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# The Old and the New

The Math Wars continue to rage. And now the back-to-basics faction seems to dominate the National Mathematics Advisory Panel, whose recommendations will have as much effect on curriculum and instruction as those of the National Reading Panel. Mr. O'Brien joins those who have urged the panel to support the reform curricula developed under the leadership of the National Science Foundation.

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**BY THOMAS C. O'BRIEN**

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**T**HE FAIRLY new is the fact that the National Mathematics Advisory Panel, established by the Bush Administration on 18 April 2006, has been meeting to discuss the improvement of achievement in mathematics in the schools. From a variety of perspectives, it can be claimed that the panel was poorly chosen.

A good portion of the members have no experience in mathematics, no experience teaching children, or both. Only one of the panelists is a practicing classroom teacher.

And concerns have been raised that "the panelists' backgrounds suggest they will favor a particular approach to teaching math — generally speaking, one that stresses the need

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for drill and practice in basic computation at early grade levels, at the expense of problem solving."<sup>1</sup>

The new panel brings back some recent memories. "Similar charges of bias dogged the National Reading Panel, formed in 1997, which Bush Administration officials have said is a model for the math group."<sup>2</sup>

Yet another question might well have been raised concerning the fair selection of panel members: it is not clear that mathematically knowledgeable people from science, industry, technology, and the arts were represented. Where were experts who know about the real world? The economy? The future?

Such people would have brought a different perspective to the panel. Here's a glimpse of what *they* value:

Jobs in the new economy — the ones that won't get outsourced or automated — "put an enormous pre-

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mium on creative and innovative skills, seeing patterns where other people see only chaos,” says Marc Tucker, an author of the skills-commission report [*Tough Choices or Tough Times*] and president of the National Center on Education and the Economy. Traditionally that’s been an American strength, but schools have become less daring in the back-to-basics climate of NCLB [No Child Left Behind]. Kids also must learn to think across disciplines, since that’s where most new breakthroughs are made. It’s interdisciplinary combinations — design and technology, mathematics and art — “that produce YouTube and Google,” says Thomas Friedman, the best-selling author of *The World Is Flat*.<sup>3</sup>

And what about a knowledge of how people learn? Historically, mathematicians have not been hugely successful in their approach to students’ learning (and liking!) math.

Where do the panel experts stand on PBL (problem-based learning) — a burgeoning and apparently very successful approach to medical education and one that might be fabulously appropriate for math education?

The published writings and interconnections of many of the panel members clearly put them in the “back-to-basics” camp of educational thinking. And the panelists’ remarks at the five meetings held thus far<sup>4</sup> confirm the impression that many of them are hostile to or not very knowledgeable about the developments in American mathematics education in the past 20 years — developments that happened largely through the efforts of the National Science Foundation and yielded what have come to be known as “reform” curricula. Here, for example, is what a back-to-basics mathematician had to say at the panel’s first meeting:

It’s a question to psychologists. I understand that there has been research on how people learn, but now I want to get the specifics on whether the kind of data you have — what kind of data you have on not just learning simple numbers but more involved processes, for example multi-step thinking, acquisition of the concept of generality, how the learner uses abstract symbols? How much data has been accumulated on more involved mathematical processes of the kind I describe?<sup>5</sup>

Such a stance makes it appear that the educational role of the National Science Foundation, a nonpartisan leader in the support of high-quality curriculum development in math and science for 50 years, is under grave threat.

Each meeting of the panel allowed time for input from the public. These Public Comment Presentations (included in the meeting transcripts) are particularly interesting and revealing.

- The testimony of Sherry Fraser, director of the Interactive Mathematics Program, Sausalito, given at the Palo Alto

meeting on 6 November 2006, is noteworthy. Here are excerpts:

Shortly after publication [of the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics* (1989)], the National Science Foundation began funding the development of large-scale, multi-grade instructional materials in mathematics to support the realization of the NCTM Standards in the classroom. Thirteen projects were funded. Each of the projects included updates in content and in the context in which mathematics topics are presented. Each also affected the role of the teacher. Each has been through rigorous development that included design, piloting, redesign, field-testing, redesign, and publication. This amount of careful development and evaluation is rarely seen in textbook production. . . .

These model curriculum programs show potential for improving school mathematics education. . . . In fact, the U.S. Department of Education, through an act of Congress, evaluated mathematics programs, K-12, and in 1999 found five programs that deserved exemplary status. One of the criteria was that the program must have evidence that it made a measurable difference in student learning. The programs had to provide evidence of gains in student understanding of mathematics, evidence of gains in inquiry, reasoning, and problem solving skills, evidence of improvements in course enrollments, graduation rates, and postsecondary school attendance, and evidence of improved attitudes towards learning. Three NSF curriculum projects met all the criteria and received exemplary awards from the U.S. Department of Education. . . .

