2+2=5: FUZZY MATH INVADES WISCONSIN SCHOOLS

LEAH VUKMIR

In the fall of 1997, Kathy Siegmann of McFarland was completely unaware of the latest national controversy brewing over the teaching of math to children. An active mother of five children, Kathy busily attended to the many tasks of running her household, working part-time, shuttling children to extracurricular activities and lending an occasional hand during their evening homework sessions. It was during these nightly sessions that Kathy developed an uneasy feeling about what and how her son was being taught math.

The McFarland School District had recently adopted a new math curriculum for grades three through five that did not provide individual student textbooks. "I could not tell what my children were doing in math, nor could I look in a book to help them," she stated. Feeling frustrated and helpless, she began to question school officials and she also did a little research of her own. It was then that she realized she had come face-to-face with what is now commonly referred to as "new-new" or "fuzzy" math, the latest educational fad to invade schools around the country. Her life was about to dramatically change.

Fortunately, Kathy was not alone. Before long she was joined by Kim Ujke, another parent equally concerned about the new curriculum. After doing their own exhaustive research into various math programs, the moms decided to pull their children out of school during math class and instead homeschool for that hour using a more traditional math program. The school's principal and teachers were informed of their decision and, in December 1998, they proceeded with their plan. The next month Dawn Myers pulled her third grade daughter from the class. Shortly thereafter Mary Turke's fourth grader joined the exodus along with Kathy's 5th grade son.

The families quietly went about their home study courses and the children thrived under their parent's tutelage. All scored in the "advanced proficiency" level on the Wisconsin Student Assessment System math test. By the following school year, a total of eight families were involved in this endeavor. They never pressured the school district to discontinue the

Leah Vukmir *is a visiting fellow at the Wisconsin Policy Research Institute and President of PRESS (Parents Raising Educational Standards in Schools).*

new curriculum, but instead urged officials to consider offering a more traditional alternative that better suited their children and, they believed, many other children.

In January 2000, their tranquility was broken when they received a letter from the school district informing them that their children would be in violation of school truancy laws if the parents continued to remove them from the school's math instruction. The parents were allowed to finish out the school year, however, they now faced uncertainty about the future.

What is it about this new approach to teaching math that so concerned these parents? The “new-new” math classroom is based on the notion that children understand and learn only those concepts that they "construct" or discover on their own. The teacher is discouraged from providing information or imparting knowledge, and is instead encouraged to act as a “facilitator” of learning.

In small “cooperative learning” groups, children use blocks, beads, sticks and other “manipulative” objects to solve mathematical problems. This practice often extends beyond the early grades and is even found in high school algebra classrooms. The children are expected to discover or “reconstruct” the ancient rules of mathematics using the objects with the guidance of peers equally in the dark.

Rote memorization of math facts, e.g. multiplication tables, is considered taboo and textbooks are virtually non-existent in these bold new classrooms. Correct answers are less important than the thinking processes exhibited by the children. Classroom time is filled with projects such as writing essays *about* math versus repeated practice of the fundamental rules of math. Calculators and “guesswork” are encouraged at even the earliest of grades, and the fundamental operations of math, known as algorithms, are left to the child to discover

In McFarland, besides not understanding the unconventional teaching methods, many parents found the pace too slow for their children. Attempts to have teachers tailor the program to fit the children's needs led to frustration. Errors were found in "teaching packets" and parents were asked to be patient as the "bugs" in the new program were worked out, prompting one mom to emphatically reply in a parent survey, "Our daughter will only be in 3rd grade once. It is unfair to ask her to put her learning on hold." (See Figure 1 for examples from McFarland’s math program, *Investigations in Numbers, Data and Space*.)

This level of parental outrage and concern is certainly not confined to McFarland. According to Parents Raising Educational Standards in Schools, a Wisconsin-based parent organization, math education has become the number one concern of parents calling for information and assistance. In the last two years it has supplanted the "Reading Wars" and is causing parents across Wisconsin and the nation to organize and rebel.

To fully understand the origins of this new approach to math education, one must look to the National Council of Teachers of Mathematics (NCTM), and to the state of California — often considered the nation's laboratory for educational fads.

