The Democratization Of Mathematics.

Jo Boaler, Professor of Mathematics University, Stanford University.

CEO: youcubed.

Parents across the country are gathering to oppose the new Common Core Standards in math. Why? Because the new standards include and focus upon something called Mathematical Practices – a set of standards that call for problem solving, reasoning, communicating and other mathematical acts that are critical for our students as they live and work in the 21st century.

Why are some parents opposing these changes, saying that their children should not waste time “explaining methods” in math? One fairly sinister reason is emerging over and over again as I work with parents across the country. Most of the vocal, oppositional parents have children who are really good at computing with numbers and they sit at the top of the math achievement tree. The golden gates have always opened to these students who have been raised on math facts from birth. But the path to success is changing as the Common Core Standards downplay the calculations that are nearly always performed by computers in our technological age and focus instead on broad and important areas of mathematical work – such as problem solving, communicating and reasoning. These changes are worrying for parents whose children already know how to succeed, even if the math on which they are succeeding is of little use to them or to the US.

Students are being asked to explain their work in math classes and tests, even when it is correct, because justification and reasoning are two of the acts that lie at the heart of mathematics. They are, in many ways, the essence of what mathematics is. Scientists work to prove or disprove new theories by findings many examples or a counter-example. Mathematicians, by contrast prove the validity of their propositions through justification and reasoning. Just as a mathematician has to show that each of her steps follow logically from the ones before, justifying her use of methods and reasoning about their appropriateness, students are now being asked to ‘explain their methods’, engaging in the very same acts of justification and reasoning.

These acts are not only represented in the Common Core because they lie at the heart of mathematics, they are there because they are the ways of working that contribute to quantitative literacy, the literacy that is needed to live and work successfully in the 21st century. Conrad Wolfram, CEO of one of the world’s most important and influential mathematics companies (Wolfram-Alpha), has spoken widely about the mismatch between the math that students need for the world and the math they spend most of their time on in classrooms – computing. Computation will still be taught in the new Common Core, but it will be taught as part of a broader mathematics that is closer to the math that mathematicians use and the math that is needed in work and life.

When we invite everybody to behave like mathematicians, engaging in the ways of working needed in today’s world, many more students succeed. They do so because mathematical problems that need thought, communication, reasoning and even creativity, are more engaging for students of all levels and for students of different, races, genders and socio-economic groups. I think of this broadening and opening of the mathematics taught in classrooms as mathematical democratization.

There are some people, as one might expect, who don't want this democratization. Some traditional mathematicians want to preserve the exclusivity of their domain. Mathematics departments remain among the least welcoming to women and certain racial groups, of any University departments, as Abbe Herzig has documented. Too many high school math teachers also see their role as gate-keepers, working out who belongs and who doesn’t belong in advanced levels of math.

But there is yet another important reason that the United States is moving to a broader mathematics. We are moving because the narrow math that is taught in classrooms has led, for years, to innumeracy, math failure and math trauma across the nation. We have widespread innumeracy among adults, scores of students failing in schools and colleges, and large proportions of those who take graduate math degrees are non-residents who take their knowledge back to their own countries.

Mathematics education in the United States is broken and there is an urgent need for change. One of the reasons for the terrible state of math learning in the US is the communication of the idea that only some people can be ‘math people’. Combine this idea with the harsh stereotypes that prevail – mathematics is for dominant racial groups and men – and we have the perfect conditions for the creation of a math underclass. Math classes across the US also encourage the idea that the best math students are those who work quickly. Award-winning mathematician Laurent Schwartz reflected in his memoir that he was made to feel unintelligent in school because he was the *slowest* math thinker in his class. It is fortunate for Schwartz, and all of us, that he did not grow up in the speed and test driven classrooms of the last decade that have successfully dissuaded any child that thinks deeply or slowly from pursuing mathematics or even thinking of themselves as capable people.

We have reached the time for change. The US does not need fast procedure executors – we need people who are confident with mathematics, who can develop mathematical models and predictions, who can justify, reason, communicate and problem solve. We need the depth and rigor that is represented in the Common Core and we need a broad and diverse range of people who enjoy and can use mathematics.

Some people oppose the democratization of math *because* it opens the door to everyone, preferring the doors of math achievement to be closed to all but a select few. But the vocal parents who are aggressively opposing the Common Core because their children are at the top of the tree, don’t realize that their opposition could deprive their country – and, ironically, their own children – from a quantitative future that is built upon engaged problem solving and quantitative reasoning. The broader and more democratic mathematics that is represented in the Common Core is the mathematics we urgently need – for equity, for our children, and for the future of the United States.