Let’s teach them what they need to know

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I don’t know the full history or choices along the way that built the 20th and 21st century math curriculum in California public schools, or anywhere else, for that matter. But I do know that the space race in the 1950s and 60s and the related Cold War throughout the second half of the 20th century drew the best and the brightest of our students into physics (Hilborn and Howes 2003, fig. 1; Lövheim 2021). In terms of mathematics, calculus is fundamental to understanding physics and working in any of the related fields, including astronomy and engineering. So, it doesn’t surprise me that our public-school mathematics curricula build directly toward having the top students completing a two-course sequence of Calculus I and Calculus II by the time they graduate from high school. But there is a case to be made that our national interests have changed, and I believe that we do a disservice to our high school students when they graduate without having engaged with statistics, modeling, or really any data analysis at all.

Below I detail some of the ongoing debates happening in the state of California. I also describe one of our newest threats to poverty and income inequality: online sports gambling. And while I know that we need to continue to offer some of our students calculus (we still need physicists, after all!), I would like to see the structure of the curriculum flipped to focus most students on data acumen skills and only some students on calculus skills.

## The California debate

In 2020, the UC Board of Admissions and Relations with Schools (BOARS) for the University of California system (including UC Berkeley and UCLA) confirmed long-standing practice (BOARS 2020) that the Algebra II requirement could be validated[[1]](#footnote-1) by students who had taken Statistics. The 2020 BOARS decision was grounded in being an “equity issue”, where they state, “By clarifying the definition of college math readiness and expanding the choices of area C math courses students can take to be eligible for UC admissions, students should be encouraged to pursue the mathematics education most relevant to their academic and career goals.”[[2]](#footnote-2) However, in the same document, they seem to undermine the equity issue by “strongly encourag[ing] [STEM students] to consider a math course sequence that prepares them for calculus, either during high school or in their first year at UC.” Which reads as if they still believe that calculus should be the pinnacle of mathematics regardless of whether or not calculus is the most important mathematics course for a particular student (STEM or not).

Recently, BOARS has revisited their 2020 decision, spurred on partly by complaints from mathematicians who believe data science, which is classified as a statistics course, is dumbing down the mathematics curriculum. In 2023, more than 400 faculty from California institutions signed an open letter (Charikar et al. 2023), which argues, among other things, that the only reasonable path for any STEM major is the Algebra II to Calculus pathway. Roughly 55% of UC students are **not**, however, STEM majors (University of California 2024). The result was that in 2024, BOARS and UCOP (UC Office of the President) reversed their 2020 decision and declared that beginning with Fall 2025, only calculus-based courses (e.g., Pre-Calculus or AP Calculus) will validate Algebra II (BOARS 2024).

Despite the UC system doubling down on the calculus pathway, David Bressoud (DeWitt Wallace Professor Emeritus, Macalester College) explains how broken the calculus pathway really is. He recognizes that the “singular focus on calculus sucks the oxygen out of” building a strong curriculum for statistics and data science. He argues that what is needed is a “truly co-equal path that develops computational and data skills.” (Bressoud 2020)

The consequences of the recent UC decision are that many school districts are dropping statistics and data science (and some computer science) courses. The hierarchy of courses (some validate and some don’t) discourages school districts from spending money on courses that don’t validate the UC Area C requirement.

## Why the debate matters: sports gambling

The high school / university curricular debate aside, it is worth considering **why** the debate feels so important. The Stanford History Education Group did an extensive analysis to assess college students’ online reasoning skills. The researchers found that the students’ ability to reason about information on the internet was “bleak”. The students were unable to reason through why they should or shouldn’t believe a particular online claim. The study found that students accepted as truth the information presented to them, even when there was no supporting evidence or citations (Stanford History Education Group 2016). In many scenarios, an inability to discern online truths will not negatively impact one’s life. There are some situations, however, where having a good sense of online scams can help a person avoid bankruptcy.

In May 2018, the US Supreme Court struck down the Professional and Amateur Sports Protection Act (PASPA), a law that prevented gambling on both collegiate and professional sports. In the wake of that decision, sports gambling has become ubiquitous, particularly within online platforms. That is, the dismantling of the regulation opened the doors, but online technology opened the flood gates. Websites like FanDuel and DraftKings make it remarkably simple to connect your bank account to the gambling platform, and they bombard you with exciting opportunities to win big.