And in 2004 the National Academy of Sciences released a book, *On Evaluating Curricular Effectiveness: Judging the Quality of K-12 Mathematics Programs*, which looked at the evaluation studies for the thirteen NSF projects and six commercial textbooks. Based on the 147 research studies accepted, it is quite clear which curriculum programs have promise to improve mathematics education in our country. They are the NSF-funded curriculum projects.

Given a record that includes such data, Fraser went on to ask, Why hasn’t math education improved?

In 1997 California was developing a set of mathematics standards for K-12. A State Board member hijacked the process. She gave the standards, which had been developed through a public process, to a group of four mathematicians to fix. She wanted California’s standards to address just content and content that was easily measurable by multiple-choice exams. The NCTM standards, which the original California standards were based on, were banned and a new set of California standards was adopted instead. . . .

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The four mathematicians and a few others called California's standards "world class." But saying something is world class doesn't make it so. In fact, we now have data to show these standards haven't improved mathematics education at all. Most of California's students have had all of their instruction based on these standards since they were adopted almost ten years ago. Yet, if you go to the California Department of Education's website on testing and look at the 2006 data you will find that only 23% of students are proficient in Algebra I by the end of high school, a gain of 2 points over four years.

Fraser finished her testimony with comments intended to shed light on Mathematically Correct, an organization that sponsors a website that supports back-to-basics policies and practices. She urged the panel not to "move backwards to ineffective habits."

- Susan Friel, a professor of mathematics education at the University of North Carolina, gave a presentation at the Chapel Hill meeting on 29 June 2006 that addressed the development of mathematical thinking in grades K-5. She included a noteworthy and up-to-date bibliography, which will be especially welcome in states where anything connected with the National Council of Teachers of Mathematics has been marginalized by the back-to-basics fervor.

- Mathematician Solomon Garfunkel, executive director of the Consortium for Mathematics and Its Applications, spoke at the Cambridge meeting on 13-14 September 2006:

My comment to this Panel is don't . . . write the report that we all expect to come out of this Panel, because I think it will set back mathematics education for a number of years. Don't write a report that says there is a lot we don't know . . . and [that] until that research is complete, we should stop innovation in curriculum development, except if we adopt something like the Singapore Program, and that we should cut off funding for that curriculum development, we should cut off funding for the National Science Foundation. I suspect that that's what this report will eventually say and it's a terrible mistake.

- Math teacher Holly Concannon spoke briefly at the Cambridge meeting about her rescue of an "academically damaged" young girl and of the progress seen in the Boston Public Schools since the adoption of a curriculum that stresses understanding of mathematical concepts.

- Randy Harter, a mathematics specialist in the Buncombe County Schools in Asheville and president-elect of the North Carolina Teachers of Mathematics, spoke at the Chapel Hill meeting:

In 2001, the Mathematics Learning Study Commit-

tee stated in *Adding It Up* that "mathematics learning has often been more a matter of memorizing than of understanding." Later on the same page, "The overriding premise of our work is that throughout the grades from pre-K through 8 all students should learn to think mathematically." In 2005, the Common Ground Report identified as [its] three foundational premises computational proficiency, careful reasoning, and the ability to formulate and solve problems. My concern is that our long-standing traditions and culturally based instructional practices and the unbalanced emphasis on mathematics as procedures in most K-8 classrooms in this country have inhibited the development of reasoning and problem solving. For most students that come through this system, the result has been that mathematics is merely a set of procedures.

## THE NEW

In October 2006, two back-to-basics leaders from California conducted a marathon of presentations in Seattle. They called for the dismissal of everyone in the Office of the Superintendent of Public Instruction who had been involved in developing the state's math standards and the WASL (the state tests), from Superintendent of Public Instruction Terry Bergeson on down.

They also advocated replacing the state standards with a set of "world-class standards"; getting rid of any vestige of "reform" curricula; erasing the influence of the NCTM over the state's curriculum; making sure that no decision on math instruction is influenced by any educational research or anyone from a college of education; adopting certain textbooks, such as those now being produced in

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Russia or Singapore; looking to mathematicians and “good teachers” while avoiding “mathematics educators” (a rung or two below the night custodian) and teachers who have any sympathy with constructivist notions and are therefore not “good teachers.” Ironically, one session was titled “Finding Common Ground in the Math Wars.”

Their “world-class” standards are the ones cited by Fraser. After they'd been used for 10 years in California, only 23% of algebra course-takers scored in the “proficient” level.

### THE OLD

Those who wish that innovative math programs would disappear seem to have ignored people (especially children) in their educational manifestoes, and I believe it is reasonable to label their wares “Parrot Math.” (I have used this term in prior articles in the *Kappan* in February 1989 and January 1999.) I chose this name because, unlike parrots' mindless copying, people interpret things in terms of their existing mental networks. We then change those networks in the face of the things that we experience, and so we construct our own realities.