NCTM Origins

For more than 75 years, NCTM, the nation's most influential organization of math teachers, has been dedicated to "improving mathematics teaching and learning from preschool through post-secondary school." NCTM boasts more than 110,000 members worldwide.[1]

In 1989, NCTM published *Principles and Standards for School Mathematics*, a set of math standards seen by many as the basis of today's "fuzzy" or "new-new" math curricula. This document put into print the philosophy of math education noticed by the parents in McFarland. Embraced by teacher colleges long before its publication, *Principles and Standards*, in essence, became the bible for a progressive education theory known as "constructivism," and according to many critics put a legitimate stamp of approval on an approach to math

FIGURE 1 EXAMPLES FROM INVESTIGATIONS IN NUMBERS, DATA AND SPACE

3rd Grade Worksheet

1. Suppose you can hold 150 beans in your right hand and 217 beans in your left hand.

   How many more beans are in your left hand?

   Write down how you figured this out.

2. Solve this problem three different ways. Using a calculator can be one way. Make notes about how you solved the problem. Be sure that others can understand what you did:

   42+36+18=

   First way:

   Second way:

   Third way:

From 3rd Grade Manual (Addition)

Birthday: Pantomime holding a newborn baby in your arms. Tell students that the baby was just born, and write today's date on the board. Explain that this is the baby's birthday. Sing "Happy Birthday," and encourage students to sing with you. Ask for volunteers to sing the song in their native languages. Students might also make a poster with the words "Happy Birthday" in all the languages spoken in the class. Have each student point to his or her birthday on the calendar. This is a good opportunity to make a graph of the months of students' birthdays.

education that had already invaded schools nationwide.

The California Experiment

Armed with a new math education manifesto — the NCTM Standards — teachers around the country pushed forward with a new sense of purpose and eagerly unleashed the constructivist ideology in their classrooms. California heavily bought into "new-new" math in the early 1990s, and by 1992 had released the California Mathematics Framework — a document based largely on the NCTM Standards.

Before long, this unorthodox approach to teaching math was noticed by a group of California parents. Largely hailing from scientific fields, these parents believed their own children would never be able to function in professions similar to their own with the scant skills and weak foundation they were developing in their new math classrooms. Calling themselves "Mathematically Correct," these parents organized through the Internet and mounted a fierce opposition to California's NCTM-modeled math standards.

The Mathematically Correct web site documents the history of today's "Math Wars," critiques NCTM standards, analyzes a variety of math texts and programs (see Figure 2), and provides parents with a multitude of resources to fight "fuzzy" math in their own communities. In a strong and authoritative voice, the mathematicians and scientists who run the site warn parents that:

> Although there are many variations in the methods of these new programs, they have one clear characteristic in common — they are weak in mathematics. The expectations for our students are seriously undermined. And, as the mathematics is leeched out of the textbooks, the opportunities for our students to learn is withering away.

They found that this problem is not limited to the elementary schools, or to the four operations of mathematics. The combination of new methods and "low content levels" are present in many high schools and even in college calculus. Incoming college freshmen are showing a decline in math achievement, causing concern over the quality of future teachers.

FIGURE 2 "FUZZY" MATH PROGRAM RATINGS:

The following is a partial list of programs reviewed by Mathematically Correct. Other reviews can be found at: www.mathematicallycorrect.com

Second Grade	
Investigations in Numbers, Data and Space by Dale Seymour	**F**
Everyday Mathematics by Everyday Learning Corporation (The University of Chicago Mathematics Project)	**C**
Fifth Grade	
Investigations in Numbers, Data and Space by Dale Seymour	**F**
Everyday Mathematics by Everyday Learning Corporation (The University of Chicago Mathematics Project)	**C-**
Seventh Grade	
Connected Mathematics by Dale Seymour	**F**
Math Thematics by McDougal Littell (Book 2)	**D+**

They conclude:

> Now we are faced with an inadequate supply of teachers who are really qualified to teach mathematics, with new curriculum materials that lack the content our students need, and with poor achievement compared to our international competition, all wrapped in glowing rhetoric about the new directions in mathematics education.[2]

