From: Titan, Hari
Sent: Wednesday, May 12, 2021 12:35 AM
To: IQC
Subject: [EXTERNAL] agenda item #3

Instructional Quality Commission (IQC)
California Department of Education

Dear commission members,

I have a Master's degree in Mathematics and a Ph.D. in Computer Science. Both of my degrees required that I find new mathematical theorems and provide mathematical proofs that were validated by experts in the field at multiple universities. Since 1993, I worked in the field of artificial intelligence for a number of companies in California.

The United States of America is the sole remaining superpower in the world and has led in all fields of Science, Technology, Engineering, and Mathematics (STEM) since World War II. California grew to be a center of STEM jobs within the United States. Very good mathematical skills are key for success in Science, developing cost-effective Technology, and Engineering. Doing well in STEM subjects is one of the ways poor and middle-class American families can find a path to the American dream.

I have been an advisor to my local K-12 school district, Piedmont Unified School District, and have run for school board a few times. I have also actively participated in school board meetings on various matters (from extended-day Kindergarten to pay-as-you-go school bond funding) and created a parent group called Parents for Educational Excellence in Piedmont.

I respectfully request that the IQC please tread carefully when altering the Mathematical Framework for education in California and not hold back the best and brightest future mathematicians getting their start in California's public schools.

There is great variation from student to student in terms of the ability to fill in the blanks when being taught mathematics. During graduate school, I've worked with dozens of my colleagues to see this variation as well as when I taught mathematical proofs of computational complexity to undergraduate students of computer science.

Wealthy parents who can afford tutors know the incredible benefits of personalized instruction to help their children achieve their maximum potential. I live in a wealthier neighborhood of Piedmont, California, and am aware of a number of parents who have hired local math tutors to help their children do their best in math classes. Poor and middle-class Americans have a very hard time obtaining individualized instruction for their children.

Individualized student instruction falls under the rubric of differentiated learning. It is the key to success for students at all levels of mathematical understanding. The CDE has gone to great lengths to provide special education (SPED) for students with the greatest

need and is quite aware of the importance of every student achieving their maximum potential within the bounds of the normal school day and limited time for homework.

Parents and teachers agree on the goal of reducing class sizes in part to allow greater personalized attention for their children as teachers walk around the classroom after delivering a lesson targeted to the most students as possible. Wealthy parents often enroll their children in private schools which have smaller class sizes and more individualized attention. These examples of individualized instruction fall within the rubric of in-class differentiation.

In-class differentiation has limited scope compared to creating separate classrooms with lessons taught in ways that are most appropriate for each class.

If funding for education was not an issue, students could be grouped by their current mathematical understanding and speed of learning math into many different classes where the teacher would teach mathematical material at a pace and level of detail that the group of students needs. Such student groupings might reveal half a dozen or so clusters of students in a particular grade, all requiring a different pace and level of detail in their instruction. Unfortunately, this dream approach would lead to very small class sizes and require orders of magnitude more teachers than school districts currently can afford.

Current K-12 funding allows for math compression at 7th and 9th grades as well as access to Advanced Placement (AP) and honors math courses in high school. This level of differentiated learning is to be appreciated, not dismantled based on new unproven theories. California's most gifted children should not be treated as guinea pigs in a live experiment.

None of the scientific articles cited in Chapter 1 of the 2021 Mathematics Framework for California prove conclusively that all students taught in the same classroom will improve students achieving their potential.

The premise of the new Math Framework is based on flawed conclusions drawn from the research cited, see page 9 of Chapter 1:

"Multiple studies have shown the incredible capacity of brains to grow and change within a short period of time (Huber et al, 2018; Luculano et al, 2015; Abiola & Dhindsa, 2011; Maguire, Woollett, & Spiers, 2006; Woollett & Maguire, 2011). Learning allows brains to form, strengthen, or connect brain pathways in a process of almost constant change and adaptation (Doidge, 2007; Boaler, 2019a). An important goal of this framework is to replace ideas of innate mathematics "talent" and "giftedness" with the recognition that every student is on a growth pathway. There is no cutoff determining when one child is "gifted" and another is not.

Enrolling in compression math or advanced placement math is not a matter of a cutoff that determines when a child is "gifted" or not. Math compression courses are taught at

a faster pace than regular courses to cover 3 years of material in 2 years for example. Students are told they will have more homework than regular math classes. Parents and students decide if they want to enroll in compression math. Teachers often recommend whether students are ready for math compression or not. Students can enroll in compression and if they don't like the pace they can opt back into regular math classes within a few months.

The 2021 Math Framework cites Boaler, 2019a et al and claims that their research shows it is "*clear that all students are capable of becoming powerful mathematics learners and users."* The actual paper does not make that claim at all. In their discussion and conclusion section of that paper, the authors state:

"Gateside District is an unusual school district in many ways. It is an urban and diverse district and one of the largest in California. More notably, it is a district that is committed to equitable outcomes (Ellis & Berry, 2005; Gutiérrez, 2017; Hand, 2010; Joseph et al., 2017) and one that has been prepared to study research, act on the findings, and make hard decisions even in the face of public opposition from groups of parents. These hard decisions have included district wide de-tracking (Oakes, 1986; Boaler, 2017, 2013, 2008; Boaler & Staples, 2008) and the teaching of algebra in ninth rather than the more currently popular eighth grade (Daro & Asturias, 2019)."

Gateside Union District in California has 2 high schools: Robert H. Lewis Continuation High School and Edison High in Huntington Beach.

The high schools are linked to their CAASPP math test results. Results from Robert H. Lewis High School show almost no student met or exceeded the math standards. Results from the more affluent Edison High show a stable 56% of students who met or exceeded the math standards. These schools both followed the advice of Bowler et al and ended up with very different results. This clearly refutes the assertion above that it is "*clear that all students are capable of becoming powerful mathematics learners and users."*

The CAASPP test results also show that Gateside Unified School District failed to meet its goals of equitable outcomes, as highlighted in yellow above. Bowler et al's study does not account for college readiness in STEM careers.

Boaler et al also are studying the issue of "innate ability" which is different from "demonstrated mastery" of the subject material, often demonstrated by testing and grading of homework. No teacher looks at recommending compression math or advanced placement in terms of "innate ability" or binary proclamations like "gifted". They view the recommendation in terms of demonstrated ability and parents and students have the final say whether they would like to try compression or advanced placement math classes.

Boaler et al's unproven assertions, incendiary views, and inconclusive research should not guide the new 2021 Math Framework for California.

Removing math compression, "de-tracking", and delaying Algebra until high school will hold back the students with the greatest demonstrated ability in math. Please remove these recommendations from the 2021 Math Framework.

I hope better science prevails.

Thank you for your attention to these matters.

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