

## Response to Hacker's Editorial

Professor Hacker's provocative article raises some important issues, but people involved in mathematics teaching will find them to be depressingly familiar. In fact, mathematicians have been beating themselves up over the same concerns for about 25 years now. He argues persuasively about the need for quantitative literacy and notes correctly that it is in short supply in American schools, but, in a game effort to assess blame within the confines of a single op-ed piece, he has dangerously oversimplified the problem.

The title "Is Algebra Necessary?" (which I realize might not have been chosen by the author) adds fire to the page, but it is not very helpful for understanding the credible points in the article. In fact, if almost any group of thoughtful, educated citizens were asked to itemize what mathematical topics a quantitatively literate person should know, algebra would almost certainly make the cut. Hacker himself admits the need for algebraic understanding in his essay. What he deems unnecessary (apparently) are things like those polynomial identities and other symbolic manipulations that are so prevalent on mathematics tests and so absent in the experiences of life. To illustrate his point, he actually cites a polynomial identity that he must have expected most readers to identify readily as useless:  $(x^2 + y^2)^2 - (x^2 - y^2)^2 = (2xy)^2$ . Since he has opened the door to this kind of vacuous argument, I will point out that I could cite Hamlet's soliloquy as useless on similar grounds (I have not personally found it useful in life), but I would not presume to do so, as it is such a beautiful achievement of the human mind that it deserves to be appreciated, and learned, and therefore taught. I also happen to have an aesthetic appreciation of the equation that Professor Hacker so casually dismisses, as it proves that there are infinitely many Pythagorean triples and demonstrates how they can be easily found. That's the cool part of algebra, and with the right pedagogy it can be used to motivate students to learn about mathematical proof and the scientific method. Sadly, without the right pedagogy it can also be used to convince people that such things are unnecessary. The fact that so many students have only had the latter experience is stark evidence that there is a problem, but it does not prove that the problem is algebra. He took a few shots at those standardized tests that substitute symbolic manipulation for algebraic understanding; he should have kept his fire trained on them.

Thoughtful educators who have studied the quantitative literacy problem (for decades, by the way) have concluded that we have simply been teaching good mathematics badly at every level. Paradoxically, mathematics teachers have even convinced *themselves* that only some students can do real mathematics (e.g., algebra), so they consider it to be part of their mission to weed out incapable students before they are passed on to the next level. Teachers at the next level, predictably, react to the first signs of student weakness as evidence of bad weeding. This is the one reaction that could possibly serve to perpetuate the problem in an educated society, and it is sadly the party line to which Professor Hacker seems to adhere.

I believe (as do many others) that there is nothing inherently unfathomable about algebra or geometry -- and that there are topics in both areas that are necessary for quantitative

literacy. Indeed, I also believe that there is nothing inherently unfathomable about calculus, which Professor Hacker correctly observes that not everyone needs to know – although many more people would surely enjoy it if college mathematicians would welcome them into their classrooms and stop obsessing about prerequisite algebraic skills. English professors learned long ago not to define literary skill in terms of spelling and syntax, which is why so many educated people consider themselves to be literate. It is mathematics that they could never do.

While I have all kinds of problems with Professor Hacker's essay, I applaud him for bringing these concerns to the attention of *Times* readers. The subsequent dialogue has the potential to accelerate the educational reforms that I have been espousing for the aforementioned 25 years. Professional organizations like the National Council of Teachers of Mathematics, the Mathematical Association of America, the Mathematical Sciences Education Board, and the Mathematical Sciences Academic Advisory Committee of the College Board have actually enjoyed modest success in fomenting pedagogical change over the years, which explains why your readers have not yet heard from them.

Now, however, I suspect you will.

Dan Kennedy  
Mathematics Teacher  
Baylor School  
Chattanooga, TN