The Mathematically Correct parents faced an arduous task when they decided to take on California's education establishment. Nevertheless, they were buoyed by an undisputed fact: California kids scored among the lowest in the nation on the 1996 National Assessment for Educational Progress (NAEP) math test. More than half of California's fourth graders scored below the basic proficiency level and 49% of the state's eighth graders had "below basic" math understanding. Overall, California's fourth graders ranked fourth worst in the nation, tying with Louisiana and trailed only by Mississippi, Guam and the District of Columbia.[3]

According to Dr. David Klein, Professor of Mathematics at California State University–Northridge, California experienced "a backlash at the grass-roots level against the general education reform movement (including Whole Language Learning and Integrated Science), and mathematics reform in particular." The conflict pitted the so-called mathematics reformers from the schools of education against parents and a significant portion of the university mathematics community.[4]

The combined forces of parents and mathematicians began an information campaign that ultimately led to the development of a revised set of state math standards adopted by the California Board of Education in December 1997. The new blueprint, "California Mathematics Academic Content Standards," delineated benchmark standards for each grade level. Gone were the prescriptions for constructivist teaching methods. Finally, a set of standards that emphasized the development of basic math skills!

Mathematically Correct maintains a vigilant watch over California's math instruction and textbook adoption. The group also serves as a resource to parents in other states who are starting to notice the invasion of "new-new" math in sleepy towns across Middle America.

Wisconsin Joins The New World Of Math

McFarland is just one of the many sleepy Wisconsin towns choosing to adopt "fuzzy"

math. But how did a West Coast math craze make its way into the heartland of America's Midwest? Can a national organization of math teachers wield that much power over the local decision making processes of small Wisconsin school districts? What factors are responsible for the invasion of "new-new" math in Wisconsin and how entrenched is this ideology in our schools? To answer these questions we must look to three sources:

1. Federal Math Program Recommendations
2. Wisconsin Model Academic Math Standards
3. Wisconsin Academy Staff Development Initiative

Federal Math Program Recommendations

In October 1999, a United States Education Department "panel" released a controversial list of 10 "exemplary" or "promising" mathematics programs to a captive audience of educators attending a national conference. The programs reflected the pedagogical approaches to math outlined in the NCTM standards. With one swift wave of a wand, the federal education "experts" gave educators their blessing to proceed down the road to "Fuzzy Mathdom." (See Figure 3)

Fearing the effects of such an endorsement, a group of 200 highly respected university mathematicians and scholars, including several Nobel Laureates, sent an open letter to Education Secretary Richard Riley urging him to withdraw the recommendation.[5] Warning that the programs had "serious shortcomings," they urged local districts to "exercise caution in choosing mathematics programs." The education establishment has largely ignored these warnings. Many local districts in Wisconsin continue to cite federal recommendations in their push to embrace the new math curricula.

Figure 3

Math Programs Endorsed by the United States Department of Education October 1999

1. Cognitive Tutor Algebra
2. College Preparatory Mathematics (CPM)
3. Connected Mathematics Program (CMP)
4. Core-Plus Mathematics Project
5. Interactive Mathematics Program (IMP)
6. Everyday Mathematics
7. MathLand
8. Middle-school Mathematics through Applications Project (MMAP)
9. Number Power
10. The University of Chicago School Mathematics Project (UCSMP)

Two hundred mathematicians wrote to Education Secretary Richard Riley asking to withdraw his recommendation of these programs that they found to have “serious shortcomings.”

Wisconsin Math Standards

A second influencing factor can be found in the Wisconsin Model Academic Math Standards, adopted in 1997. One need not dig too deep to find the NCTM influence on the state standards. The introductory paragraph cites the NCTM *Curriculum and Evaluation Standards for School Mathematics* as a resource document used during standards deliberations. Under the heading of "Goals and Instructional Practice," the introduction continues:

> Classroom practice geared to the attainment of the Wisconsin Standards should be aimed at creating a community of learners and scholars, a place where the teachers and students actively investigate and discuss mathematical ideas, using a wide variety of tools, materials, and technology. Classes should engage students in more high-level mathematical thought and emphasize conceptual understanding, more so than in the past.[6]

Sound familiar? Strains of constructivism echo throughout the entire document.

