

High School Science & Math

A critical entry point to STEM careers

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There's a need for policy advocacy

- Math support in 7th grade and the following summer
- Default science course registration in high school

My journey



- San Juan, PR → FL until last year → Holyoke, Massachusetts
- I dance, make music, and fix things (like my '57 Bel Air)
- CC grad; 11 years between HS and B.S. Physics & Anthropology (waiting tables, touring in punk bands)
- Most of my career in physics education
 - 10 years teaching HS → 10 years at university
- Came to APS 2.5 years ago

Other projects



- QuarkNet: my teacher community since undergrad
- Coding & data science outreach → codingink12.org
- Outreach for Lunar-VISE → 🌕 in 2028
- Rigorous self-educator on my own privilege
- Moderate AI party pooper

HS Biology, Chemistry, & Physics are key

- For **any** student planning on education post-high school
- Different sequences are fine (e.g., phys→chem→bio)
- Not much data showing level (honors vs AP) is important, but teacher quality and support matters a lot

But, most U.S. students are missing out

- Nearly all students (95%) take a year of **biology** in high school. In part, it's easier to staff, has a lower math load, and can be coupled with reading interventions.
- Most students (70%) take a year of **chemistry** in high school. That's helped by the relevance to health careers and basis in algebra & proportions.
- Few students (36%) take a year of **physics** in high school. Roadblocks include a lack of identity, advising into other courses, and math needed.

From the National Center for Education Statistics

But, most U.S. students are missing out

“These rates are simply unacceptable in a 21st century economy dependent on a STEM-educated workforce.” — [American Physical Society \(APS\)](#), commenting on the U.S.’s low high school Physics enrollment.

Why Biology, Chemistry, & Physics?

- Two semesters of each are required for nearly all STEM majors
- Trade and 2-year programs want this, too

“... High school students hoping to complete a college degree in engineering or engineering technology should include a full year each of chemistry, physics, and (at least) precalculus.” – [American Society for Engineering Education \(ASEE\)](#)

Don't forget the math

- The standard high school math sequence is

Algebra 1 → Geometry → Algebra 2 → Precalculus → Calculus

- Math electives often detour students on this track
- [The Calculus Project](#) supports rising 8th graders to be ready for Alg 1

Why is high school so critical?

- College is a tough place for your **first** chemistry or physics course
- Students with high school credit in chemistry are 2x as likely to graduate college on time; physics credit boosts that to 4x ([ref](#))
- Calculus 1 is the primary roadblock course for college STEM majors

High school preparation is an equity issue

- The **top earning** majors require bio, chem, & physics ([ref](#))
- The top majors for **ROI** require bio, chem, & physics ([ref](#))
- Persistent gaps in STEM degrees awarded by gender and race ([ref](#))

See [Georgetown's Center on Education and the Workforce \(2014 report\)](#)

High school preparation is an equity issue

- HS chemistry enrollments show
 - little/no gaps by gender
 - significant gaps persist by race & ethnicity and household income
- HS physics, precalculus, & calculus enrollments show
 - significant gaps by race & ethnicity, household income, and gender

