

RESEARCH PROJECT OVERVIEW

The Study of Pre-College Math Remediation Programs in Tennessee

SUMMARY

In an effort to promote college enrollment and degree completion, the state of Tennessee has invested a student-centric, technology-based blended learning model of high school mathematics instruction, The Seamless Alignment and Integrated Learning Support (SAILS).

The SAILS program provides high school seniors likely to require math remediation in college with coursework equivalent to college-level developmental education classes. Eligible students who complete the program are able to satisfy math requirements for high school graduation and, upon postsecondary matriculation, to enroll directly in credit-bearing coursework toward a college degree.

Researchers at the Center for Education
Policy Research at Harvard University and
Vanderbilt Peabody College of Education are
partnering with the SAILS Program and
Tennessee state leadership to conduct an
evaluation of SAILS. Using a range of
quantitative and qualitative research
methods, the study will examine the impact
of participation in SAILS on students' shortand long-term outcomes and investigate the
mechanisms by which the program may
promote students' postsecondary success.

I. BACKGROUND

The Connection Between College-Level Remediation and College Completion

Postsecondary education has become a critical step to achieving stable employment and financial security. An individual with a college degree will earn more, on average, over his or her lifetime than a high school graduate (U.S. Census Bureau, 2009). Unfortunately, given the increasing importance of a college credential to future employment and lifetime earnings, low college completion rates have been a persistent problem (US DOE, 2011). Among all four-year institutions, 59% of students complete a bachelor's degree within six years (57% at public four-year institutions). Among all two-year institutions only 31% of students who enroll complete their credentials within three years. The rate is even lower (20%) for students enrolling in public two-year institutions (US DOE, 2014).

Many students enter higher education underprepared for college-level coursework, and institutions require students to take remedial courses to recover the requisite knowledge. Data from 2007–08 suggest that 36% of all first-year college students report ever taking a remedial course, with 20% having taken at least one remedial course in that year (US DOE, 2011). Among public institutions,

rates of remediation vary: 24% of students in four-year doctorate-granting institutions, 39% of students in four-year non-doctorate-granting institutions, and 42% of students in two-year institutions enrolled in at least one remedial course in the 2007–08 school year. Remediation course enrollment rates are generally slightly lower for comparable private institutions (US DOE, 2011).

Evidence suggests that remediation has costs and consequences for students. First, it impacts students' use of time in school. Many institutions require remedial courses to be completed prior to enrolling in college-level courses. If a student must complete multiple remedial courses in the same subject, it may take over a year before the remediation requirements are fulfilled. Ultimately, less than 50% of students referred to remediation complete the entire sequence to which they are referred and, among these students, about half fail to earn college credits in the following three years (Bailey, Jeong, & Cho, 2010). The percentage of students that completes the remediation sequence is even lower for men, older students, African American students, part-time students, and students in vocational programs. Second, there are financial implications for students. Students must pay tuition for remedial courses, but rarely do these courses count towards their degree requirements. Recent estimates suggest expenditures of \$3.6 billion in direct costs to students, primarily in the form of tuition (Alliance for Excellent Education, 2011).

Finally, the majority of large-scale research studies have found that remedial courses have little or no effect, and in some cases have a negative effect, on student persistence and degree completion, especially for students at the margins of passing out of remediation (Attewell, Lavin, Domina, & Levey, 2006; Calcagno & Long, 2008; Boatman & Long, 2012; Martorell & McFarlin, 2011; Scott-Clayton & Rodriguez, 2012). Two potential explanations for these discouraging findings are (a) that college is too late in the educational process to address issues of underpreparedness, or (b) that the requirement to take non-credit bearing courses itself undermines student interest and will to complete a degree (i.e., a "time tax"). National costs for remedial courses topped \$5.6 billion, including \$2 billion in lost lifetime wages due to the greater likelihood that students in need of these courses will drop out of college without earning a degree (Alliance for Excellent Education, 2011).

One promising innovation in remedial education is to identify students who would likely require remediation while they are still in high school, and to remediate before they graduate and seek a college education. Those who are successful would be exempted from further remedial requirements in college and would be free to begin taking credit-bearing, college-level courses immediately. While there is little rigorous research on these approaches to readying underprepared students for college-level work, there is some causal evidence that early assessment programs (Howell, Kurlaender & Grodsky, 2010) and improvements to the instruction and delivery of remedial coursework (Boatman, 2012) can diminish students' need for remediation or promote better academic outcomes, respectively.

