Ruth Parker: An Open Letter In Response To Questions

Dear Parents,

I have kept your email intact in order to respond directly to each question. You will find all of your questions in italics, followed by my replies. In light of your suggestion that others may have some of the same questions and my answers should be accessible to everyone who is interested, I have posted my response on MEC's website. I apologize in advance for my lack of brevity, but the issues you raise are important, misconceptions exist, and are too great to take lightly. I have responded to each concern you raised in order to directly address misconceptions and hopefully promote productive dialogue.

Dear Dr. Ruth Parker,

Thank you for sharing your passion for quality math education last week at Inglewood Jr. High School. We share your passion because we have such a vested interest in ensuring our children succeed in math. It's not only vital for their futures, but as you'll recall from "The World is Flat", it's vital for our economy and national security.

It was unfortunate that time didn't allow us to have a 2-way conversation to fully vet the issue and clear up misunderstandings and questions. Open discussion would help ease the tension surrounding this issue and build a more trusting partnership among parents, teachers and administrators. Your purpose was to build a case for this radically different approach to math education so we hope you won't mind correcting any misunderstandings and providing valid evidence for your assertions. I'm sure you would agree that as parents of the children who will be subjected to this curriculum, we have the right and responsibility to scrutinize the validity of your case. Below are some questions and concerns about your presentation that we'd like you to address.

I too wish there had been more time available for dialogue, but I was asked to speak to the community about important issues in mathematics education. Although if asked I would be happy to do so, I was not invited to talk about curriculum or moderate a discussion. As you know, I did plan time into the session for questions and dialogue with parents, although time inevitably runs short in such situations.

As I'm sure you could tell from my talk, I consider this a more meaningful approach to mathematics education rather than a "radically different approach" as you suggest. Students still need to know basic skills, and how to compute efficiently, and they need much more. If they are to be successful in mathematics then they need to understand the mathematics that they do. They need productive mathematical dispositions, and they must be able to reason with mathematics and communicate their thinking both orally and in writing.

1. Several times, you made the assertion that the "old way" of teaching math was a mass failure (even mentioning it only worked for about 5% of our citizenry), yet you only showed one isolated test problem from the NAEP. Can you provide more reliable evidence to support your assertion that it was a mass failure? The "old" math was used to fuel the technology revolution providing numerous jobs and historically low unemployment in our country, which indicates it was successful for many people.

I told of a community / business advisory meeting in Saratoga, California where a leader from Intel mentioned that when it comes to mathematics in today's world, Intel doesn't need to have just 9% of the population well educated, but rather, to have an educated population. I don't believe I ever used the words "mass failure," but from my perspective, it's not too far off. Many, many people have learned in school to fear and/or avoid mathematics. Very few adult Americans are able to reason with numbers, determine the reasonableness of data or statistics, or confidently use mathematics to make sense of information and situations in their lives. We, as a nation, are too numerically and mathematically illiterate. Yes, some of us understand mathematics and use it in important ways, but all too many do not.

Widespread mathematical illiteracy in the US has been documented in many ways, at least from the early 80's, when President Reagan set up a National Commission on Excellence in Education and charged it with studying in depth the state of America's educational system. Its report entitled "A Nation at Risk" was an unambiguous cry for reform. Among other telling statements was the following, "If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war. As it stands, we have allowed this to happen to ourselves." (The report can be found at http://www.ed.gov/pubs/NatAtRisk/index.html)

As for the National Assessment of Educational Progress (NAEP) data, if you 'Google' "NAEP" you will find lots of evidence that US students have been performing poorly for decades when it comes to mathematics education. You will also find that NAEP scores have not been declining since the publication of the NCTM Standards. Student performance has continued to improve, but at far too slow a rate.

2. You showed the standard algorithm for adding 3 digit numbers and stated that carrying/borrowing teaches kids incorrectly because it un-teaches place value. How can you support that claim? When carrying and borrowing are taught properly (such as using place value manipulatives, like in our previous curriculum) it reinforces understanding of place value, and builds both number sense and an efficient method to solve all like problems.

I do indeed believe that teaching standard paper and pencil algorithms, especially when they are taught prematurely, obscures place value relationships and can interfere with the development of numerical reasoning skills. I, too, taught computation for years using place value manipulatives. While my students learned how to perform the standard paper and pencil algorithms, they still did not learn to reason with numbers. Thinking About Alternative Procedures, a piece I wrote on standard and non-standard algorithms, might help you understand my position as well as my concern about students' lack of understanding of place value. It describes the numerical reasoning practice that I advocate.