The late psycholinguist Hermina deZwart Sinclair, a research colleague of Jean Piaget at the University of Geneva, said, “We should see children as wearing signboards saying ‘Under Construction.’ No, wait a moment. I should say it more strongly: We should see everybody as wearing signboards saying ‘Under Construction — Self-Employed.’”

Despite the back-to-basics supporters' attempt to demonize the notion that we all construct an individual reality, the fact is that such construction is as common as breathing. Furthermore, there is reason to distrust confidence in goals (and tests that address those goals) that emphasize rote memory and instant, atomistic responses, however correct the answers. In the 1980s, a colleague and I asked fourth-, fifth-, and sixth-graders who had been on a chant-out-the-facts arithmetic regimen to give us the answer to, What is  $6 \times 3$ ? The result was close to perfect success across the three grade levels. Almost universally, the children answered 18.

Pretty good, yes? High marks for those kids? High marks for that test?

No. No. And no.

In individual interviews, we asked the children to give us a real-life story or a word problem for  $6 \times 3 = 18$ . These kids had been surrounded by real life for at least nine years by that time, and for virtually all of their school lives they had been surrounded — not to say drowned — by “arithmetic facts.”

In response to our question, a large proportion of the children said something like this: “On Monday I bought six doughnuts. On Tuesday I bought three doughnuts. How many doughnuts did I buy altogether? 18, because  $6 \times 3 = 18$ .” Indeed, more than 75% of the responses at grade 4 and 85% of the responses at grade 5 were incorrect. Worse, half the incorrect responses at grades 4 and 5 were stories for  $6 + 3$ .<sup>6</sup>

Lest readers misunderstand my point, let me stress: kids need to know their facts. But knowing the facts (or knowing anything) in the same way that a parrot can learn to say “ $6 \times 3$  is 18” is a waste of everyone's time. In a slightly overstated but highly amusing put-down of mindless computation, French mathematician Gaspard Monge, the father of differential geometry (1746-1818), said, “Anyone who has done two long divisions in their lifetime has done one too many.”<sup>7</sup>

The British mathematician and philosopher Alfred North Whitehead must have foreseen the advent of Parrot Math when he said, 90 years ago, “In training a child to activity of thought, above all things we must beware of what I call ‘inert ideas’ — that is to say, ideas that are merely received into the mind without being utilized, or tested, or thrown into fresh combinations.”<sup>8</sup>

### THE NEW

In early 2007 the following announcement appeared on [wheresthemath.com](http://wheresthemath.com), a new website in the state of Washington. I reproduce it here, verbatim.

Join Where's the Math in Olympia on February 19th, 2007 beginning at 10:00 AM.

On this Focus Day we will deliver our petition to the Legislator's [sic] and personally meet with key leaders asking for meaningful change in math education and relief from the failures that have plagued our state. We need your help! Please join us.

Check back later for updates and location of meeting place.

The link “Click here to take action” takes one to this page:

We must make it clear to the Governor and our elected officials that reformed math is not interna-

tionally competitive or recognized for its excellence. Reformed programs such as Everyday Math, TERC/Investigation, Connected Math, CMP, IMP, and other NSF-funded programs are not balanced and do not teach computational fluency which are [sic] essential to higher-level math and thinking skills.

As with Mathematically Correct, mentioned in Fraser's Panel testimony above, the site's membership and funding seem to be closely held.

### THE VERY NEW

In early February 2007, there appeared on the Where's the Math website a video titled "Math Education: An Inconvenient Truth," which featured a Seattle meteorologist, M. J. McDermott. The same video appears at [www.youtube.com/watch?v=Tr1qee-bTZI](http://www.youtube.com/watch?v=Tr1qee-bTZI). McDermott, a weathercaster for Seattle's Channel 13, conducts a broadcast-quality lecture in which she extols the virtues of the traditional approach to two-digit multiplication. "If you think that Washington pupils should perform multiplication and division with mastery by the end of fifth grade, you must insist that schools and school districts not use TERC's *Investigations in Number, Data and Space*, and *Everyday Mathematics*," she states, while the texts are shown on camera. (An interesting sidenote: *Investigations in Number, Data and Space* is the very curriculum that Boston teacher Concannon praised in her testimony before the Advisory Panel.)

