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Preparing High School Students for the Challenges of Postsecondary Math

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Math proficiency isn't just a stumbling block toward a high school diploma. A major challenge facing students as they pursue a postsecondary degree is a lack of academic preparedness for college-level math. When newly minted high school graduates arrive on campus, a high percentage of them are referred to developmental math (i.e., remedial courses that do not count toward their degree program).

According to national data on a 2003 cohort of students that was tracked to 2009 ([Radford & Horn, 2012](#)), more students participated in developmental math than developmental English: 60% of students who attended a public, two-year college took a developmental math course and 17% took a developmental English course. One-third of students who attended a public, four-year

college and 22% of students who attended a private, nonprofit four-year college also took developmental math while fewer than 10% of students at these types of colleges took developmental English.

Beyond posing an obstacle to college math success, being academically underprepared in math can have consequences for students and reduce the probability that they will complete college. It can negatively affect their interest and success in science, technology, engineering, and math (STEM) fields; their opportunities in the labor market; and their lifetime earnings ([Baum, Ma, & Payea, 2010](#); [Executive Office of the President, 2012](#); [Jacobson & Mokher, 2009](#); [Rivera-Batiz, 1992](#)).

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Just the Facts

- Accelerated college credit options generally offer high school students a more rigorous curriculum, an early indication of their readiness for college-level coursework at a particular institution or higher education system, and a better understanding of the expectations of college-level work ([Speroni, 2011](#)).
- Educators have increasingly implemented ACC programs to support the postsecondary preparation and success of all students, not just the highest-achieving ([Lerner & Brand, 2006](#)).
- Early assessment is a fairly widespread practice with 25 states supporting statewide early assessment programs ([Barnett, Fay, Bork, & Trimble, 2013](#)).
- According to recent national scans, bridge programs and boot camps, which are similar but often shorter in duration, are relatively common at colleges across the country ([Edgecombe, Cormier, Bickerstaff, & Barragan, 2013](#); [Sherer & Grunow, 2010](#)).
- In the 2014–15 academic year, 45 states that have adopted the standards will administer new assessments aligned with Common Core to juniors and the states will set a minimum cutoff score at which students are considered to be college and career ready ([Barnett & Fay, 2013](#)).

reforms and interventions at both the secondary and postsecondary levels. This research review summarizes rigorous research on three popular strategies for improving high school students' college math readiness and success: accelerated college credit, early assessment, and summer bridge programs.

Accelerated College Credit

Accelerated college credit (ACC) options, such as AP classes, the IB program, dual credit, and dual enrollment, allow students to earn college credit while in high school. ACC options generally offer high school students a more rigorous curriculum, an early indication of their readiness for college-level coursework at a particular institution or higher education system, and a better understanding of the expectations of college-level work ([Speroni, 2011](#)). As a result, such options may improve students' transitions to college, decrease the likelihood that they will require developmental classes to access a full college curricula, and reduce the time it takes them to earn a degree.

Educators have increasingly implemented ACC programs to support the postsecondary preparation and success of all students, not just the highest-achieving ([Lerner & Brand, 2006](#)). The popularity of these programs is evident in the high percentage of US public high schools that are offering accelerated college coursework. During the 2010–11 school year, 82% of public high schools reported that students were enrolled in dual credit courses, 69% reported enrollments in AP or IB courses, and 59% reported enrollments in both dual credit and AP or IB courses ([Thomas, Marken, Gray, & Lewis, 2013](#)).

Florida is one of the few states that funds dual enrollment courses that allow high school students to earn college credits that count toward degree programs at the state's public postsecondary institutions ([Speroni, 2011](#)). Students must have a minimum 3.0 GPA and demonstrate college readiness on the state's college placement exam to be eligible to take dual enrollment courses. [Speroni \(2011\)](#) evaluated the effects of the dual enrollment program, in general, and the effects of taking college algebra,

specifically—one of the most popular dual enrollment courses—and found that participation in a dual enrollment course did not improve students' high school graduation rate and postsecondary enrollment and completion.

[Speroni's \(2011\)](#) research did show, however, that specifically taking college algebra in high school improved students' college enrollment by 16 percentage points, associate degree attainment by 6 percentage points, and bachelor's degree attainment by 11 percentage points. The findings suggest that although the impact of dual enrollment in general is limited, taking more rigorous math in high school can have a significant impact on students' college access and success.

Early Assessment

Early assessments indicate whether high school students are academically prepared for college-level math and English. Early assessment is a fairly widespread practice with 25 states supporting statewide early assessment programs ([Barnett, Fay, Bork, & Trimble, 2013](#)). Typically, a postsecondary state agency in collaboration with the K–12 state agency offers all high school students a statewide assessment that measures readiness for college coursework in that postsecondary system.

In most early assessment programs, however, high schools are left to decide what interventions, if any, to provide to students who are not deemed college ready ([Hodara, Jaggars, & Karp, 2012](#)). Only eight states also have statewide “transition curricula,” which are English and math courses offered in the senior year to students who are deemed to be not college ready by their performance on the tests. It is more common for K–12 state agencies to lead transition curricula initiatives rather than postsecondary state agencies.