3. You said you were unhappy if 5th graders did double-digit multiplication problems with paper-and-pencil because it doesn't develop numerical understanding, so it's better to do them in their head. How can mentally solving problems be considered always better than paper-and-pencil—especially for visual and tactile learners? Is there any evidence to prove this theory?

You saw examples of how my students mentally solved double-digit multiplication problems, but I said that I would be disappointed if my 5th graders bothered to take the time to pick up a paper and pencil to solve a problem such as 578 + 756. I would expect students to recognize this as a simple problem that is easy to solve mentally since it only involves adding 1200 plus 120 plus 14 for 1334. Kids don't think this way though if they've never learned to reason with numbers. They reach for their paper and pencils to write the problem down and then find an answer without even considering whether the answer they arrive at makes sense.

I certainly would never make the claim that mentally solving problems should always be considered better than paper and pencil. Some calculations are complex enough to require either available technology or paper and pencil, and students should certainly know how to compute using paper and pencil when necessary. Students need to have efficient ways to record and keep track of the mathematics they are doing. They also need to use the language of mathematics to efficiently communicate ideas.

Notes On A Successful School provides evidence that daily practice in mental arithmetic (or what I call Number Talks) combined with the program *Investigations In Number, Data, and Space* can result in improved student performance on a significant scale. You will read about a school in Colorado that recently received the Governor's award for the best progress in mathematics of all schools in Colorado. Increased test scores were also the norm in the schools that combined these two practices in our National Science Foundation funded work in Portland, Oregon.

As problems get more complex, students can't do them accurately in their heads and will need to know how to solve them with paper-and-pencil. Developing this proficiency requires many years of sequential practice and must start with the basics.

While I certainly agree that students need to be able to do more mathematics than what they can do mentally, and that numerical understanding is developed over many years, I advocate that the basics can and should be taught in the context of developing numerical literacy, and hand-in-hand with problem solving as children use the basics to do mathematics.

I also agree that learning the "basics" is important from the start. Where I think we may differ is on how best to teach in ways that develop an understanding of the basics of mathematics, and perhaps what it is that constitutes "the basics." I believe that when we teach a mathematical idea, such as multiplication, we should teach it conceptually and in mathematical contexts that help children understand the relationships involved. It should be taught in ways that reveal the arithmetic properties that are foundational to success with algebra. Practice should happen continually as children do mathematics and work to make sense of what they are doing. The development of conceptual understanding and frequent practice go hand-in-hand, and can be accomplished as students learn mathematics in ways that build a more sturdy mathematical foundation.

The bottom line for me is that our first priority should be to teach for conceptual understanding; to teach in ways that help children understand the mathematical relationships involved. There is decades of evidence to show that when students do not understand mathematics they cannot effectively put it to work. Students cannot reason efficiently with mathematics if they cannot reason with number; without understanding, little to no reasoning occurs.

As you might appreciate, I find it so discouraging that some individuals are working today with such vigilance to convince the American public that we in mathematics education do not care about kids being proficient in basic skills, and that we do not care if they can compute with accuracy. Imagine my shock to read in a front-page article in the Los Angeles Times in 1997 that Ruth Parker does not believe in having children learn multiplication facts. Nothing could be farther from the truth. I have, for decades, taught teachers and parents how to build fluency with 'basic facts.'

When you say, "*Developing this proficiency requires many years of sequential practice and must start with the basics,*" do you mean that first students practice the 'basics' and then second we should teach them to problem solve? If so, then I must respectfully disagree. By the time we have drilled them on 'the basics,' we have convinced most students that mathematics is a subject to be memorized not understood, or worse yet, that it is a deadly boring subject to be feared and avoided.

Granted, when you and I were in school many of us learned the so called 'basics' and became fairly proficient at adding, subtracting, multiplying and maybe even dividing whole numbers with paper and pencil. Fewer of us are proficient when it comes to ratios, or decimals and percents. Those topics consumed nearly the entire first eight years of our mathematics education and, as I mentioned earlier, left most of us ill-prepared for success in algebra and mathematically and numerically illiterate when it comes to the needs of a well-informed citizen of today, and the unprecedented demands of the workplace.

