

March 13, 2019

Dr. Zee Cline
Co-Director, Center for the Advancement of Instruction in Quantitative Reasoning
CSU Office of the Chancellor
401 Golden Shore
Long Beach, CA 90802-4210

Dear Dr. Cline,

I write as the founder of Just Equations, a project of the Opportunity Institute that works to reconceptualize the role of mathematics in education equity. Our goal is to advance equitable college opportunity through evidence-based policies and practices to ensure math serves as a foundation, rather than a filter, particularly for low-income students and students of color.

Just Equations supports your efforts to examine the faculty recommendation to increase admission requirements in quantitative reasoning. I've been following this recommendation since it first emerged in 2016 as a [resolution](#) from the Academic Senate's Academic Preparation and Education Programs (APEP) committee and subsequently become a recommendation of the [Quantitative Reasoning Task Force](#), for which I served as an advisor. Also that year, I hosted a [webinar](#) series (hosted by LearningWorks and the Opportunity Institute) examining several topics, including the [link](#) between high school math course-taking and college readiness.

The proposed fourth-year requirement was also a key topic at our 2018 convening, *The Mathematics of Opportunity*, which was well-attended by CSU faculty. We were pleased that Professor Rick Ford of Cal State Chico described the faculty recommendation on a key panel, and that you were able to join that discussion and share your end-of-day reflections.

We appreciate our recent conversations and the opportunity to serve as a resource to the Chancellor's Office in your efforts to review this recommendation. Just Equations doesn't have a position on the recommendation itself at this point. Having been party to years of discussions, we recognize the positive intentions behind it and share the goal of ensuring students have the quantitative preparation they need to succeed in their lives and careers. However, we do feel strongly about the evidence that should be

marshaled and the perspectives that should be considered in evaluating whether the recommendation would advance that goal in evidence-based and equitable ways.

With an eye to ensuring that any policy adopted doesn't inadvertently exacerbate inequities, we believe it's essential that it reflect emerging evidence about mathematics education as well as new developments at CSU and nationally. Most of all, it's essential to weigh the evidence supporting the recommendation as well as the risks it may pose to access for students who are already under-represented in higher education.

Below are some of the issues we hope you will analyze as you review the recommendation:

Evidence.

Our recent report, *The Mathematics of Opportunity*, highlights the ways in which math achievement can be used arbitrarily to confer pedigree to those students who already have privileged access to educational opportunities. We are confident that the CSU administration and faculty have no intention of doing so. Thus, it is especially important that any additional requirements be accompanied by clear evidence that they not only support student success, but in fact are necessary for achieving it.

The National Council of Teachers of Mathematics as well as the Common Core State Standards recommend four years of high school math (though Common Core requires only three years), and [eighteen states](#) require all students to complete four years to earn a high school diploma. However, evidence tying four years of mathematics to success in college is weaker than is typically assumed. Much of the evidence points to a correlation vs. causation, underscoring the risk that the additional math courses could merely be providing a "signal" of assumed readiness rather than actually strengthening students' ability to succeed in college.

Clearly, taking math in the senior year benefits many students, and it makes sense to explore ways of expanding those benefits. However, absent clear evidence of a direct causal link between advanced math course-taking and college success, we advise caution around making this a *requirement*. Our analysis of the research literature raises several flags:

- One of the few [studies](#) showing a strong link between high school math course-taking and future outcomes (Rose, Betts, 2001) was conducted nearly 20 years ago based on

students who are now in their mid-fifties. While the study found a connection between advanced high school math courses and college graduation as well as earnings, the authors acknowledged that one explanation could be **the role math plays in “procuring admission” to universities**. They added that their results could not “speak to the consequences of policies requiring that all students take a specific math course for graduation.” And, noting the potential for negative side-effects, they advised small-scale pilots of such reforms before full-scale implementation.

- A more recent [study](#) (Byun, Irvin, Bell, 2015) paid particular attention to students’ ethnicity and income. While that study, too, found a strong relationship between advanced math course taking and student outcomes, it concluded that the effect was **“largely due to other student, family, and school factors rather than advanced math course taking itself.”**
- Studies analyzing students’ [performance on standardized tests](#) also have been used to argue for tightening high school math course requirements. And high schools have been known to advise students to take math in their senior year in order to be prepared to take a college placement exam. Our reports have highlighted evidence on the disparate impact (along lines of race, ethnicity, and income) inherent in standardized testing, including [recent research](#) showing an apparent increase in that disparate impact on California students. Furthermore, high school grades have consistently been found to be [more predictive of college performance](#) than performance on standardized tests. CSU has, in fact, abandoned the use of its traditional placement tests, in part for this reason, eliminating that as an argument for senior-year math. Concerns about the use of those tests in general should extend to caution about relying on them for research evidence.

