

Web Weaver

Mathematical Proficiency

Historical and Contemporary Web Resources
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The discussions about “mathematical proficiency” have intensified in recent years as statistics from nationwide assessments like NAEP and NWEA’s Measures of Academic Progress (MAP), and International assessments such as TIMSS and PISA have become widely available online, and featured prominently in education news. These statistics, combined with the data collected by each individual state on assessments such as the WKCE in Wisconsin, have raised the question about the variety of definitions of **proficient** as relates to mathematics instruction, performance, assessment, and intervention, as well as the comparative **proficiency** of students across states and throughout the world.

I was curious about when and how “mathematical proficiency” was first used, and also wanted to feature some of the most prominent contemporary sources for this article; I used two of Google’s lesser-known features in my search. By using quotes, I limited my results to about 60,000 results where the two words occurred together, and looked to the sidebar for several excellent resources for my next steps.

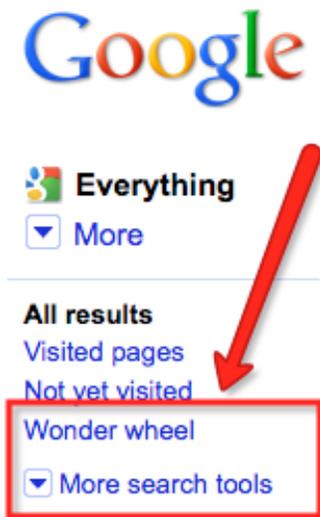


Figure 1: Google Sidebar

By clicking Wonder Wheel, the results of your search become re-organized as a simple mind map. Each of the “arms” is another clickable link with related articles appearing at the right. The categories are not mutually exclusive; some important articles and links appear multiple times.

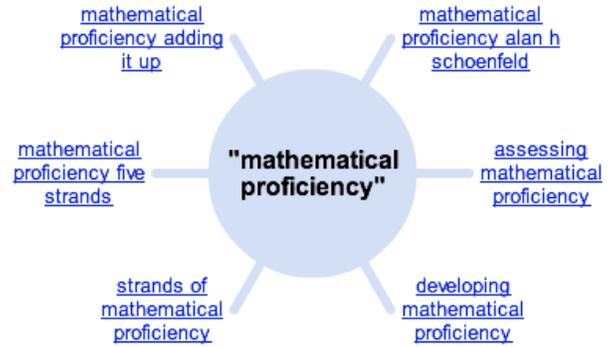


Figure 2: Google Wonder Wheel

The second Google tool I used is Timeline, which can be selected from an expanded sidebar after clicking “More Search Tools.”

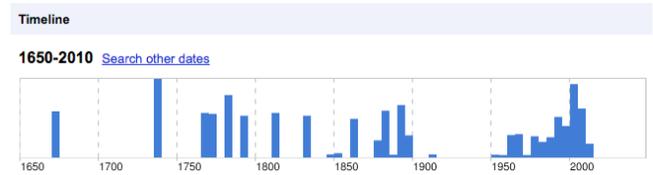


Figure 3: Search Results in Google Timeline

While Google is digitizing more resources daily, they haven’t yet reached back as far as 1672. This web reference is from the book *School Days of Eminent Men* written almost 200 years later in MDCCCLXII. Most of the entries that appear early on the timeline share the trait of the phrase “mathematical proficiency” occurring in a book or article about an earlier historical figure.

The first evidence I located of the phrase used contemporaneously was in the December 11, 1879 edition of the New York Times.

CITY AND SUBURBAN NEWS

NEW-YORK.

The column contained a brief notice from the Naval Office about a competitive examination for candidates that noted, “Particular weight will, in this instance, be attached to **mathematical proficiency** when combined with practical command of modern languages.”

For the first three quarters of the 20th Century, the use of the phrase occurred mainly in classified ads for business and administrative positions, and as before in historical contexts. It wasn’t until the 1970’s and 80’s that “mathematical proficiency” appears in conjunction with discussion of some of the first statewide assessments. The movement

from local, school-based assessment to large scale proficiency testing began to focus the public's attention on the state of mathematics instruction in much the same way as Rudolf Flesch's book, *Why Johnny Can't Read*, had thirty years earlier on reading instruction.

In 1989, National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards* was in the forefront of standards movement. Six years later, in the introduction to the NCTM *Assessment Standards*, authors write, "Some **proficiency** with paper-and-pencil computational algorithms is important, but such knowledge should grow out of the problem situations that have given rise to the need for such algorithms." This idea of proficiency focused on the mostly concrete, observable application of algorithms – the "facts" that still fuel some heated discussions among people who care deeply about mathematics.

These documents, and the 2006 *Curriculum Focal Points*, served to outline key ideas that formed the basis for mathematics success. During this time, the idea of **mathematical proficiency** was forming within academic circles as educators and mathematicians addressed the complex issues of what students should know and be able to do, and how we, as teachers can improve our practice.

Contemporary Resources 2001-2010

Adding It Up: Helping Children Learn Mathematics, National Research Council, 2001. The term "mathematical proficiency" was chosen to encompass what it means to learn mathematics successfully. *Adding it Up* identifies "five interdependent components of mathematical proficiency and describes how students develop this proficiency."

The iconic intertwined rope on page 8 of the online version shows the five strands of conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. When you visit the site, skip the html version that initially appears in favor of the chapters that can be freely downloaded in .pdf form after registering → left sidebar link. http://books.nap.edu/catalog.php?record_id=9822

Mathematical Proficiency for All Students: Toward a Strategic Research and Development Program in Mathematics Education, Deborah Loewenberg Ball, 2003.

The culmination of ten years of research and reflection, nearly the entire RAND report is available online for personal use. The chapters, *Teacher's Mathematical Knowledge*, and *Teaching and Learning Practices* would be excellent texts for a mathematics professional learning community or critical friend's group. http://www.rand.org/pubs/monograph_reports/MR1643/index.html

Assessing Mathematical Proficiency, Edited by Alan H. Schoenfeld, Cambridge University Press, Cambridge, 2007

"In a conference at the Mathematical Sciences Research Institute, mathematicians, math education researchers, teachers, test developers, and policymakers gathered to work through critical issues related to mathematics assessment." R. J. Milgram's. *What Is Mathematical Proficiency?*, Alan Schoenfeld's *What Is Mathematical Proficiency and How Can It Be Assessed?*, and *Mathematical Proficiency for Citizenship* by Bernard Madison are among the 22 articles available as .pdfs linked here. <http://www.msri.org/communications/books/Book53/contents.html>



In June 2010, State Superintendent Tony Evers formally adopted the newly released **Common Core State Standards** for Wisconsin. In the introduction to "Standards for Mathematical Practice" on page 6 of the .pdf, CCSI authors cite both the NCTM process standards and the National Research Council's five strands of mathematical proficiency as central to Common Core. Each of the eight mathematics practice tenets begins with the phrase, "mathematically proficient students ..." along with action verbs like notice, consider, understand, and can apply.

As we begin the next steps of aligning curriculum, benchmarks, and assessments with Common Core Standards in our own districts, it is important for us as teachers and staff to notice, consider, understand, and apply what research and practice have taught us about our roles in developing mathematical proficiency for all students.

<http://www.corestandards.org/the-standards>