There has never, ever to my knowledge been a time in history when our nation's schools have done a good job of preparing more than a small percentage of students mathematically. The saddest thing about this anti-NCTM, anti-NSF, anti-mathematics-reform movement is that it has severely restricted the progress that was beginning to be made subsequent to the publication of the NCTM Standards in 1989. A small group of individuals has now managed to convince a good segment of the American public that there was a time when everyone was well prepared in mathematics, and that the NCTM Standards were the beginning of the downfall of mathematics education. There is quite simply no evidence, at least none that I have seen, to support this position.

Your demonstration problems had multiple steps and you never showed us a reliable method of mental book keeping to increase accuracy.

In fact, I showed several examples that work more efficiently than the standard algorithm when it comes to reasoning mentally with numbers, and examples that work with paper and pencil no matter how complex the problems get. I doubt that many people today solve 'very complex' math problems with paper and pencil. I would think the norm, by far, would be to use available technology when the problems get complex. As I said in my talk, technology does not absolve us of the need to understand numbers. Rather, it demands that students understand far more about number than has ever before been the case.

Additionally, showing work is required for the WASL and by most teachers, so our students must learn how. When do you recommend teaching and providing practice of these skills so students can develop *the necessary proficiency?*

As was evident in the student work I shared, students do show their work. Hopefully you noticed in the examples that my fifth-graders accurately and effectively used fractions notation including operations on fractions to represent their work.

Again, practice with math facts and computation should be provided from the very beginning of a student's schooling. It is how they are practiced and taught, not if they should be practiced that is the issue I address repeatedly in my sessions with parents, teachers, administrators, mathematicians, and business and community leaders. As I mentioned in the session you attended, contrary to what some would have people believe, I, as well as the National Council of Teachers of Mathematics, believe that fluency with basic facts is essential. Students must be able to compute with accuracy, efficiency and flexibility. As I suggested earlier, if there is interest I would be happy to offer the parent session designed to help parents and educators see how multiplication facts can be learned with understanding.

A major concern parents have with our Investigations curriculum is that it does not provide enough practice to develop proficiency in both computation and problem solving skills. This point was made during your presentation and you avoided answering the question. A cogent answer is necessary to alleviate parent concern with TERC Investigations because many of us see our kids entering 6th grade hampered in problem solving because they can't compute accurately.

I did not intentionally avoid answering any question that was asked. Much of the practice in *Investigations In Number, Data, and Space* is embedded in games and mathematical investigations. If the games are not being played, then much of the practice is being missed. A concern I have heard from parents is that there are too few support materials for parents and they do not know how to help their children at home, a valid criticism of the first edition. I hope you will look at the 2nd edition of *Investigations* that has just recently been published. I understand that this and other parent concerns have been addressed therein.

The claim that *Investigations* does not provide enough practice to develop proficiency in both computation and problem solving is not consistent with the data I have seen. Many districts that are using Investigations have seen student test scores rise. This is the case in Boston (MA), Portland (OR), St. Vrain Valley (CO), several Washington State school districts, and many school districts elsewhere. Where are the data to support your claims that students who are using *Investigations In Number, Data and Space* do not develop proficiency in computation or problem solving skills? I'm sure it is easy to find anecdotes to support any position, but I have not, to date, seen any objective data to indicate that your generalization above is accurate.

Unfortunately, there have always been too many students who are unsuccessful in mathematics, no matter what the curriculum. This is one primary reason that the National Council of Teachers of Mathematics (NCTM), with the publication of its Curriculum and Evaluation Standards in 1989, and its Professional Teaching Standards in 1991, sounded a call for a more powerful and meaningful mathematics education for ALL students.

James Stigler's video study, part of the Third International Math and Science Study, (TIMSS) makes it clear that the critical piece is what happens in the classroom. He found that the United States spends much more time than our international peers emphasizing definitions and practicing procedures, and less time teaching for conceptual understanding.

4. You stated high tech employers don't want people who can compute, they only want people with problem solving skills. Then you gave a few extremely anecdotal examples. Do you have any hard data to show this is true and that employers aren't looking for people with <u>both</u> skills? How do you explain the outsourcing of math-demanding jobs to foreign countries where students are educated to be extremely proficient in computational skills and follow curricula that you condemn? Additionally, you might want to refrain from using Microsoft interview strategies. Several Microsoft audience members found your assertion that problem-solving skills in the absence of strong computational skills demonstrated a gross misunderstanding of their interview process.