What default course enrollment looks like

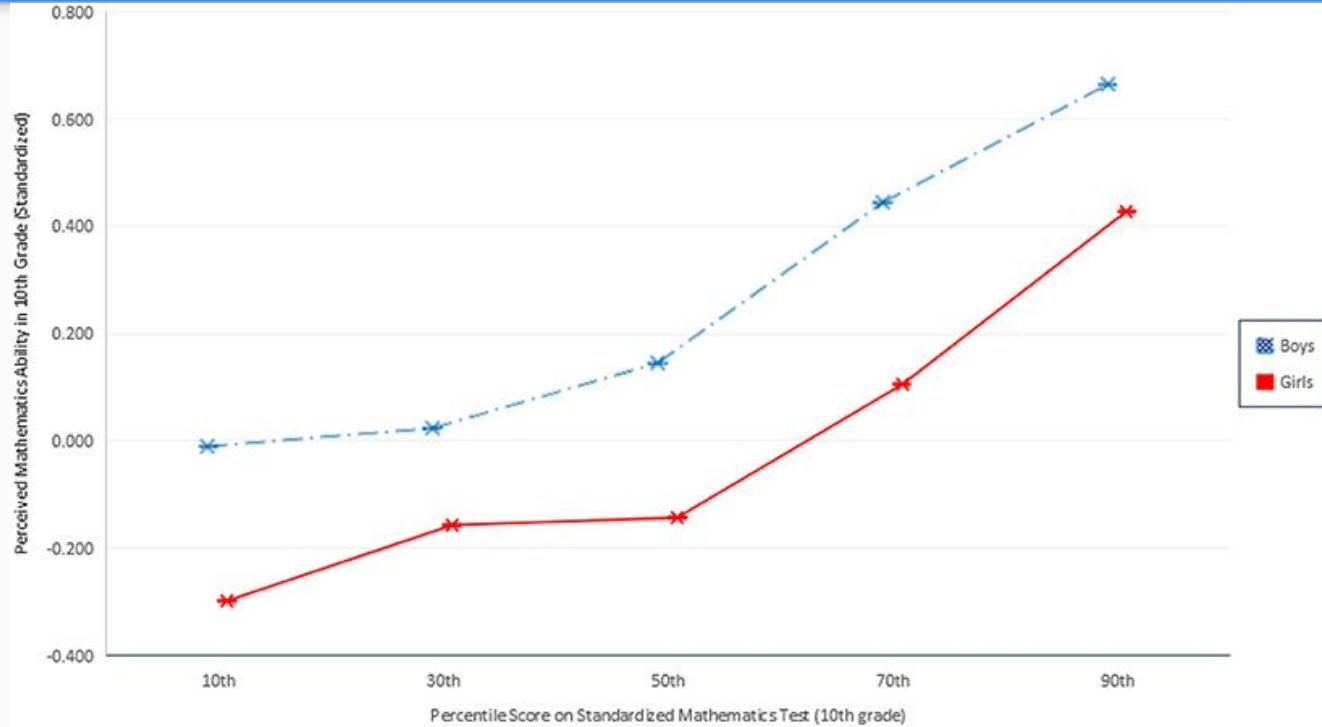
- Default registration examples:
 - Passing biology → enrolled in chemistry next year
 - Passing chemistry → enrolled in physics next year
 - Passing Algebra 2 → enrolled in precalculus next year
- Schools using this process have:
 - higher overall registration in these key courses
 - little to no gaps in enrollment by gender, race/ethnicity/ or household income
- Pro: changing policy once instead of convincing a new cohort of students each year

Why advocate for default enrollment?

- Without these courses, a student planning on a different major or career will find it hard to catch up if they change their mind later
- Common student pressures are:
 - I hear those are hard classes
 - That'll ruin your GPA for college
 - Lack of self-efficacy and identity in STEM
 - "I need to focus on getting into a pre-med/pre-law/engineering program instead"
- A tale of two Nathaniels (former high school students of mine)

Teenagers may not know what's best?

Dr. Laura
Perez-Felkner's graph
of the gender gap in
10th graders'
perception of math
ability ([paper](#))



A message from a local university faculty member carries A LOT of weight

- Talk to your local high school science and math teachers
- Meet with an Assistant Principal, Guidance Chair, Science or Math chair
- Meet your local school district's Secondary Science Supervisor
- Don't forget Title 1 schools (those in low-income areas)
- Draft a letter of support signed by local college/uni leadership, [like this one](#).
- Include these as recommendations for HS students interested majoring in Engineering at your university

What about the state and federal levels?

- There's high variability in policy between and within states.
- National standards (i.e., NGSS) are only adopted in ~half of states
- State advocacy suggestions
 - Make chemistry and physics graduation requirements
 - Make student enrollment data easily accessible to the public
- Federal advocacy suggestions
 - Funding for teacher support in chemistry, physics, precalculus, & calculus
 - Funding for student support in 7th grade to increase 8th grade Alg 1 enrollments

Other important work to do

- Getting students enrolled in key courses is only half the equation
- Those spaces need to be made welcoming and supportive
- Teachers need broad support in content, pedagogy, and supporting a diverse student body ([NSTA position statement](#))
- In college & university programs, we need to keep removing barriers