During the online lecture, McDermott takes us through a computation, step by step, as depicted below.

$$\begin{array}{r}
 1 \\
 26 \\
 \times 31 \\
 \hline
 26 \quad 1 \text{ times } 6 \text{ is } 6 \text{ and } 1 \text{ times } 2 \text{ is } 2. \\
 78 \quad 3 \text{ times } 6 \text{ is } 18. \text{ Write } 8 \dots \text{ carry the } 1. \text{ } 3 \text{ times } 2 \text{ is } 6 \text{ plus } 1 \text{ is } 7. \\
 806 \quad \text{We do the addition. } 6. \text{ } 8+2 \text{ is } 10. \text{ We carry the } 1. \text{ } 7+1 \text{ is } 8.
 \end{array}$$

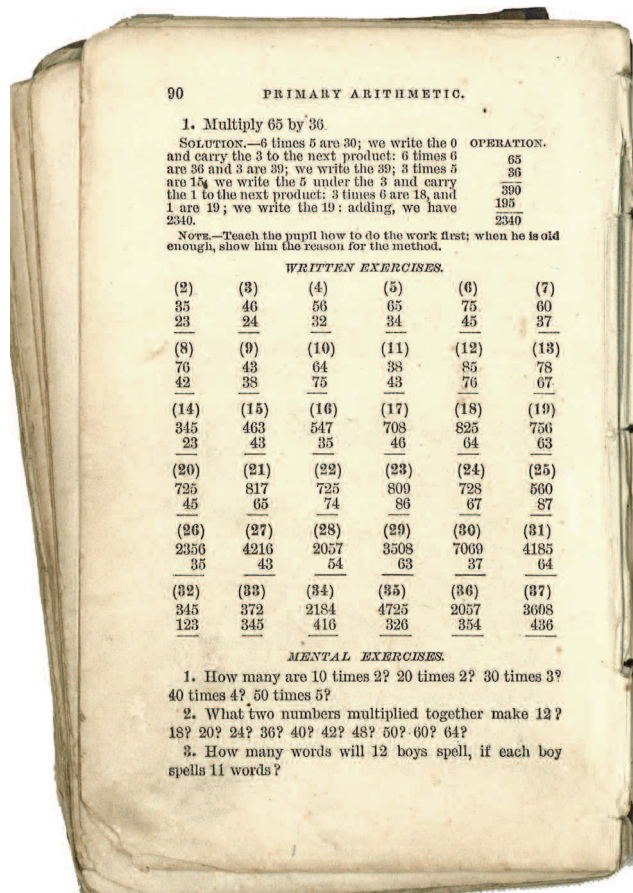
She then takes us through the TERC and the Everyday Math approaches and claims that children rarely become efficient, confident, and fluent in computation in the case of the TERC method. With regard to *Everyday Math*, she admits that the "partial products" method always works, but she often has trouble remembering which bit gets added to which bits.

All of which leads to a sales pitch for Singapore Math.

### THE VERY, VERY OLD

Here, with one small comment, is a page from *The Normal Union Arithmetic*, published in 1878. Lo and behold,

we learn that back-to-basics really means back at least as far as the 19th century in both arithmetic and educational methods. Note the algorithm for multiplication at the top of the page and the practice "problems" that are no such thing. Worthy work for a parrot.



- Sean Cavanagh, "Some Worry About Potential Bias on the National Math Panel," *Education Week*, 19 May 2006.
- "White House Suggests Model Used in Reading to Elevate Math Skills," *Education Week*, 15 February 2006. See also Diane Jean Schemo, "In War over Teaching Reading, a U.S.-Local Clash," *New York Times*, 9 March 2007, available at [www.nytimes.com](http://www.nytimes.com), search on the date and the author's name.
- Claudia Wallis and Sonja Steptoe, "How to Bring Our Schools Out of the 20th Century," *Time*, 18 December 2006, pp. 50-56.
- The meetings took place between May 2006 and January 2007 in Washington, D.C.; Chapel Hill; Cambridge, Mass.; Palo Alto; and New Orleans. Five more meetings are planned and will run through February 2008. (The one scheduled for Chicago in April 2007 will have taken place by the time you read this.) Transcripts of the meetings are being published on the U.S. Department of Education's website, [www.ed.gov/about/bdscomm/list/mathpanel/meetings.html](http://www.ed.gov/about/bdscomm/list/mathpanel/meetings.html).
- Transcript of Meeting of National Mathematics Advisory Panel, 22 May 2006, Washington, D.C., p. 97.
- Thomas C. O'Brien and Shirley A. Casey, "Children Learning Multiplication — Part 1," *School Science and Mathematics*, Spring 1983; and Thomas C. O'Brien and Shirley A. Casey, "Children Learning Multiplication — Part 2," *School Science and Mathematics*, Fall 1983.
- Cited by the South African mathematician Michael deVilliers at <http://mysite.mweb.co.za/residents/profmd/newsletter.html>.
- The essay was first published in 1917. See Alfred North Whitehead, *The Aims of Education and Other Essays* (New York: Free Press, 1957). **■**

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