One of the ways that online gambling platforms make money is through something called a parlay bet. A parlay is a type of bet in which multiple selections are made on different events (e.g., LA Dodgers win the game **and** Ohtani hits a home run at some point during the game **and** the total score of the game is fewer than 7.5 runs). It is difficult to win a parlay bet because each event must come out in your favor in order to win. As such, the platform offers long odds (extra payouts) for those rare occasions when a parlay bet succeeds. The long odds make the bet seem like a good idea to the average amateur gambler. Unsurprisingly to mathematicians, however, “the bookmakers are taking advantage of the increased risk involved in a parlay by offering lower odds” than the probability calculation would suggest (LeansAI, n.d.). And certainly, the platform would not allow you to take the other side of the parlay bet. That is, the platform offers a big payout if your parlay wins, but if the betting market were even somewhat close to fair, the offer should be for a truly enormous payout if your parlay wins.

Understanding the concept of expected value (the long run average on the return of, say, a parlay bet) is paramount to being able to know whether the online gaming platforms are taking advantage of their users (spoiler: they are). Season 5 of Michael Lewis’ podcast, Against the Rules[[3]](#footnote-3), walks through how being data illiterate leaves a person open to getting taken advantage of by online gaming platforms. He describes the tactics that the industry uses (e.g., not allowing large bets from individuals who win) to take advantage of a population of people who are not trained to understand critical reasoning through data. The podcast serves as a warning for anyone considering online sports gambling, but it is only one voice in a sea of industries set up to take advantage of people who are not trained to understand data, evidence, and reasoning–all important concepts taught in a data science course.

## Recommendation

In the end, I find the curricular part of the debate between Algebra II and Data Science to be distracting. The material in both classes is equally important. But I believe that the material in data science and statistics courses is more equally important, especially when it comes to serving the vast majority of high school students in California public schools. That is, I’d like to see us focus on how we can get every single high school student graduating with some kind of training in data. While I recognize that there is only so much space in a high school curriculum, I advocate for statistics and data training above most other things, including Algebra II. I worry that we do our students a disservice when we send them insufficiently prepared into a world optimized to take advantage of them. It is in our national interest to minimize the information asymmetry between the average patron and the industries who are using data against consumers. Let’s teach our students what they need to know.

## References

Board of Admissions and Relations with Schools (BOARS). 2020. “Statement on Mathematics Preparation for the University of California UC Board of Admissions and Relations with Schools (BOARS).” <https://senate.universityofcalifornia.edu/_files/committees/boars/documents/statement-on-mathematics-preparation-for-uc.pdf>.

———. 2024. “Statement on Mathematics (Area C) Admissions Requirements.” <https://senate.universityofcalifornia.edu/_files/committees/boars/documents/boarsacwphase1report-20240221.pdf>.

Bressoud, David. 2020. “The Strange Role of Calculus in the United States.” *MAA Launchings, Teaching & Learning*. <https://www.mathvalues.org/masterblog/launchings20201001>.

Charikar, Moses, Brian Conrad, John Dabiri, Sandy Irani, Grace O’Connell, Dana Paquin, Barna Saha, and David Van Valen. 2023. “Data Science and the High School Math Curriculum.” <https://sites.google.com/view/mathindatamatters/home>.

Hilborn, Robert, and Ruth Howes. 2003. “Why Many Undergraduate Physics Programs Are Good but Few Are Great.” *Physics Today* 56 (9): 38–44. <https://doi.org/10.1063/1.1620833>.

LeansAI. n.d. “Are Parlays Worth It? 4 Reasons to Avoid Them.” <https://leans.ai/betting/how-to/are-parlays-worth-it/>.

Lövheim, Daniel. 2021. “Cold War Fostering of Scientific Elites: International Youth Olympiads in Chemistry and Physics 1967â1984.” *History of Education* 50 (5): 685–703. <https://doi.org/10.1080/0046760X.2021.1890239>.

Stanford History Education Group. 2016. “Evaluating Information: The Cornerstone of Civic Online Reasoning.” <https://stacks.stanford.edu/file/druid:fv751yt5934/SHEG%20Evaluating%20Information%20Online.pdf>.

University of California. 2024. “UC STEM Degree Pipeline.” <https://www.universityofcalifornia.edu/about-us/information-center/uc-stem-degree-pipeline>.

1. “validate” is the formal term used to indicate fulfilling a particular requirement. [↑](#footnote-ref-1)
2. Area C represents the high school mathematics subject requirements for admission into the University of California system. [↑](#footnote-ref-2)
3. available at: https://www.pushkin.fm/podcasts/against-the-rules [↑](#footnote-ref-3)