A central component of [California's Early Assessment Program \(EAP\)](#)—developed by the California State University (CSU), the California Department of Education, and the California State Board of Education—is optional early testing on the 11th-grade state standardized exam that assesses students'

Laying an Early Foundation for Math Success

Students at [Alice Ott Middle School](#) in Portland, OR, are getting a jump on being ready for more demanding math courses. Alice Ott was recently recognized for its high math and reading achievement and selected by the National Association of Secondary School Principals [www.nassp.org] as one of its nine [2014 MetLife Foundation–NASSP Breakthrough Schools](#). Despite the fact that 70% of Alice Ott students are low income and nearly 40% are nonnative English speakers, the school got 75% of its students to pass the state math tests last spring.

Today's results are a far cry from 2008 when just over half of the students were at grade level in math. Principal James Johnston and his staff members have been slowly building the math program by introducing a daily 80-minute math class for all students who aren't "exceeding" or "high-achieving" in math. "We've also provided incentives so students who exceed benchmarks in sixth and seventh grade move to prealgebra or algebra and they earn an extra elective so they have math every other day," he explained. Students who are even more advanced are bussed to the local high school for higher-level math classes.

Professional learning teams have also contributed to the school's success. A late start on Wednesdays provides one hour for grade-level teams to study students' data, develop common assessments, and identify supports to meet each student's needs. Johnston and his vice principal rotate among the groups to offer their input. Other pieces of the puzzle include a focus on reducing absenteeism and building parent engagement. Each month teachers are required to make 10 parental contacts by phone and send postcards and e-mails, communicating with families about the good things their students are doing, as well as any problem areas.

"Our mantra is 'champions find a way,'" Johnston said. "My job as principal is to provide the infrastructure for a place that challenges students to do their best regardless of identifying labels."

readiness for college math and English in the CSU system. Through this test, students are identified for participation in [EAP](#) and are more likely to work on their math skills in their senior year, increasing their chances of placing into college math as a freshman than those who did not receive additional support. According to a study by [Howell, Kurlaender, and Grodsky](#) (2010), California's EAP had a positive impact on placement into college math. High school juniors in the 2003–04 school year who were identified through the test and participated in EAP were about four percentage points less likely to be referred to remedial math at CSU-Sacramento than juniors in 2001–02 (before EAP was developed).

Summer Bridge Programs

Summer bridge programs have a long history in higher education and usually are geared to students who are placed into remediation through testing or to students entering STEM programs who are not prepared for the first college math course in the program (often precalculus or calculus). Bridge programs are typically designed to improve students' math skills, as well as orient them to the college culture, build their study skills, and provide a network of support prior to enrolling. According to recent national scans, bridge programs and boot camps, which are similar but often shorter in duration, are relatively common at colleges across the country

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(Edgecombe, Cormier, Bickerstaff, & Barragan, 2013; Sherer & Grunow, 2010).

A randomized experiment evaluated the effects of the [Texas developmental summer bridge program](#) offered to recent high school graduates whose college placement tests showed that they required remediation at two open-admissions, four-year colleges and six community colleges across the state in the summer of 2009 (Barnett et al., 2012). Although the programs at each college varied, they shared similar features: accelerated instruction in math, reading, and writing to prepare students to retake the placement exams; academic support outside of class through individual tutoring; and a college knowledge component provided through a college success course or presentations and workshops. In addition, the programs offered an initial stipend of \$150 to improve recruitment efforts and \$250 after comple-

tion of the program to encourage students to finish.

After agreeing to take part in the study, participants were randomly assigned to the summer bridge treatment or the control group. A higher proportion of students in the treatment group than the control group passed a college-level math course through fall 2010, but by spring 2011 there was no significant difference in the proportion of treatment group and control students who passed college math.

The statistically similar college math pass rates of the treatment and control groups signify that even if the Texas summer bridge program helped more treatment students place into college math, it had no long-term impact on helping them pass college math. Also, there were no statistically significant differences between the two groups in the total semesters registered over the two-year period and the number of college credits attempted and earned. The findings suggest that short-term programs, particularly those that focus on improving placement test performance, may not have a meaningful effect on students' long-term college success.

Conclusion

Presently, the evidence on interventions that are intended to improve college math readiness and success is limited, but promising. Dual enrollment algebra in Florida, early assessment in California, and summer bridge programs in Texas appear to have had positive impacts on students. However, the impact of the [Texas summer bridge](#) program faded over time. That suggests that interventions for high school students who are underprepared for college math may need to be more connected and comprehensive to have an enduring impact on educational outcomes.

In a more connected and comprehensive approach, high schools would offer students early assessments to test their college readiness in their junior year and, just as important, provide transition curricula in the senior year to students whose test results show they are not college ready. For students who continue to struggle in math, colleges would offer summer bridges and boot camps that address gaps

in students' math skills and understanding, as well as build their college knowledge and connect them to campus life and a network of support.

The Common Core State Standards provide an opportunity for public secondary and postsecondary systems to offer a connected set of supports for high school students transitioning to college. In the 2014–15 academic year, 45 states that have adopted the standards will administer new assessments aligned with Common Core to juniors and the states will set a minimum cutoff score at which students are considered to be college and career ready (Barnett & Fay, 2013). For students who score below the cutoff, high schools and colleges have the opportunity to work together to develop transition curricula and prematriculation summer programs for students who are deemed underprepared for college math.

Offering ACC, early assessments, and bridge programs often requires partnerships between secondary and postsecondary schools and systems. Although that cooperation demands greater effort, collaborative programs to improve students' college math readiness and success may have a significant and lasting impact on students' math learning before they reach college and their overall success once they arrive there. PRR

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