Wisconsin Academy Staff Development Initiative

Perhaps the most powerful influence on Wisconsin's movement toward "fuzzy" math can be found in the Wisconsin Academy Staff Development Initiative (WASDI). Average Wisconsin citizens are likely unaware of this six-million dollar project funded by a National Science Foundation grant. WASDI is, however, a very familiar resource to Wisconsin math and science teachers. Aimed at improving K-12 mathematics, science and technology education in Wisconsin, the goal of WASDI is:

> To totally transform the way technology education, mathematics and science are taught. It's not just reading the chapter and memorizing terms and filling in the blanks at the end of the chapter. It's hand-on learning.[7]

To that end, WASDI conducts a series of one-week summer academies throughout Wisconsin at which participants can earn graduate credits for learning new approaches to teaching math, science and technology. Over 2000 teachers participate in these workshops each year at 11 sites located across the state.

WASDI also takes an active role in developing teachers as future leaders through its "Lead Teacher Institute." According to the WASDI web site, teachers completing this eight-week "Institute" will be able to:

1. Serve as local, state, and regional state resources to their school, other districts and state associations.
2. Present a core curriculum at the summer academies, specifically one that "uses a constructivist approach to teaching."
3. Network with other "Lead" teachers throughout the state.

At the helm of this ambitious project that infuses Wisconsin districts with "new-new" math is Dr. Billie Earl Sparks, Co-Project Director of WASDI. A math professor at the University of Wisconsin-Eau Claire, Sparks also teaches math "content" to the university's education students.

According to Sparks, WASDI has trained 337 "Lead" teachers in the past six years. He explained that the National Science Foundation (NSF) has been a leader in advancing new math approaches across the country by providing grants to groups willing to write math curricula that match the NCTM Standards. Currently, 13 NSF-sponsored curricula are available to local districts.[8]

Sparks could best be described as a standard bearer for constructivist math in Wisconsin. Indeed, it is difficult to speak with Dr. Sparks without sensing his fervor to this cause. In September 2000, Sparks spoke at a public forum held in the McFarland School District. He gave an impassioned presentation entitled, "Mathematics Education: Past, Present, and Future." In it he described the philosophy behind the district's recent adoption of "Investigations in Numbers, Data and Space," the controversial NCTM-based math program that spurred the McFarland parents into action.

During his talk, Sparks outlined his own personal odyssey toward constructivist math. He reflected on his student days in a traditional mathematics classroom that, in his view, only allowed certain students to excel in math. "Today, we need a curriculum for all, not just the select God-chosen few, " Sparks explained.

Dr. Spark's presentation was replete with comments showing his deep commitment to the constructivist philosophy:

> "Math programs should be presented in a fashion where there is exploration first. Exploration should proceed convention, rule and formula."
>
> "Math programs need to incorporate group activities. Within groups, children learn from each other and learn the value of the contributions of others. This is what happens in the workplace."
>
> "I am not a fan of acceleration of children and grouping of children by ability levels. If we put the brightest kids in one group, the other kids will never get the benefit of their strategies for learning."

To many this may sound more like sociology than math. Yet, Sparks is a true believer. He emphatically asserted that math skills should not be taught in isolation. This is the "old" way of learning where teachers demonstrated a skill and students were expected to understand the skill through repetition, and rote memory. In classrooms today, students are expected to explore with their classmates until they find the skill that will solve the problem. As they explore, teachers intervene and teach skills as they arise. This is how math becomes meaningful, he believes, and how children will more likely remember the skill.[9]

According to Harvard University Math Professor, Dr. Wilfried Schmid, there is some value in the practices that Sparks describes. "These are used by good teachers all over the world. The problem comes when these ideas are pushed to the point of becoming an ideology as they are in the 'Investigations in Numbers, Data and Space' math program. Many teachers using this program manage to do a good job, by using their own judgment to filter out the ideology. When the manuals are taken literally, then you get into trouble. [10]

At the 5th grade level, curriculum is more than two years behind the Singapore curriculum

Dr. Schmid ought to know. Last year, his second grade daughter was enrolled in the same math program being used in McFarland. He lists the following problems with the "Investigations" program:

Mathematical substance is very shallow

Memorization is discouraged

Students are kept dependent on mental crutches (fingers, blocks, clock faces)

Intellectual level is demeaning to bright students

At the 5th grade level, curriculum is more than two years behind the Singapore curriculum

Dr. Schmid described a situation where his daughter, Sabina, was not allowed to add two-digit numbers by carrying tens, despite the fact that she knew perfectly well how to do so. Instead, her teacher insisted that she demonstrate her work with blocks or by counting on her fingers. "So Sabina is reduced to drawing 39 little men to solve problems like 39 minus 14."[11] Today Schmid is a vocal critic of constructivist math programs.

