I presented my data, and soon the institution came to agree.

Reference

1. J. H. Healy et al., *Science* **161**, 1301 (1968).

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Although one can sympathize with Ricardo Heras's plea for more creativity in physics teaching, the entire structure of physics education is currently founded on mastery of content, as reflected in tests taken at various stages. Those tests determine whether the student is qualified for promotion and even for admission to the PhD program.

To modify the didactic structure in favor of creative learning wouldn't accomplish the goals of physics departments as they are presently structured. For one thing, the time consumed for such learning would surely be much greater than for the current lecture–lab format. Of course, one could assign projects such as I have during my physics teaching career in the 1980s to early 1990s, but those would be *outside of class time*. Hence, they do not facilitate learning by supporting independent student creativity in class.

Heras mentions *The Feynman Lectures on Physics*; that three-volume work exemplifies its author's unconventional approach to physics teaching. But even today most physicists I know look at it as an interesting supplement to their undergrad courses and not as a standalone text.

The very reason Feynman's teaching and methods wouldn't work in physics departments as currently established is spelled out by Heras himself in his Commentary (page 11). He says, "Feynman's lectures successfully omitted proposed problems. His teaching style is also exemplified in the noncredit, no-homework, no-registration, tuition-free Physics X course he offered at Caltech."

What physics department today could even remotely entertain such a course? I am not saying it could never work, but it would require a radical rethinking of physics pedagogy and would come up against the existing system for promotion and qualification and for how we integrate students into the formal university course system.

Perhaps the optimal time for free inquiry might be when Heras pursues his PhD. Then he can find original expression for his curiosity, creativity, and inquiry. Of course, to reach that point, he will have to pass rounds of comprehensive examinations, and those will entail solving a lot of "traditional" problems.

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▶ **Heras replies:** Cameron Reed suggests that at the PhD level, a physics student will have worked lots of standard undergraduate problems and can finally acquire "a sense of the nitty-gritty that underpins the insights of great creative minds." I disagree. Richard Feynman, Julian Schwinger, and Lev Landau, for example, did not need a PhD to acquire that sense. Each published his first paper as an undergraduate.

Intuition in physics is, for Reed, a matter of "practice, practice, practice." Again, I disagree. Intuition is the key to, for example, imagining a new sport, inventing a new language, or composing a new symphony. To reach any of those goals, practice is necessary but not sufficient. I believe intuition triggers creativity, which is characterized by a crisis occurring when one imagines a plausible