

## Mathematics in the NYC Children First Initiative

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### “Delivery on the Promise of Mayoral Control”

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I'm Fred Greenleaf, Professor of Mathematics here at Courant. I speak today because of my involvement over the past 10 years with issues of K-12 math education. Let me start by thanking Elizabeth Carson, founder of NYCHOLD, for her tireless efforts to organize this event under the auspices of the Courant Initiative for Mathematical Sciences in Education (CIMSE).

You have already heard from others about K-12 reading programs. I and my colleagues will be speaking about Everyday Mathematics, the mandated New York City K-5 math program under Chancellor Klein's Children First Initiative. I focus on this because of the profound impact this choice will have on all later levels of math instruction.

#### *Some History*

I would like to begin with some history, explaining how Everyday Math came to be the mandated NYC math program. In 1989 the National Council of Teachers of Mathematics (NCTM), the nationwide professional organization of K-12 math teachers, unveiled their “Curriculum and Evaluation Standards for School Mathematics.” These Standards were enthusiastically received by many members of the Education community. By a trickle-down effect of both funding and ideology, the 1989 Standards had an enormous effect on virtually all state standards, new mathematics programs, and the content of state assessments.

Unfortunately, those Standards were a disjointed “vision” of mathematics rather than an organized presentation of what students should be able to do at each K-12 grade level. There were a lot of verbs. Typical language called for students to *understand*, to *explore*, to *represent*, to *analyze*, to *develop confidence*, to *investigate*, to *apply algebraic methods*, to *communicate* and so forth. But the Standards failed to suggest or outline any structured body of knowledge or skills that students should acquire – the sort of coherent and content-rich K-12 curriculum college bound high school graduates will need.

The Standards did, however, call for a reordering of priorities in the curriculum, and included a list of areas that should receive changes in emphasis. They were explicitly critical of the formal and symbolic portions of the mathematics curriculum, and denigrated the role of drill and practice in helping students lock in basic arithmetic and algebraic skills. Topics slated for *de-emphasis* included virtually all of the formal and algebraic skills that are prerequisites for success in college level mathematics.

Among the most enthusiastic proponents of the new Standards were the education professionals who controlled funding of curriculum development projects in the National Science Foundation's division of Education and Human Resources (EHR). In the decade after the NCTM Standards appeared, EHR devoted much of its \$100 million a year math budget to development of math programs such as TERC, CMP, IMP, and Everyday Mathematics that conformed to the NCTM

vision. Later those funds were directed, through the EHR's *Urban Systemic Initiative* program, into multi-million dollar grants to school districts willing to adopt these programs in place of traditional math curricula.

Literature accompanying these programs loudly proclaimed that "extensive educational research" demonstrated their effectiveness and their superiority to traditional math curricula. Those claims were bogus from the start. Supporting research was often conducted by the very people who created the curricula being assessed – hardly impartial judges – and often employed grossly inadequate statistical protocols. In fact a National Research Council report issued this year, surveying more than 200 research articles supporting NCTM-based curricula, concluded that *none* offered valid justification for the claimed superiority of the new math curricula.

The NCTM Standards were grounded in an educational philosophy called "constructivism," two of whose tenets are

- The only way children can truly learn mathematics is to discover it for themselves, constructing their own knowledge via exploratory small group projects
- The role of the teacher is *not* to instruct, but rather to be the "guide on the side" who encourages children in their explorations. "Direct instruction," in which "a teacher, in front of a class, instructs and passes knowledge on to students" is anathema to many constructivist educators.

All this emphasis on constructivist methods in the NCTM Standards, carried to remarkable extremes in some NCTM-based programs such as TERC and IMP, ignored the existence of a massive federal study, *Project Follow Through*. This surveyed 70,000 students in 180 schools during the period 1967-1976 (with follow up studies extending through 1996). This investigation revealed that "direct instruction" – a teacher, in front of a class, instructing students – was in every case superior to a variety of constructivist modes of instruction, both in reading and mathematics, for students at all economic levels. <sup>1</sup>

More history: In the early 1990s California, always in the avante-garde, was one of the first states to encourage widespread implementation of math programs based on the new Standards. About a decade later, it became the first state to decisively reject *all* of the existing NCTM-based programs, in response to a dramatic rise in the need for math remediation among California students entering California colleges, and plummeting California math scores on state and nationwide tests. The State created an entirely new set of K-12 math standards, this time with quite substantial input from college and university mathematicians.

