youcubed

"How Far into the River Should I Go?"
Reflections of a Teacher Moving to a Big Ideas Approach

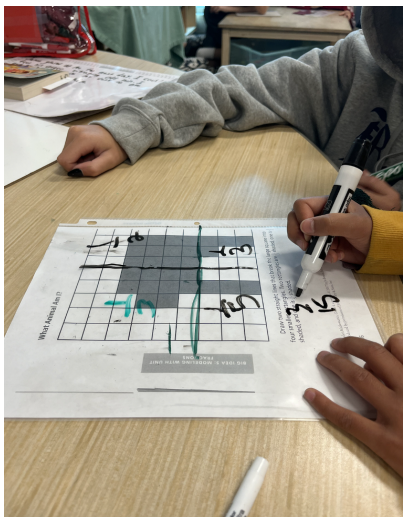
Jo Boaler, Kristina Dance, & Jack Dieckmann

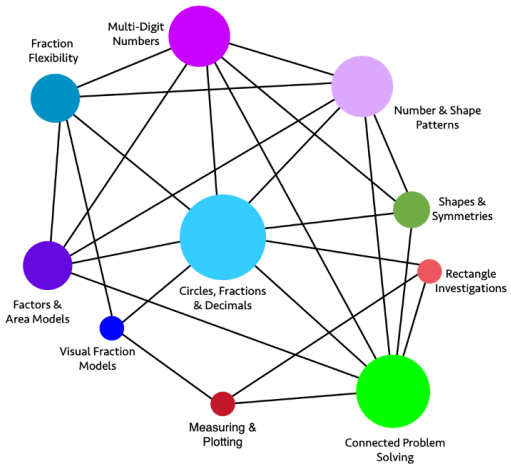
Stanford University.

Many teachers are teaching from textbooks prescribed by their district, that require students to work through worksheets of procedural math, and they are not happy. The reason that some teachers are dissatisfied is they see that students are not engaged, they are not learning well, and they are not enjoying math. Caroline Lucas, a 4th grade teacher, was one such teacher. She described math time in her classroom saying:

> "Nobody liked math. I didn't like it. It was something we kind of muddled through."

But in the 2022-2023 school year Caroline attended a youcubed workshop "Teaching to Big Ideas, "and then started integrating big idea tasks into her curriculum. This is also a recommended approach of the California Mathematics Framework – that the big ideas, (or fundamental concepts), are taught through rich tasks that allow students to think deeply, to make connections, and to learn conceptually. Caroline started teaching these tasks at the beginning of units in her district adopted textbook. For example, one of the tasks, in book 4, is called Pixelated Fractions. Students are given different shapes, such as animals and trees and asked to break them up into different fractions.



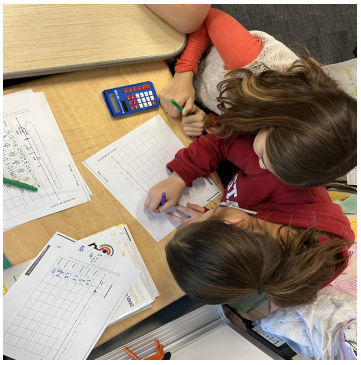


Big Ideas Grade 4 California Math Framework

This is a challenging task and students work together, sharing different strategies, working with the ideas of fraction addition, fraction equivalence, area of composite shapes and the relationship between area and fractions. There was an energetic buzz around the room as students set to work on the fraction puzzles, and students were excited when they found solutions - calling the teacher over to verify their ideas. As Caroline visited the groups, she asked students to convince her, pushing their understanding to higher levels.

Through these richer and more interesting tasks Caroline could see her students' high engagement and the many opportunities they received to understand deeply. When we asked Caroline what she had to let go of, from the prescribed curriculum, to make space for the rich tasks, she said:

"It was the flat time of the day - going through workbooks. When you're convinced that more learning is happening, it doesn't really feel like you are letting go of anything."



Caroline was not sure how well the approach she had used would match the state tests and was pleasantly surprised when she learned that every single student in her class increased their achievement, compared to their test scores when they were in the previous grade. In fact, the growth in student learning as measured by year over year change in CASSP scores was large and significant ($MDiff = 86.5$, $t(19) = 11.62$, $p < .001$).

Caroline teaches in a school with a lot of students from socioeconomically advantaged backgrounds, and most of them were already high performers in state tests. Some people worry that high achievers are disadvantaged by working collaboratively with others, on rich tasks, but these students, just like all the students in the class, were helped by the big ideas approach they experienced, and increased their achievement.

