

## POLICY RESEARCH BRIEF



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ENLACE FLORIDA is a state-wide college access network promoting college-readiness, access, and success for underrepresented students in Florida.

### Why Algebra II?

Florida students entering grade 9 in 2012 will be required to pass Algebra II to graduate from high school. The provision is part of a sweeping reform of Florida's high school curriculum contained in Senate Bill 4, signed into law by Governor Charlie Crist on April 21, 2010. The bill represents a significant effort by policy makers and education leaders to prepare more high school graduates to succeed in college or the workplace. In addition to the Algebra II requirement, the reform:

- Increases high school graduation requirements, beginning with students entering grade 9 in the following years, to include:
  - ◆ Geometry (2010-2011 school year);
  - ◆ Biology I (2011-2012);
  - ◆ Chemistry or Physics (2013-2014);
- Requires students to pass a statewide, standardized end-of-course (EOC) examination in the following courses for students entering grade 9 in specified school years:
  - ◆ Algebra I (2011-2012);
  - ◆ Biology I and Geometry (2012-2013);
  - ◆ Algebra II and Chemistry or Physics (2014-2015);
- Requires students to pass district, standardized EOC assessments for other courses, when they are developed; and
- Discontinues the Florida Comprehensive Assessment Test (FCAT) for mathematics (Grades 9 and 10) and science (Grade 11), as EOC assessments are implemented.

Teachers, students, and parents across the state are likely to applaud the discontinuation of the FCAT examination, but the introduction of the tougher graduation requirements and the end-of-course examinations may cause some concern. ENLACE Florida has long advocated for higher graduation requirements and even a college prep curriculum, convinced that more rigorous and relevant coursework will better prepare our students for postsecondary education and give them an edge in the global marketplace for jobs<sup>1</sup>. We do not serve our students or the state well by holding on to a curriculum that does not prepare them for success in either

<sup>1</sup> ENLACE Florida, "Toward a College Preparatory High School Curriculum in Florida," *Policy Research Brief*, Vol. II, Issue 6 (June 2008).

college or their career. According to Craig Barrett, a former CEO of Intel Corp., our high school curriculum must adapt to the new demands of the marketplace. In 1950, Barrett explains, “60% of all jobs were classified as “unskilled” and available to those with high-school diplomas or less, according to research published by the Education Testing Services. Now more than 80% of jobs are skilled, requiring education and training beyond high school, according to research published by the Brookings Institution. For example, to work on the manufacturing floor at Intel today, an employee must have an associate’s degree or higher.”<sup>2</sup>

While ENLACE Florida is confident that students will rise to our expectations, the transition to more rigorous high school graduation requirements will undoubtedly cause some concern among students, parents, and communities around the state. Not everybody is convinced that high school students must take Algebra II in high school, particularly if they have decided not to pursue a post-secondary degree. To address these concerns, ENLACE Florida has prepared this policy brief on the importance of passing Algebra II in high school. Our researchers have reviewed expert opinions in the field and consulted with mathematics professors to make the case that no high school student in Florida should graduate without passing an Algebra II course.

### **National Support for Higher Standards**

Forty-eight states including Florida, 2 territories, and the District of Columbia have committed to the Common Core State Standards Initiative, a state-led effort coordinated by the National Governors Association Center for Best Practices and the Council of Chief State School Officers. By developing a common set of standards for the entire country, a number of education organizations intend to prepare our students for success in either college or the workforce. The standards, released as a draft for public comment in March 2010, define the knowledge and skills students should develop or acquire so that they will graduate high school prepared to succeed in entry-level, credit-bearing college courses and in workforce training programs. The standards are

- Aligned with college and work expectations;
- Clear, understandable, and consistent;
- Include rigorous content and application of knowledge through high-order skills;
- Build upon strengths and lessons of current state standards;
- Informed by other top performing countries, so that all students are prepared to succeed in our global economy and society; and
- Evidence-based.<sup>3</sup>

The proposed standards reflect an emerging consensus among educators, researchers, and the private sector that there is no longer a viable distinction between a college-prep and a career-prep curriculum in high school. According to Achieve, Inc., an independent, bipartisan, non-profit education reform organization, the knowledge and skills in English and mathematics that employers and colleges expect high school graduates to have are virtually the same. In other words, college readiness is the same as career readiness. Achieve and other educational researchers have concluded that

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<sup>2</sup> Craig Barrett, “The Case for Common Educational Standards,” *The Wall Street Journal*, April 6, 2010.

