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Review of *The Math Myth and Other STEM Delusions* by Andrew Hacker

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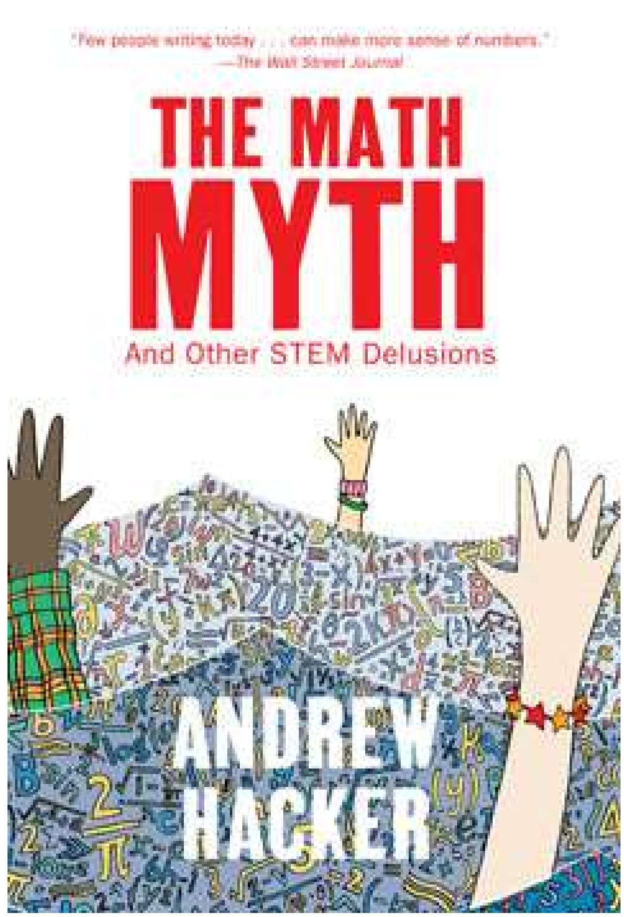

Andrew Hacker's new book, *The Math Myth and Other STEM Delusions*, is an expansion of a controversial opinion article he wrote for the *New York Times* in 2012. Many readers of the earlier newspaper column assumed that Hacker was "anti-mathematics" and that he wanted to abolish algebra from the school curriculum. In fact, Hacker believes there is an "inherent beauty" in mathematics. Furthermore, his objection is not to algebra, but to the arbitrary establishment of algebra as a gate-keeping requirement that blocks many avenues of educational opportunity.

Hacker cites high failure rates on school exit exams, state-wide proficiency test results, community college remedial math class statistics, and other measures to show that algebra, far from being a pipeline to success, is "...a barrier [that] ends up suppressing opportunities, stifling creativity, and denying society a wealth of varied talents." The failure rates, typically between 40 and 60%, are not the fault of school mathematics teachers, and they are not because the students were indifferent or lacking in intelligence. Hacker believes that if we could dispel the "myths and

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delusions" about mathematics, then students who wanted to study mathematics at advanced levels could do so, while other students could take alternative, equally rigorous but more relevant courses. He describes such a course in a final chapter of the book.

The "myths" and "delusions" he examines include:

- The line of argument that US global competitive advantages require a compulsory program of secondary school mathematics for all citizens;
- The argument that mathematics is used by most workers in the majority of trade and professional jobs;
- The belief that studying math develops the mind in ways that transfer to other domains of thought.

These myths and delusions that obscure rational thinking about school requirements persist partly because of a general confusion in the minds of the public between correlation and causation. To use one of Hacker's many examples, although it's true that students who studied calculus in high school have higher professional incomes, it's also the case that these students generally come from more highly-advantaged homes to begin with. Similarly, adults who consider themselves highly rational may believe that studying trigonometry contributed to their general reasoning skills, when in fact their intellectual abilities were influenced much more by early family and social environment.

The mythology about mathematics as the key to success, both for individual citizens and for the United States is continually reinforced by a network of academic, business and governmental decision makers. Hacker uses the term "Mandarins" to identify the academic experts who advise governmental agencies on the structure of state and national mathematics standards. His chapter on the "Common Core" standards explains the rather remarkable emergence of a shared set of curricular objectives in a country that values local control of its schools. Although many people believe that the Common Core is a product of the federal government, Hacker shows that these standards, now supported by about 40 states, came from a coalition of business and state government associations. Hacker objects to the Common Core with the same critical phrase once used in Nebraska and elsewhere to oppose state-wide testing—that it is a "one size fits all" solution.

The curriculum that Hacker objects to has been in place since the 1890s. A useful extension of his book could include this history to show how little has changed—in curriculum or curriculum discussions—since a group of academic authorities called "The Committee of Ten" (the Mandarins of that time) decided that the academic curriculum should include two years of algebra, a year of geometry, and a further course in trigonometry (today it's "pre-calculus"). Although modern problem contexts have been brought up to date, Hacker is critical of classroom lessons that claim to be "real world math." He gives an example of a presentation he observed at a national math education conference in which algebra was used to check the accuracy of a cell-phone bill. The result was an approach that few customers would ever employ. In discussing other aspects of teaching, the pedagogy Hacker presents is a somewhat naive "cooperative discovery" method, which he compares favorably to the "whole language" approach to teaching reading.

The final chapter of Hacker's book describes a course Hacker teaches in what he calls "adult arithmetic," or, borrowing the term from mathematician John Paulos, "numeracy." This chapter contains interesting and useful problems, all of which can be done without algebra, including a method for approximating the constant Pi. Although algebra could be enlisted for solving these problems, arithmetic is all that's needed.

Hacker clearly states that he is not a mathematician, and despite the blurb on the book's dust cover, he has not been a "professor of mathematics." He is a political scientist who has taught numeracy courses in a mathematics department. Although many mathematicians are referenced in the book, a close reading by a mathematically-trained editor would have helped in several cases. When Hacker refers to topics in higher mathematics, he sounds as if he were randomly pulling words from a college mathematics department catalog. There is also one rather bad misuse of the statistical term "average" instead of "median," which I hope was typographic, rather than conceptual. This and a few other misprints, for example the number "8" becoming the letter "H" in one of his blackboard-style graphics, will probably be caught in later editions.

The chapter titles in this book are in keeping with the clever, often alliterative style used to attract attention, such as "Will Plumbers Need Polynomials?" or "Does Your Dermatologist Use Calculus?" Cute titles such as these are likely to mislead a casual browser. The point made for each job referenced is not that the required technical thinking is trivial; rather, that the formal symbolic manipulations of high school algebra are not part of the daily work, whether it's reading a complex blueprint or interpreting a biopsy report. Mathematics certainly underlies blueprints, biopsies, and the other features of our modern world, so in one sense we are "using" math at practically any conscious moment. The explicit "use" of mathematics, whether it be arithmetic, algebra, calculus or "higher math," is a different matter. Hacker's analysis is a useful step towards a more detailed understanding of the educational trajectories that lead students through the gateway of algebra—or stop them at the barrier. The chapter references in his book provide a good basis for further exploration.

About the Reviewer

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David Fowler taught undergraduate and graduate courses in mathematics education in the UN–L College of Education and Human Sciences. He maintains a continuing interest in the ways technology changes the teaching and learning of mathematics. He was editor-in-chief of the journal *Mathematica in Education and Research* and a Wolfram Visiting Scholar at the University of Illinois, Urbana-Champaign. His work in teacher preparation and mentoring of masters and doctoral students was recognized with a Lifetime Achievement Award from the Nebraska Association of Teachers of Mathematics.

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