II. TENNESSEE'S SEAMLESS ALIGNMENT AND INTEGRATED LEARNING SUPPORT (SAILS) PROGRAM

The Statewide Context

For decades, the state of Tennessee has struggled with its rates of college completion. Twenty-six percent of all students attending community colleges complete an associate's degree in three years, and 51.5% of students attending four-year colleges complete a bachelor's degree in four years (compared to national rates of 29.2% and 55.5%, respectively). Following his election in 2011, Tennessee Governor Bill Haslam set clear statewide objectives to address the state's level of college-readiness and to increase overall rates of college completion by its residents.

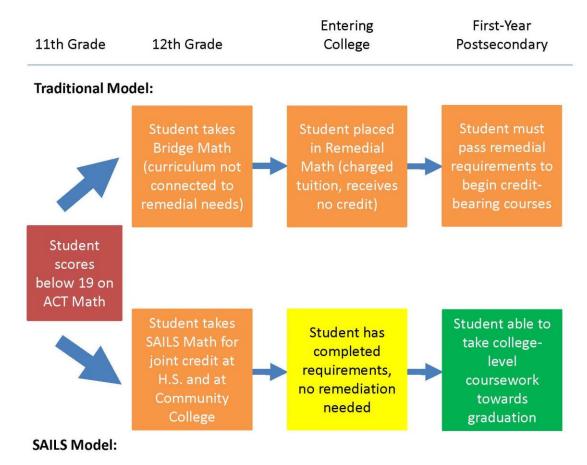
In the fall of 2013, the governor established the "Drive to 55" campaign to raise the share of residents with a college credential from 32% to 55% by 2025 (Drive to 55, 2015). At the community college level, rates of remediation for incoming students were a primary barrier to achieving these postsecondary outcomes. In the fall of 2012, 68% of first-time freshman community college students in Tennessee were enrolled in one or more developmental or remedial courses (Tennessee Higher Education Commission, 2014). Descriptive evidence suggests that remedial coursework may impact college completion rates in Tennessee: of the students needing remedial coursework, over 95% did not complete their certificate or associate's degree within three years of matriculation and only 25% obtained the

credential within five years (Tennessee Higher Education Commission, 2013). A central element to the "Drive to 55" campaign is the "Tennessee Promise" scholarship, which, beginning in the fall of 2015, will provide funding that enables any recent high school graduate in the state to attend community college or technical college for free. With more students potentially enrolling in college this fall than in the past, it is more important than ever to address students' remedial needs while still in high school.

The SAILS Program

In an effort to promote college enrollment, persistence, and degree completion, leadership at Chattanooga State Community College developed the Seamless Alignment and Integrated Learning Support (SAILS) program (Chattanooga State Community College, n.d.). By offering the equivalent of the college remedial math course to high school students during their senior year, SAILS intends to address students' remedial needs earlier and set students up for long-term success in college. Piloted locally in the 2012–13 academic year, the program allows seniors to simultaneously complete their fourth year of high school math required for graduation while eliminating the need for remedial coursework in college. Enrolling in SAILS saves students both money and time, as students who complete the course no longer need to enroll and pay for remedial math courses in college.

Figure 1: Traditional Remediation Model vs. SAILS Program Model



Note: Adapted from Chattanooga State Community College (n.d.) and Tennessee Higher Education Commission (2013).

The SAILS program has three key components.

Curricular Alignment:

Statewide college-level standards as set by the Tennessee Board of Regents are explicitly embedded into SAILS core curriculum. The material is also aligned to meet the senior-year upper-level math course required for high school graduation in Tennessee.

Modular, Self-Paced Online Curriculum: Students participate in SAILS by completing a set of learning modules delivered through a customized software platform. Rather than a traditional teacher-led, lecture-heavy setting, SAILS relies on the "flipped classroom" model of instruction. Teachers serve as learning partners and coaches, providing individual assistance as requested, and working in collaboration with students to help them advance in the work. The software platform also provides an extensive amount of data to help teachers monitor student progress and identify students who are falling behind.

Comprehensive Support System:

Students, teachers, and schools are provided with several layers of support to help as many students to complete the course as possible. All 13 Tennessee community colleges participate in the SAILS program, and these are connected through a team of field coordinators led by program leadership at Chattanooga State. Field coordinators train high school SAILS instructors, maintain the

administrative link to the college, and ensure that the program is being administered smoothly at each of the up to 12 schools in their caseload. Coordinators also provide an additional layer of support for students. They monitor student progress through the system platform and visit each school 2–3 times a month, enabling them to intervene directly with struggling students and help them to get back on track.

How Does the SAILS Program Work?