<sup>3</sup> Common Core Standards Initiative, <http://www.corestandards.org/>

<sup>4</sup> “Aligning High School Graduation Requirements with the Real World: A Road Map for States, Achieve Policy Brief, (December 2007), <http://www.achievetest.org/node/980>;

“what once was considered the ‘college preparation’ level is now the standard that all students need to meet to be successful after high school.”<sup>4</sup>

As a signatory to the Common Core Standards Initiative, Florida is committed to the adoption of a standard high school curriculum that will ensure that all graduates are college or career ready. The high school reforms recently approved by Governor Crist are closely aligned with the Common Core Standards Initiative and the college prep curriculum advocated by Achieve and other organizations. According to research completed by Achieve, high school students must take four years of challenging mathematics, including Algebra II or its equivalent, to be prepared for success in any post-high school setting.<sup>5</sup>

Governor Crist, Commissioner of Education Eric Smith, and state policy makers recognize that less than 50% of Florida’s high school students take a level 3 mathematics course like Algebra II (see table below). In fact, only 57.9% of high school students in 2008 completed a college preparatory curriculum, which is, again, essential for success in any postsecondary setting.

<b>Readiness Indicator</b>	<b>2008 Participation Rate (Statewide)</b>
Percent of graduates who complete a college preparatory curriculum	<b>57.9%</b>
Percent of graduates who complete at least one AP, IB, AICE, or	<b>41.9%</b>
Percent of graduates who complete one level 3 math course	<b>47.0%</b>
Percent of graduates who completed at least one level 3 high school	<b>53.9%</b>

Source: <http://data.fldoe.org/readiness>

The cost of inadequate preparation impacts students, employers, and the state. In 2006, 78% of the students who enrolled at a community college and 10% of the students who enrolled at a state university in Florida had to enroll in a remedial course in mathematics, reading, and/or writing. The costs of these remediation courses totaled \$118.3 million in 2004-05, with Florida picking up a 53% (\$62.9 million) of the tab.<sup>6</sup>

### **What is Algebra II?**

The experts at Achieve explain: “Algebra is generally the first math course students take that has a name other than “math,” but few students approach it with much sense of why that is so, or of the doors it can open. Algebra is an ancient branch of knowledge; its name refers to the revolutionary idea that originated with it, that one could use known relationships to answer questions about unknown quantities. Algebra was a way of moving beyond calculating and into abstract reasoning.” Simply put, the value in Algebra courses isn’t based on the formulas and calculations that students learn, but the development of analytical skills and abstract reasoning that it fosters. “Algebra is the “gateway” course,” Achieve explains, “not just because it is a prerequisite for many high school and postsecondary math, science, engineering, and technology courses, but because it is an intellectual gateway to abstract reasoning.”<sup>7</sup>

<sup>5</sup> Achieve, Inc., “Closing the Expectations Gap,” 2008, <http://www.achieve.org/node/990>

<sup>6</sup> Florida Legislature, Office of Program Policy Analysis and Government Accountability (OPPAGA), “Steps Can Be Taken to Reduce Remediation Rates, Report No. 06-40, (April 2006) : <http://www.oppaga.state.fl.us/reports/educ/r06-40s.html>

<sup>7</sup> Achieve, Inc., “Closing the Expectations Gap,” 2008, <http://www.achieve.org/node/990>