My work has been about strengthening computational skills, not weakening them. Not once have I ever suggested that students' problem solving abilities should be devoid of strong computational skills. It is difficult for me to understand how you could make such an assertion after attending the session where I focused so directly on the importance of numerical literacy.

On many occasions, I have shared the statement made during one of my community math nights by a father who works at Microsoft, and I have done so in the presence of other Microsoft employees. Never before have I been asked to stop sharing it. It is my understanding that in their hiring practices Microsoft looks for workers who can think and reason (including with numbers and numerical information), and who can put mathematics to work to solve real and complex problems. I would also assume that they look for workers who can defend their ideas and make sound mathematical arguments in support of their ideas and problem solutions.

In the session you attended, I mentioned several times that students must be able to add, subtract, multiply and divide accurately, efficiently and flexibly. When someone turns my call for 10 to 15 minutes of daily practice with mental computation into a statement that I don't want kids to be able to compute or to ever compute with paper and pencil it is simply a gross misrepresentation of my beliefs and my practice.

5. You portrayed Dr. William Schmidt, director of TIMSS, as referring to the "old" math as shallow and spiraling. That's not accurate. His studies where done when the reform NCTM standards had been in place for over a decade. See the following article for his detailed findings. Schmidt, W., Houang, R. and Cogan, L.: 2002, "A Coherent Curriculum, The Case of Mathematics," American Educator, Summer 2002 Issue,
http://www.aft.org/pubs-reports/american_educator/summer2002/curriculum.pdf
In addition, some of us heard Dr. William Schmidt state on February 27th, 2006 at a Seattle School District meeting, that he did not recommend TERC Investigations.

Yes, I did say that Dr. Schmidt told a group of mathematics teachers at an Asilomar math conference that we in the US think we have a spiral curriculum, but that because we teach ideas very shallowly, we compress the spiral, and end up with students going pretty much around in circles as we re-teach the same skills shallowly year after year. He was certainly right about this, just as I believe he was right when he described typical mathematics programs in the US as "a mile wide and an inch deep."

U.S. mathematics textbooks have many more topics per grade level than do textbooks from countries that are outperforming us. According to TIMSS data, eighth-grade mathematics textbooks in Japan have around 10 topics, but U.S. textbooks cover over 30. It should be noted that only 8% of schools in the U.S. were using a middle grades reform-based curriculum at the time of the Third International Math and Science Study (TIMSS). In the elementary grades it was less than 20%. The report on U.S. classrooms in 2000 (Weiss et al., 2001) shows that mathematics classrooms were still dominated by the use of traditional textbooks. http://2000survey.horizon-research.com/

6. You stated that students who receive a combination of both reform and traditional math instruction do worse than students who receive either alone. Can you provide us with the evidence you're basing this statement upon?

I think you will find several of the studies very interesting in the book *Lessons Learned from Research*, edited by Judith Sowder and Bonnie Schappelle. One study of interest in the book is *"Interference of Instrumental Instruction In Subsequent Learning"* by Pesek and Kirshner. Chapter 12.

From the Abstract of the study: To balance their professional obligation to teach for understanding against administrators' push for higher standardized test scores, mathematics teachers sometimes adopt a 2-track strategy: teach part of the time for meaning (relational learning) and part of the time for recall and procedural-skill development (instrumental learning). A possible negative effect of this dual approach is noted when relational learning is preceded by instrumental learning. A group of students who received only relational instruction outperformed a group of students who received instrumental instruction prior to relational instruction.

Another research study of interest can be found in the Journal of Research in Mathematics Education (JRME), volume 29, January 1998, *"A Longitudinal Study of Invention and Understanding In Children's Multi-digit Addition and Subtraction"* by Carpenter, Franke, Jacobs, Fennema, Empson.

According to the abstract: "This 3 year longitudinal study investigated the development of 82 children's understanding of multi-digit number concepts and operations in Grades 1-3. Students were individually interviewed 5 times on a variety of tasks involving base-ten number concepts and addition and subtraction problems. The study provides an existence proof that children can invent strategies for adding and subtracting and illustrates both what that invention affords and the role that different concepts may play in that invention. About 90% of the students used invented strategies, students who used invented strategies before they learned standard algorithms demonstrated better knowledge of base-ten number concepts and were more successful in extending their knowledge to new situations than were students who initially learned standard algorithms."