- Curriculum includes five individual modules aligned with the Tennessee Board of Regents five learning support competencies. Students sequentially take one module at a time.
- Students who score 75%* or above on the assessment at the end of each module can move on to the next.
- Students who do not score above 75% on the assessment at the end of the module review their results with peers, teachers, and/or field coordinators, and are directed back to specific module problems before retaking the test.
- Coursework consists of a series of problem sets, supplemented by instructional videos and
 other multimedia tools. Problems can be completed at any time, at school or at home. Endof-module assessments are password-protected and must be taken at school under the
 supervision of a proctor.
- Teachers are available during classroom periods to address student questions and review student progress to identify struggling students or areas of focused intervention.
- If a student completes all five modules, they are automatically exempted from remedial math courses when enrolling at a public postsecondary institution in Tennessee.
- When all modules are complete, students are eligible for dual-enrollment courses that provide them with college credit accumulation before graduating from high school.

*Passing scores may vary by individual community college.

Source: Chattanooga State Community College (2014).

Initial Results from SAILS Implementation

To this point, the SAILS program has measured success primarily by the proportion of high school students completing the modules. Students who complete all five modules of SAILS program are defined to be college-ready. In the 2012-13 pilot, SAILS reported that 83% of the initial sample of 500 high school students who enrolled in SAILS graduated high school college-ready in math (Tennessee Higher Education Commission, 2013). Of these students, 30% also completed at least one college-level course in high school. Anecdotal evidence from several high schools also suggested that SAILS participation was influencing college enrollment rates. At Meigs County High School, for example, the rate of students attending two- or four-year colleges in 2013 was 55%, a substantial increase from a rate of 38% in 2009 (Denn, 2014).

In 2012, the Governor's office appropriated \$1.1 million in funding to expand the pilot program from four community colleges supporting 500 high school students to reach all 13 of the state's community colleges and up to 8,500 students at 120 high schools. An additional \$2.6 million grant in 2014–15 enabled the program to reach almost 185 schools and over 13,500 students statewide (Chattanooga State Community College, 2014), and expansion in the 2015–16 school year may reach almost 150 high schools and up to 18,000 students.

III. THE EVALUTION

Because of the promising results reported by the program so far, we hope to learn more about the comparative impact of the program relative to those in traditional remedial courses, and the mechanisms by which the program affects students. Specifically, we hope to answer the following questions:

- 1. What are the short-term outcomes for students who participate in SAILS in high school?
 - Is there an impact on students' demonstrated math achievement?
 - Do these impacts differ from students in other types of remedial math classes, for various student subgroups, school contexts, or implementation configurations?
- 2. What are the long-term outcomes for students who participate in SAILS?
 - What is the impact on college enrollment, gatekeeper course completion, term-to-term persistence, and college degree completion?
- 3. By what mechanisms does SAILS "work"?
 - Does the program effectively increase students' math achievement?
 - Or does it work by simply reducing the "time tax" currently imposed by remedial courses in college?
- 3. Are there differences in teacher practices, beliefs, or experiences when comparing SAILS and non-SAILS math teachers?

- 4. How are schools implementing the SAILS program?
 - What are some of the more successful variations in the model? What factors appear to be related to successful implementation?
 - What are the costs and benefits of the SAILS program relative to other developmental options used in Tennessee?

The study will collect a range of data to address these questions, including:

- data on short-term student outcomes (math achievement gains) and on longterm student outcomes (postsecondary enrollment, persistence and completion);
- survey data from students about highschool experiences and college plans and from teacher surveys about classroom and instructional experiences;
- qualitative information from site visits, classroom observations, interviews, and focus groups; and
- program cost information.

Measuring Students' Short- and Long-Term Outcomes

The research team has developed a comprehensive data collection plan to follow a cohort of Tennessee high school juniors in 2014–15 for three years (though 2017–18), collecting student survey and testing data, as well as administrative data from high schools, teachers, and postsecondary institutions in the state. To measure short-term outcomes (such

as improved math achievement) and longterm outcomes (such as postsecondary enrollment and degree completion), the study will merge two data sources: a math postassessment and students' statewide administrative records.

student Math Post-Assessment. A key component of the SAILS evaluation is the collection of a post-assessment of math skills from a sample of seniors during the 2015–16 school year. The math post-assessment provides the evaluators with an important post-test measure of student achievement. It is a short, low-stakes test of math skills that is aligned to the full ACT math section, which is initially used to place students into SAILS courses. For this portion of the evaluation, the research team is recruiting 130 schools to assess the math skills of the majority of their senior math classes at the end of their 12th-grade math course.

Because it was not feasible to randomize schools, classes, or students to receive SAILS, the evaluation will implement a rigorous quasi-experimental research design.