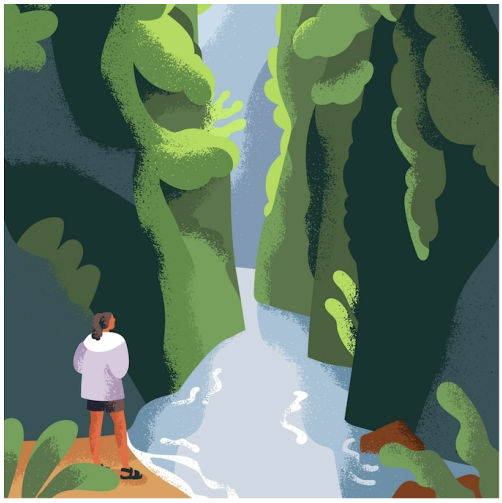
Many educators believe in the value of deep, rich tasks, that allow students to see mathematics as a creative subject, as they know that they are engaging for students and give opportunities for math joy. But some worry that time spent on such tasks will reduce students' test performance. This did not happen in Caroline's classroom - in fact, the opposite happened and achievement, even on state tests, significantly increased. This happened because students learned the standard content more deeply through longer, conceptual tasks than they did through short questions.

Caroline is fortunate to work in a district that supported change, with an administrator who encouraged Caroline to venture into the unknown – teaching through rich tasks. The district and school leaders have been thrilled with Caroline's achievements.

Caroline is not the only teacher who has taken this leap and seen great results. In the California Central Valley, teachers who moved to a big ideas approach also saw significant increases in student achievement on state tests. This does not surprise us, since decades of research in mathematics education shows that when students are taught to think deeply, make connections and reason about mathematics, their achievement increases (Silver & Stein, 1996; Bransford, 2000; Schoenfeld, 2002; Schwartz, Tsang, & Blair, 2016; Deslauriers, McCarty, Miller, Callaghan, & Kestin, 2019).

We were also really happy to hear that Caroline has changed her own view of math, and her own potential, as she previously had doubted her ability to do well in math. Caroline told us that she now engages in mathematics outside of school and is thrilled that she is able to use the mathematics *she* is learning through the tasks. This change, as well as the increased achievement, is one we encountered in a previous research initiative, when fifth grade teachers moved to a similar approach, teaching through rich tasks, after they learned about mindset and conceptual mathematics. Even inside the first year we worked with teachers their students significantly increased their achievement on state tests.

Despite push back from some non-educators, it seems that there is increasing awareness from those in education that students need a different approach to math, and that working through procedural worksheets is not what inspires students mathematically. California's recommended approach, of teaching the fundamental concepts through big ideas tasks, is something that all teachers can try, without abandoning the curriculum and approach they know. Many districts are now working out ways that big idea tasks can supplement the books or curriculum in place, ideally starting at the beginning of a unit of work, and supporting teachers with this change.



It may feel scary to try new things, as it did for Caroline, who asked herself "How far into the river should I go?" In the end Caroline went far into the river, but teachers can choose to start by just getting their toes wet, trying the approach with one area of math. Usually, they do not need to make extensive changes to see an increase in student engagement and understanding. As more and more districts, schools, and teachers take this step, we expect to see further increases in achievement, as Caroline and others are reporting. Beyond that, we also expect more students to enjoy mathematics, to know they can achieve well, and to see mathematics as a critical part of their future.

References:

Anderson, R. K., Boaler, J., & Dieckmann, J. A. (2018). Achieving elusive teacher change through challenging myths about learning: A blended approach. *Education Sciences*, *8*(3), 98.

Boaler, J., Munson, J., Williams, C. (2017) Mindset Mathematics: Grade 4: Jossey Bass.

Boaler, J. & Sampson, C. (2024). To Teach Math Effectively California must focus on Deep Conceptual Learning. Ed Source, May 2024. https://edsource.org/2024/to-teach-math-effectively-california-must-focus-on-deep-conceptual-learning/712302

Bransford, J. (2000). How people learn. *National Academy Press google schola*, *2*, 293-332.

Deslauriers, L., McCarty, L. S., Miller, K., Callaghan, K., & Kestin, G. (2019). Measuring actual learning versus feeling of learning in response to being actively engaged in the classroom. *Proceedings of the National Academy of Sciences*, *116*(39), 19251-19257.

Schoenfeld, A. H. (2002). Making mathematics work for all children: Issues of standards, testing, and equity. *Educational researcher*, *31*(1), 13-25.

Schwartz, D. L., Tsang, J. M., & Blair, K. P. (2016). *The ABCs of how we learn: 26 scientifically proven approaches, how they work, and when to use them*. WW Norton & Company.

Silver, E. A., & Stein, M. K. (1996). The QUASAR project: The" revolution of the possible" in mathematics inst ructional reform in urban middle schools. *Urban Education*, *30*(4), 476-521.