To gain a better understanding of Algebra II and why high school students should complete it, ENLACE researchers have consulted with Mathematics Professors Kuiyuan Li, Josaphat Uva, Raid Amid, and Anthony Okafor of the University of West Florida. It may be difficult for non-experts to understand technical terms, but we should include for the record a partial description of a typical Algebra II course. According to Professors Li, Uva, Amid, and Okafor, the following topics are taught in Algebra I, but reviewed or re-taught in Algebra II:

Topics Taught/Reviewed in Algebra I & II	Topics Taught/Reviewed In Algebra II Only
Products and factors of polynomials	Variational and polynomial equations: variation and proportion, inverse and joint variation, synthetic division, remainder and factor theorems,
Rational expressions	Conic sections: distance and mid-point formulas, circles, parabolas, ellipses, hyperbolas
Irrational and complex numbers	Solve system of equations: system of linear equations, quadratic system
Quadratic equations and functions	Exponential and logarithmic functions
	Sequences and series
	Matrices and determinants

To parents who have little recollection of their high school algebra courses and to students not yet exposed to Algebra, the above terms may seem far too advanced for any high school student and, perhaps, of little use in the “real world.” However, our experts at the University of West Florida Department of Mathematics emphasize that the value of Algebra II lies not so much in the equations that students learn, but the development of their thinking and analytical skills. Students receive a rudimentary introduction to high school mathematics in Algebra I while students explore in depth a diversity of engaging topics that have many real-world applications in Algebra II. “Students who successfully complete Algebra II at high school are equipped with:

- Critical thinking skills that enhance further study. In addition, this gives the student that confidence needed to engage in a challenging career that requires some level of clear thinking and methodical problem-solving;
- Ability to analyze and weigh situations in order to make better decisions based on the analysis;
- Symbolic manipulation skills necessary for considering further exploration that could lead to careers in science/technology, business, social sciences and education. In particular, students who complete Algebra II are more likely to take other courses in science to include physics, chemistry (as opposed to a general science course).
- General intellectual maturity that enhances students’ readiness for college-level study without remediation. Such students are more likely to score well on standardized tests because students who score well on the math portion of these tests do score well overall.”

To the people who wonder what value Algebra II has in the “real world,” especially for students who do not plan to pursue a career in the sciences, technology, engineering, or mathematics, the simple answer is that Algebra II helps to develop an advanced way of thinking and problem-solving that will enhance his or her career opportunities and prepare them to succeed in college. According to Achieve, “what is important to them [mathematics educators] is the development of thinking skills, or mathematical habits of mind. Once this kind of thinking is established, students can apply it in the context of geometry, trigonometry, calculus, data and statistics, or other advanced courses.”<sup>8</sup>

### **Top 10 Reasons to Take Algebra II**<sup>9</sup>

1. Algebra II is a prerequisite for many college courses, not only in math and science, but also in social science fields, economics, business, and computer and other technology courses.
2. The University of Florida and Florida State University already require Algebra II to qualify for admissions and the University of South Florida will institute an Algebra II admissions requirement beginning in 2011. Other state universities are likely to follow suit.
3. Researchers at the University of West Florida (UWF) have concluded that Students’ performance in College Algebra was strongly linked to success in their college studies generally, *regardless of the area of study*.
4. Researchers at UWF found that students who performed poorly in College Algebra had not been properly prepared in some topics that are usually covered in Algebra II.
5. Success in Algebra II is likely to lead students to success in other courses, even disciplines not traditionally associated with advanced mathematics.
6. Students who complete Algebra II in high school are more than twice as likely as those who do not to earn a four-year degree.
7. Students who take Algebra II and higher-level math courses are better prepared for the workplace and earn higher salaries.
8. The fastest growing occupations in the United States, including data communications analysts, computer software engineers, computer systems analysts, and financial analysts, require advanced math.
9. Many “Blue Collar” jobs that pay well, including electricians, pipe fitters, sheet metal workers, and draftsman require the kind of math skills taught in algebra, geometry, and trigonometry.
10. Nearly half of all graduates entering the workplace regret that they did not take more advanced math courses in high school.