For the crucial early grades K-8 these standards, updated in Year 2000, spell out the skills and math concepts students should achieve year-by-year. The California Standards are quite explicit, emphasize mastery of basic skills, prescribe a coherent progression of increasingly complex concepts to be mastered, and are illustrated by many concrete examples of what should be achieved at each grade level. My colleagues and I regard this document as the gold standard for planners of K-12 math curricula, and have often urged Board of Education (now Department of Education) curriculum planners to take a close look at this document, and at the whole dismal California experience with NCTM-based math programs.

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<sup>1</sup>A recent account of this study, its implications, and the response of the constructivist community can be found in an article sponsored by the Fordham Foundation *Why Education Experts Resist Effective Practices ( And What it Would Take to Make Education More Like Medicine)*, by Douglas Carnine. It can be accessed on the [www.nychold.com](http://www.nychold.com) website, or at: [www.edexcellence.net/library/carnine.html](http://www.edexcellence.net/library/carnine.html)

If they did they would find that Everyday Math has twice been rejected by the State of California since the new California Standards were put in place. Everyday Math has been criticized (especially in its later grades 3-5) for the following:

- its failure to cover important topics specified in the California Standards,
- for its lack of any coherent textbook from which children could study (something that would enable parents to help their children with math)
- for its confusing adherence to a “spiraling approach” to instruction that repeatedly postpones mastery of essential skills. (In fact this program never makes clear *when* mastery of any particular basic skill is to be achieved.)
- for its extensive emphasis on teaching arcane alternatives to standard mathematical procedures.
- for its extensive and early use of calculators, starting in first grade, and its de-emphasis of basic paper-and-pencil computation. (Opponents, myself included, argue that children actually gain a lot of intuition by moving numbers around in their heads and on paper; this does not happen when one merely punches keys on a calculator.)
- for inadequate time-on-task practicing math skills that must become automatic by the time children reach middle school
- and finally, for the daunting complexity of the 950-odd page teacher’s manual that accompanies each grade.

In all these respects the contrast between Everyday Math and texts that meet the California Standards is striking.

### *How did NYC end up with Everyday Math?*

So how is it that New York City chose Everyday Math? Former NYC schools Chancellor Tony Alvarado and his colleague Alan Bersin, an old friend of the Chancellor, were the first people Chancellor Klein turned to in deciding NYC curricular policy. At that time Bersin was superintendent of the San Diego school system and Alvarado was his senior advisor. When Bersin’s team took office they imposed a whole-language oriented reading program and various math programs bearing the NCTM stamp of approval, including Everyday Math as the K-5 mathematics program in San Diego’s “Focus Schools,” populated by the District’s most at-risk students. Shortly after he took office, Chancellor Klein made a special trip to San Diego to hear Bersin, Alvarado, their aides praise these programs. It is worth noting that Everyday Math and all the other constructivist programs were dropped by the San Diego system and replaced with a more traditional program, shortly after Alvarado departed two years ago amid a rising chorus of complaints by San Diego teachers and parents.

Alvarado played a key role in getting constructivist math programs adopted throughout the San Diego system, even though they failed to meet the California Standards. Given his influence with Chancellor Klein, who has since appointed him as a high-level advisor to the NYC Department of Education, it was hardly surprising that Chancellor Klein appointed Diana Lam as his Deputy Chancellor for Instruction and delegated to her responsibility for curricular matters. Before coming to NYC Lam was schools superintendent in San Antonio TX, and then Providence RI, where she imposed Everyday Math and TERC/CMP respectively, as the mandated math curricula. It is

especially noteworthy that San Antonio dropped Everyday Math shortly after Ms. Lam departed, following a secret ballot by the city's teachers, 80% of whom voted against it. Ms. Lam's programs in Providence fared little better after she left. When she departed, math scores in Providence were the lowest in the state.

Lam played a key role in the choice of Everyday Math for NYC. She headed the NYC working group that made all the curricular choices. Lam's group was unwilling to accept meaningful input from NYC math professionals, or even from the Math Chairs of the City University, who have an enormous stake in these issues because the majority of NYC high school graduates who go to college end up at City University.

