on *Productive Learning*

When I read Diane Grayson’s review of *Productive Learning: Science, Art, and Einstein’s Relativity in Educational Reform* (PHYSICS TODAY, September 2007, page 72), I saw it was flawed and chose to ignore it. However, discussions with colleagues convinced me that it should not remain uncontested and presumed accurate.

Grayson suggests that the first four chapters of *Productive Learning* were written by my coauthor Seymour Sarason, and summarizes them as dealing primarily with “educational matters at pre-college levels.” That is wrong. The book states that Sarason drafted the second chapter and that the theme of the initial chapters is how teachers learn to teach *after* they finish college.

It is not true that Sarason and I “make no reference to more than 30 years of systematic research in physics education.” We reference Arnold Arons, Lillian McDermott, and Kenneth Wilson. In addition, we refer to several resources that contextualize the criticism of the educational system; those include a book by Diane Ravitch, an issue of *Daedalus*, and several books by Sarason. The objections appear to stem from superficial reading and lack of familiarity with the depth of issues that hamper educational reform.

Our text states that so far, all systemic reforms have failed. My diagnosis of the review’s superficiality is reinforced by its citation of a website that supposedly exemplifies a successful systemic reform. The site contains a dead link and a one-page promotion with a few sentences quoted in the review about the Discovery program in Ohio.

I visited Discovery in the mid-1990s. My positive experience there is reported in the last chapter of *Productive Learning*, though without naming the program. I was so impressed that I