Access.

There are also concerns that an enhanced math requirement could reduce access to CSU for African-American and Latinx students, as noted in my recent San Francisco Chronicle [op-ed](#). The original ASCSU resolution recommended that the CSU “investigate the impact these requirements may have on the success of all students, particularly those from historically underserved populations.”

Such an investigation seems wholly appropriate to us, though we would include access as well as success. Our colleagues at Education Trust-West (ETW) have submitted a letter detailing the sort of questions that require answers.

We understand from conversations with CSU officials and researchers that the CSU system does not possess the requisite data to conduct such a study. We can recommend at least four strategies for overcoming the absence of data:

- A data match between CSU and the California Department of Education.
- Analyses from researchers at UC Davis (led by Professor Michal Kurlaender), who have assembled the requisite data and are conducting relevant studies. They shared their preliminary results at our November meeting, and we expect their final report to be published some time this spring.
- Analysis by RTI International, which conducted the most recent (2017) university eligibility study. The eligibility data set could indicate how a change in A-G requirements would affect eligibility for both CSU and CSU. This would require permission from the education systems to use for this purpose, additional information about the proposed math requirement, and funding from a state source or foundation.
- Analyses from other researchers, such as Education Results Partnership, with access to intersegmental data.

If the analyses reveal valid concerns about equitable access to four years of high school mathematics, additional work is needed to ascertain how and whether such risks can be mitigated, assuming that there are still advantages to moving forward with the proposal.

Other Issues.

Assuming that potential risks to equitable CSU access can be addressed, there are several additional considerations to weigh:

- **Diversifying content.** Since our work has highlighted the promise of new mathematics pathways to prepare students for academic and career success, we view it as positive that the faculty specifically recommended that any senior-year quantitative reasoning requirements should allow non-STEM math courses, such as statistics and financial literacy (as well as possibly math-intensive science courses) to count as a fourth year math courses.

It would be critical for any review of this proposal to clarify which courses would meet the requirement, and to assess the **availability and quality of such alternative courses**. Most prior research on high school math course-taking doesn't necessarily account for new, diversified content.

- **Timing Issues.** The interest in a fourth year of quantitative reasoning has been prompted in part by concerns that students' math performance will "decay" if they take a year off, but most of the evidence for this has come in the form of test scores. More thought is needed around this issue. For students pursuing non-math-intensive majors, it is not clear what advantage is obtained by delaying the presumed decay until after students take a general education math (or quantitative reasoning) course. No case has been made that taking additional math in their fourth year will ensure longer-term retention of the material. If the retention holds only through completion of a freshman-year math course, its benefit is questionable.
- **Alignment.** It is essential that the examination of this proposal also address alignment with other educational segments, particularly as they affect students:
 - As UC's faculty senate has recommended adding **a year of laboratory science** (a proposal that has raised similar concerns), the effect of two such requirements as well as the potential for overlap between the two proposed policies (such that a single course could meet both the fourth year of math and the third year of science) needs to be assessed. Likewise, there is a need to analyze the potential for confusion given that the new requirement may not align with UC's Area C definition.
 - At the state level, California requires just two years of math for high school graduation -- fewer than [almost any other state](#). Given that a majority of districts in the state are now requiring more than the state-mandated minimum, it is also important to consider the range of requirements that students around the state face. Since concerns about equitable access to senior-year math courses ultimately must be addressed by the K-12 system, discussions with leaders at the California Department of Education as well as school district leaders are especially important.

If the goal is ensuring equitable access to rigorous high school mathematics, the possibility should be considered that **changes in high school graduation**

requirements might be a better lever than changes in university admission requirements.

- California's current **shortage of mathematics and science teachers** is another factor to consider in addressing the capacity of the K-12 system to offer more quantitative reasoning courses. As one of the state's largest providers of teacher education, CSU has key role to play in addressing the shortage.
- We are aware of dual-enrollment quantitative reasoning classes at at least two CSU campuses that confer college credit, allowing students to meet their general education math requirement during high school. Given that many courses beyond Algebra 2 may be at the level of a college course, we recommend that CSU examine the **potential for using the senior year to help more students complete their general education requirement** in math/quantitative reasoning.

We hope these suggestions are of use to you in your further investigations, and we would be happy to discuss any of them further. Please consider us a resource as you consider how best to ensure that any policies ultimately adopted by CSU serve the best interests of California students.

Sincerely,



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