Center for Mathematics Education - CME Project

Response to EdReports Evaluation

The *CME*, NSF-funded, 4-year sequence was developed to help high school students see how the mathematics they learn in school fits into the larger landscape of mathematics as a scientific discipline. One of the main organizing principles of the program is an emphasis on the habits of mind that lie behind major results, raising this thinking to the same level of importance as the results themselves. In addition to this explicit focus on mathematical thinking, there are several other design principles that form the foundation for the program:

- **Textured emphasis.** We focus on matters of mathematical substance, being careful to separate them from convention and vocabulary. Even our practice problems are designed so that they have a larger mathematical point.
- **General purpose tools.** The methods and habits that students develop in high school should serve them well in their later work in mathematics and in their post-secondary endeavors.
- **Experience before formality.** Worked-out examples and careful definitions are important, but students need to grapple with ideas and problems before they are brought to closure.
- **The role of applications.** What matters is how mathematics is applied, not where it is applied.
- **A mathematical community.** Our writers, field testers, reviewers, and advisors come from all parts of the mathematics community: teachers, mathematicians, education researchers, technology developers, and administrators.
- **Connect school mathematics to the discipline.** Every chapter, lesson, problem, and example is written with an eye towards how it fits into the landscape of mathematics as a scientific discipline.

These principles have formed the core of our curriculum and professional development work for over four decades. Teachers, educators, and mathematicians from all over the country have used and helped develop our materials, and these principles have always resonated with these groups as distinguishing features of our work in

mathematics education.

So, we were quite astonished when what has been a hallmark of our work— focus and coherence—was completely missed by the low-level methodology employed by EdReports. In addition to the errors in its analysis about missing or deficient content—we can supply specifics to anyone who contacts us—the most astounding aspects of the report are how many times it completely misses the mathematical purpose of many topics and lessons, even ones that are essential for the success of the program. Just a couple examples:

- The opening chapter of Algebra 1 does look superficially as if it is a review of middle school material, but the chapter was designed to be at grade level and to preview many of the ideas in the program. Further, it is designed to develop two focal points that will recur throughout the program:
  1. *The extension principle.* The extension of arithmetic from positive integers to all integers is not a theorem—it is a definition, carefully designed to preserve the rules of arithmetic with whole numbers. There are other ways to extend multiplication to all integers (and we provide one), but there's only one that preserves, for example, the distributive law.
  2. *Structure in expressions.* The multiplication and addition tables are laid out in a way that corresponds to the Cartesian plane. This allows students to identify all of the pairs that, say, add to 7 as a line—and the defining condition of that line is $x + y = 7$. The can look at the multiplication table and get a preview of the graph of $xy = 12$. This comes back in the chapter on factoring quadratics: factoring $x^2 + 7x + 12$ amounts to finding integers that sum to 7 and multiply to 12—the tables are revisited here.
- The CME approach to area may look on the surface as a revisiting of middle school content. But the approach is squarely at a level of sophistication desperately needed in high school.
  1. Area is developed via the notion of equidecomposability, based on the foundations for measure theory that go back (at least) to Hilbert. Area is defined as a property that is invariant under finite decomposition. This is decidedly not middle school material.
  2. All area formulas are developed via student-generated algorithms that dissect one polygon into another. What's important here is that students prove that their algorithms work. This makes for some genuine applications of geometric theorems that are already established, and it also provides motivation for new theorems that are needed to show that an algorithm does what is claimed.

Since the publication of *CME Project's Common Core edition*, we have seen its successful adoption in many districts. The program's focus and coherence around mathematical habits of mind has improved student achievement on standardized exams. Teachers say *CME* helps students organize their mathematical thinking around big ideas and greatly increases their perseverance in problem solving.

We firmly believe that EdReports misses the forest for the trees, marginalizing our work in leading students to deep understandings of key concepts, while rewarding programs with very little true mathematical coherence.

Both Pearson Education and its CME authors agree with the position of the National Council of Teachers of Mathematics (NCTM) and National Council of Supervisors of Mathematics (NCSM) on EdReports:

> The EdReports methodology, including its evaluation tool and process, has produced reviews that fall short of providing useful and accurate information about many critical features of materials reviewed, such as how the materials address the Standards for Mathematical Practice and the quality of the instructional activities. As a result, the current ratings and reviews do not provide the types and quality of information needed to make informed choices about the extent to which particular materials support students' learning, or teachers' teaching, of CCSS-M.