### **Policy Implications**

Students, parents, educators, and elected officials have expressed concern that the tougher graduation requirements, particularly Algebra II, will lead more students to fail or drop out of high school. Research and best practices have demonstrated, however, that students will meet the higher standards, *provided* that they are given the proper support and the high-quality instruction that they will need to succeed. The Final Report of the National Mathematics Advisory Panel in 2008 noted that social and intellectual support from teachers and peers can improve performances in mathematics courses by African American and Hispanic students. The panel therefore recommended “the scaling-up and experimental evaluation of support-focused interventions that have been shown to improve the mathematics

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<sup>8</sup> Florida Legislature, Office of Program Policy Analysis and Government Accountability (OPPAGA), “Steps Can Be Taken to Reduce Remediation Rates, Report No. 06-40, (April 2006) : <http://www.oppaga.state.fl.us/reports/educ/r06-40s.html>

<sup>9</sup> Achieve, Inc., “The Building Blocks of Success Higher-Level Math for All Students,” May 2008, <http://www.achieve.org/mathworks>

outcomes of African-American and Hispanic students. These and related studies focused on improving task engagement and self-efficacy of such students hold promise for helping to close the mathematics achievement gaps that are prevalent in U.S. society.”<sup>10</sup>

In districts and states that have imposed a college prep curriculum that includes Algebra II, higher graduation requirements actually led to **HIGHER** graduation rates. In the San Jose, California school district, the imposition of a college prep curriculum that required Algebra II was initially met with skepticism by students and parents. As it turned out, the tougher standards actually closed the achievement gap between white and Latino students and led to an increase in the graduation rates for Latino students from 73% in 1998 to 79% in 2003. In Texas and Indiana, states that imposed a college prep high school curriculum as the default curriculum for all students, high school graduation rates actually increased after students were required to meet the tougher standards.<sup>11</sup>

Florida can succeed in its efforts to prepare more students for success in college or their careers. However, the implementation of the tougher standards will require careful planning and coordination to ensure that:

1. Teachers are given professional development opportunities to improve their instructional skills for Algebra II and the other new required courses.
2. Sufficient numbers of teachers are recruited and rewarded to teach the more challenging courses, particularly in struggling schools to under-represented students.
3. Students are provided with additional support services that might include afterschool or summer programs with a math focus, and small group or one-on-one tutoring sessions.
4. The content of new Algebra II courses is not watered down to such an extent that it is not a re-titled version of Algebra I.
5. The requirements and course content of Algebra II are aligned with the expectations and requirements of post-secondary institutions.

The introduction of a tough new high school curriculum represents a milestone in Florida’s efforts to create a world class educational system. It will empower more of our students to succeed in higher education or the increasingly competitive job market. ENLACE Florida expects students to welcome the imposition of more rigorous and relevant standards. If we demand more from our students, we are confident that they will deliver more. Evidence from several states and school districts around the country shows that Florida made the wise choice to raise high school standards. Our students will succeed, provided that parents, teachers, and administrators provide them with the proper support and high quality instruction.

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<sup>10</sup> National Mathematics Advisory Panel, *The Final Report of the National Mathematics Advisory Panel* (March 2008), p. 60. <http://www2.ed.gov/about/bdscomm/list/mathpanel/report/final-report.pdf>

<sup>11</sup> See ENLACE Florida, “Toward a College Preparatory High School Curriculum in Florida,” *Policy Research Brief*, Vol. II, Issue 6 (June 2008).

**ENLACE FLORIDA** is a statewide college access network promoting college readiness, access, and success for Latinos, African-Americans, and other underrepresented students in Florida through non-partisan research, communication, advocacy, and support. The views expressed in this Policy Brief were developed independently and do not reflect the opinions of the universities with which the Leadership Team and staff are affiliated. For more information, visit: [www.enlaceflorida.org](http://www.enlaceflorida.org)

