

The Value of the Fourth Year of Mathematics

Too many students and educators view the senior year and graduation from high school as an end point, rather than one vital step along the education pipeline. Students who engage in a fourth year of math tap into and build upon their advanced analytic skills and are more likely to have better success in postsecondary course work, as they have maintained their momentum and continued to practice mathematics throughout their high school experience.

Math is a continuum of learning.

- Mathematical learning is a progression in which conceptual understanding builds logically, and expertise is developed gradually.¹
- When students are not directly engaged in instruction, they suffer a learning loss. Just over an average summer, students lose approximately 2.6 months of grade-level equivalency in mathematics.² The learning loss during a student's senior year similarly has the potential to be very significant.
- Additionally, 67 percent of middle school teachers rank math as the single most difficult subject for students to re-engage in when returning to school after the summer break and 50 percent claimed that students' math skills regress the most, compared to other subjects, during that time off.³
- All students gain more advanced math skills later in high school, but the most significant gains are found among students who take rigorous math during their junior and senior years. The largest learning gains made in advanced skill proficiency—such as complex multi-step analysis—were among students who took pre-calculus and another course during 11th and 12th grade. The largest gains in intermediate math skills—such as simple operations and problem solving—were made by students who took Geometry and Algebra II during the last two years of high school.⁴
- Unsurprisingly, the smallest gains at all proficiency levels were made among students who took no math or only one math course during 11th and 12th grade.⁵

FOURTH YEAR MATH ALTERNATIVES

The research is clear on the benefit of students engaging in mathematics throughout all four years of high school – but that does not mean all students need to, or should, take pre-calculus or calculus while in high school. Rather, states, districts and schools need to ensure that they are offering courses that include rich and meaningful mathematics—whether in traditional mathematics courses, capstone experiences or applied/technical courses with rigorous (and identified) embedded mathematics – particularly for students who complete the Common Core State Standards in 10th or 11th grade. By offering students courses that are aligned with their interests and post-high school plans, students will be able to truly see the connection between what they are learning, why they are learning it, and what it will mean for their future.


$$[X_i - \bar{X}]^2 \partial^2 \Omega$$

A fourth year of math improves students' college readiness.

- On average, students with four years of high school math score 52 points higher on the SAT-I mathematics section than students with only three years of math. Students who take more than four years of math, such as those who complete Algebra I in middle school, score 57 points higher on the SAT-I mathematics section than students with exactly four years of math.⁶
- In one study of students from three states who had taken the ACT, 26 percent of students who took three years of math in high school (including Algebra, Geometry and Algebra II) required remediation upon entering college, while taking a fourth year of advanced math reduced the remediation rate to 17 percent.⁷
- About half of 2010 high school graduates wish they had taken different courses in high school, with math being the most commonly referenced course. 40 percent of graduates say they wish they had taken "more math/higher level math."⁸

ENDNOTES

- 1 NRC, 2005. www.nap.edu/openbook.php?record_id=11101&page=43
- 2 Cooper, Harris et al. (1996). *The Effects of Summer Vacation on Achievement Test Scores: A Narrative and Meta-Analytic Review*. Review of Educational Research, v66 n3 p227-68 Fall 1996.
- 3 The Raytheon MathMovesU Back-to-School Survey, Nov 2006.
- 4 Bozick, R., and Ingels, S.J. (2008). *Mathematics Coursetaking and Achievement at the End of High School: Evidence from the Education Longitudinal Study of 2002*. (NCES 2008-319). Washington, DC: U.S. Department of Education, National Center for Education Statistics.
- 5 *Ibid.*
- 6 College Board. (2011). *2011 College-Bound Seniors Total Group Profile Report*. www.collegeboard.com/profdownload/cbs2011_total_group_report.pdf
- 7 ACT, Inc. (2007). *Rigor At Risk: Reaffirming Quality in the High School Core Curriculum*. www.act.org/path/policy/pdf/rigor_report.pdf
- 8 College Board (2011). *One Year Out: Findings From A National Survey Among Members Of The High School Graduating Class Of 2010*. www.collegeboard.org/OneYearOut


$$\sqrt{b^2}$$
$$x - \mu$$