Based on international testing data from the Third International Mathematics and Science Study (TIMSS) conducted in 1995, it appears that Schmid's concerns are not unfounded. Considered by far the most comprehensive and rigorous comparisons of international math achievement ever to be conducted, the study involved 42 countries and assessed children at three grade levels. Although American 4th graders scored above the international average, the study found that:

U.S. 12th graders scored below the international average in math and were ranked 19 out of the 21 nations that tested high school seniors. Only Cyprus and South Africa scored below the U.S students.

Among students taking advanced math courses, U.S. students ranked 15 out of 16 tested.

U.S. 8th graders scored below the international average.[12]

A follow-up study just released in December revealed even more troubling results. Conducted in 1999, the TIMSS-Repeat assessed students at the 8th grade level and found that U.S. 8th graders were well below

average when compared with countries that were included in both the 1995 and 1999 studies. Additionally, the TIMSS-Repeat was specifically designed to provide information about changes in the math achievement of a cohort of students over the past four years. Most significant was the finding that U.S. 8th graders dropped from 9th to 12th place among the 17 nations tested, indicating that American students are falling behind their international peers the longer they remain in our school system.[13]

Wisconsin education officials are quick to note that Wisconsin students consistently rank in the top five on NAEP math tests, often referred to as the "Nation's Report Card." This is no consolation given the country's overall international rankings. At the same time, DPI officials state that one-third of Wisconsin school districts are shifting toward some type of new math curricula.[14] With the gradual encroachment of "fuzzy" math into more and more Wisconsin school districts, it may only be a matter of time before Wisconsin slips further in the national rankings.

While the debate regarding math rages on, one thing remains certain: Parents in Wisconsin are not idly waiting for the experts to come to a consensus of opinion. Time does not stand still for young children at critical ages when fundamental math principles must be learned. Parents are finding their own ways to deal with the flaws they see in the new curricula.

In McFarland, that means that some parents have enrolled their children in private schools. Others have left the district entirely. Some children are being privately tutored. Still others have been forced to put their children back into the very math classrooms that started this controversy in the first place. Parents hoping to counter the negative effects of fuzzy math tutor these children at home.

For Kathy Siegmann it means becoming a member of the McFarland School Board. The "new-new" math curricula has become more than a personal issue for her. Now she is concerned about the long-term effects of this program on the entire community. She has decided to stand up for her beliefs, even if it means being "a lone voice on the board."

Only three families from the original group of parents continue to fight on in McFarland. Sadly, it appears their fate may lie in the hands of a court instead of the hands of parents.

Notes

1. www.nctm.org.

2. www.mathematicallycorrect.com.

3. NAEP scores can be found at the National Center for Educational Statistics web site: www.nces.ed.gov/index.html.

4. Dr. Klein's essay entitled "Big Business, Race, and Gender in Mathematics Reform" is found in *How to Teach Mathematics* by Steven Krantz, American Mathematical Society, January, 1999.

5. Mathematically Correct web site.

6. Wisconsin Model Academic Standards Home Page: 7. www.dpi.state.wi.us/standards/index.html.

7. www.wasdi.org.

8. Information obtained in a phone conversation with Dr. Sparks, December, 2000.

9. Taped presentation to McFarland School District, September, 2000.

10. Obtained from email correspondence with Dr. Schmid, December, 2000.

11. Anemona Hartocollis, "The New, Flexible Math meets Parental Rebellion," *The New York Times*, April 27, 2000.

12. The National Center for Educational Statistics Home Page: www.nces.ed.gov/.

13. *Ibid.*

14. Valeria Davis-Humphrey, "McFarland finds some successes in math program," *Wisconsin State Journal*, September 24, 2000.