The working group operated in complete secrecy. Lam and the DOE were unwilling to even reveal its membership until a FOIA action by Elizabeth Carson's NYCHOLD forced them to do so. That action revealed that the committee included no college level mathematicians; that no minutes of their deliberations on this important matter were recorded; and that no final report was issued explaining their actions. Everyday Math was imposed upon us by fiat by Diana Lam and her associates in the newly empowered NYC Department of Education.

### *What is to be Done?*

Ms. Lam has left the NYC educational scene but, alas, this flawed and much-rejected program is alive and well. We have mentioned the National Research Council report on the failings of education research supporting the NCTM-curricula. Even research studies conducted by proponents of NCTM-based programs (the recent ARC study)<sup>2</sup> have only been able to report meager and uncertain results for Everyday Math. The inevitable question is:

*Is Everyday Math as effective as widely used traditional curricula that meet the K-5 California Standards?*

I don't think the DOE every really considered that question, but in fact there is substantial evidence that Everyday Math and other constructivist programs do not fare well in such a comparison. I mention a recent study by Bill Hook and Wayne Bishop, comparing cohorts in California schools as they progressed from grades 1 to 5.<sup>3</sup> Performance in schools using NCTM-based math programs (mostly in San Diego and Los Angeles Unified School District, which had obtained a temporary waiver from the California math standards) was compared with that in other demographically matched schools throughout the state using programs compatible with the California Standards. Math performance was measured by the statewide SAT-9 exams given each year. The result: Schools using math programs compliant with the California Standards outperformed those using constructivist programs by stunning margins, across all demographic groups.

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<sup>2</sup>The recent ARC Center Tri-State Student Achievement Study, sponsored by an organization that has consistently championed NCTM-based curricula, examined the performance of students using three reform programs (Everyday Math, TERC, and Math Trailblazers), comparing it to that of students exposed to various more traditional programs. This study, involving about 100,000 students, reported an average score of 66.8% for students in the reform programs, compared to 65.0% for students in the comparison group. Aside from the fact that the effect of Everyday Math cannot be disaggregated from these data, and well defined reform programs (implemented with unspecified amounts of teacher training) were being compared with a hodgepodge of existing traditional programs, the gain from 65.0 to 66.8% is not very impressive. To put it concretely, on a test of 55 questions the average student in a reform program would have answered 37 correctly while students in the other programs got 36. The ARC report can be found on the ARC website: [www.comap.com/elementary/projects/arc/aboutarc.htm](http://www.comap.com/elementary/projects/arc/aboutarc.htm)

<sup>3</sup>For details see *Urban elementary schools in California show stunning improvement in SAT-9 test scores over initial four year period of new Math Standards*, by Wayne Bishop and William Hook, to appear (preprint Jan 2004). A copy of this article is posted on the [www.nychold.com](http://www.nychold.com) website.

Much has been made of this year's rise in NYC math scores in statewide 4th Grade tests; less is made of the dismal performance at the 8th Grade level. It remains to be seen whether Everyday Math, if and when it is completely phased in, will improve or worsen the eight grade situation. The favorable results for NCTM-based programs reported in the ARC study barely rise above the noise level inherent in this statistical study. Furthermore, no one has ever done a longitudinal study of how students raised on Everyday Math perform in higher level math courses with serious pre-college level math content. My suspicion is that Everyday Math will make things worse because it fails to provide the math content knowledge, or fluency in such basic skills as the use of fractions, required for success in higher level math. The deficiencies of Everyday Math are particularly apparent as a preparation for algebra, which time and again has proved to be a key indicator of likely success in college.<sup>4</sup>

I close by asking: Isn't it time math curricula were chosen by careful examination of programs that actually work, rather than for their conformity to a particular educational ideology? And what about the teachers, who have to implement these curricula in the trenches? This program sets up teachers to fail, forced to use a program that in the long run will not work. I leave you with a question: What do you think would happen if NYC teachers were allowed to vote, in secret ballot, on the merits of the Everyday Math curriculum they are being forced to use? Nobody has yet been willing to take teachers' concerns into account and answer *that* question.

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<sup>4</sup>See *On Course for Success: A Close Look at Selected High School Courses that Prepare All Students for College*, a 2004 report by the Education Trust Foundation and the ACT educational testing service with which it is affiliated. This report can be found on the [www.nychold.com](http://www.nychold.com) website, or accessed at the ACT site: [www.act.org/path/policy/pdf/success-report.pdf](http://www.act.org/path/policy/pdf/success-report.pdf)