You can link to other recent research reports from the websites www.mathematicallysane.com and www.washmath.com .

7. You suggested that these newer math programs could only be successful if parents fully supported teachers and administrators in the implementation of them. What is the basis for this comment? Do other curricula have this same limitation? If the kind of parent support you described cannot be achieved in our district would you recommend that we consider a different math curriculum?

I believe and therefore say during my talks that the mathematics textbooks developed with support from the National Science Foundation sometimes look unrecognizable to parents and teachers who learned mathematics through traditional programs. Many adults learned primarily arithmetic and algebra. Teachers are now teaching mathematics including arithmetic, data analysis, probability, geometry and other areas of mathematics essential to the workplace of today, and essential to being an informed citizen. As an example, I quoted Lynn Steen, professor of mathematics at St. Olaf College who wrote that, “Probability theory is the theoretical underpinning of the modern world. Current research in the physical and social sciences cannot be understood without it. Today’s politics, tomorrow’s weather report, and next week’s satellites all depend on probability theory.” Yet, when a probability problem goes home as homework, it is likely that a typical parent will not know how to help their child with the mathematics. When this occurs, parents are naturally concerned. When they are then told, falsely, that we are avoiding teaching basic facts and that children are not learning to compute, these natural concerns often grow into anger.

As I said during the Community Math Night, I believe that we are unlikely to see the best mathematics programs available today fully implemented in schools on a broad scale until we as educators bring parents and the public to the table, provide opportunities to learn about important issues in mathematics education, and engage with them in ongoing dialogue as we work together to advance mathematics education. A typical parent simply cannot support something they do not understand, and a typical teacher cannot teach something well that his or her parents and community do not support.

The vast majority of the thousands of parents and community members I have worked with over the past ten years embrace the idea of daily Number Talks and they appreciate the *Investigations In Number, Data and Space* program and other NSF funded programs that their children are using. If parents are not given opportunities to understand the programs though, then it can be difficult to secure their support and they will be less prepared to support their children with mathematics at home.

No, I certainly would not recommend that your district change direction with regard to the mathematics program they have adopted. From my perspective the district has selected some of the best programs available today. Rather, I would suggest, as I did to your district leadership, that it is essential for the district to engage proactively with parents and the community, and that it is also essential that they provide all teachers with sustained opportunities to learn mathematics within environments that model the practices that will benefit students in all classrooms.

We appreciate your efforts to provide us with evidence that this new approach has proven to be successful. We can’t afford to jeopardize our children’s future on unsubstantiated assertions, theories and anecdotal evidence. As a research scientist, we are sure that you intimately understand our position.

I am not a research scientist, but rather a mathematics educator with years of classroom teaching at the elementary and middle school levels, years of working with pre-service teachers at the University of Oregon, and most recently years of providing mathematics professional development to K-12 teachers, university-level mathematicians, parents and the public-at-large. I did, however, do educational research as part of my doctoral studies.

One would not have to look far to find decades worth of evidence that traditional US mathematics programs have not worked well for the vast majority of students. Again, if you are looking for evidence of the promise of these newer programs, you will find links to research studies on the websites, www.mathematicallysane.com and on www.washmath.com .

Thank you for sending the questions and expressing your concerns. As a parent myself, I fully understand the level of concern that arises when one feels their child is not being well served, and I agree wholeheartedly that a high quality mathematics education is essential to our children's futures and to the future health of this nation.

If you are able to do so, I invite you to participate as my guest in one of the 9-day mathematics content courses that I teach to K-20 teachers of mathematics. For three years now, university mathematicians and engineers have attended these courses alongside K-12 classroom teachers. I know that you would leave the course with a deeper understanding and appreciation for the work we are doing to deepen teachers' understanding of mathematics and what it means to teach mathematics in powerful ways. And I am quite certain you would then find ways to advocate that all teachers have similar opportunities to learn mathematics and to learn to provide the kinds of mathematics instruction that will prepare all students to become productive citizens, ready to meet the unprecedented demands of the workforce of today.

Regards,

Ruth Parker
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