Specifically, researchers will use the post-assessment data to compare the math achievement gains of students whose ACT scores are at or just above the placement cutoff score of 19 to the gains of students who score just below (i.e., SAILS students) to better estimate and isolate the influence of the program on short-term math achievement outcomes. Students' prior assessment and achievement data will be used to account for other variations between student populations.

State Administrative Data. The research teams at the Center for Education Policy Research (CEPR) at Harvard University and Vanderbilt Peabody College of Education and Human Development will work with the SAILS program, the Tennessee Department of Education (TDOE), Higher Education commission (THEC), and Tennessee Board of Regents (TBR) to track students postsecondary experience and success. Statewide administrative records from these agencies will be used to make longitudinal comparisons between SAILS and non-SAILS students on factors such as college enrollment, gatekeeper math course completion, term-toterm persistence, and college degree completion. The study will also explore an important research and policy question: are impacts of SAILS on postsecondary outcomes related to higher math achievement or to a reduction in the "time tax" associated with postsecondary remedial education?

Contextual Information

Student and Teacher Surveys. An additional source of data will be teacher and student surveys. The student survey gathers information on students' attitudes towards math, critical thinking skills, and postsecondary aspirations. In addition, the surveys ask students about their experiences in a technology-assisted classroom, providing evidence of whether or how the technology-focused math curriculum is impacting students' problem solving abilities. The evaluation surveys high school seniors enrolled in a math course. In the winter of 2015, the

project anonymously surveyed 1,500 students enrolled in SAILS and 350 students enrolled in Bridge math courses (the alternative, traditional senior-year math course for students with ACT scores below 19) across Tennessee. During 2015–16, we will survey students enrolled in senior-year math classes at each of the schools participating in the math post-assessment.

The teacher surveys cover topics such as training, qualifications, and experience; instructional strategies; perceptions of students' attitudes and experiences in the course; and opinions of and experiences with the SAILS program (for SAILS teachers only). These data will support research questions aimed at comparing teachers' practices, beliefs, or experiences in SAILS and non-SAILS classes, as well as connecting these characteristics to variation in student achievement outcomes. Teacher surveys will be administered to teachers in the schools participating in the math post-assessment during the fall/winter of the 2015–16 school year.

Site Visits. In addition to surveys, the evaluation team is also conducting school site visits as an opportunity to interact with key individuals who are implementing SAILS. Site visits include schools that only offer SAILS, offer SAILS and other Bridge math courses, and offer Bridge math courses only. Among the schools that offer SAILS, selection of is based on a variety of dimensions to ensure that the site visits include schools that vary by locale, program characteristics (e.g., number

of years they have offered SAILS, number of sections, semester vs. full year) and varying student outcomes (e.g., SAILS completion rates).

During the site visits, the research team will conduct interviews with SAILS teachers, the school principal, and an additional representative of the community college that is linked to that school. Researchers will also conduct student focus groups and observe SAILS classes. The goal is to provide richer qualitative evidence on each of the research questions. For example, we hope to identify

any variation in program implementation by site, which might explain differing impacts. The site visits will focus on how students are assigned to SAILS, the role of the SAILS teacher, how technology resources are deployed, and the role of various program supports. These results will aid in identifying factors and conditions associated with successful implementation, such as characteristics of teachers, instructional strategies, support from school leadership and field coordinators, as well as student perspectives on and experiences with the SAILS program.

Table 1. Timeline of Recruitment, Data Collection, and Dissemination

Activity	Timing
Project Launch	Fall 2014
Student Surveys I	Fall 2014
School Site Visits I	Spring 2015
School Recruitment for Post-Assessment	Spring/Summer 2015
Initial Implementation Report	Summer 2015
School Site Visits II	Fall 2015
Student (II) and Teacher Surveys (I)	Fall 2015
Final Implementation Report	Winter 2016
Math Post-Assessment of High-School Seniors	Winter/Spring 2016
Final Impact Report	Spring/Summer 2017

IV. CONCLUSION

We expect that the results from this evaluation will have wide-reaching implications. In Tennessee, evidence from program implementation and student/teacher experiences may drive continued development of SAILS and could speed the development of other innovative instructional practices in schools. In fact, Chattanooga State Community College is currently developing an English language arts program modeled after SAILS that will be piloted in five high

schools (serving 125 students) during the fall of 2015. Findings may also influence state math education policies and could help education leaders in the state and across the United States begin to transform the way that math is taught. Finally, evidence of both short- and long-term impacts on student achievement and postsecondary success could serve as a model for other states seeking to improve their students' college readiness and postsecondary outcomes.

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This research is made possible through a grant from the Bill and Melinda Gates Foundation (ID# OPP1108269) to the President and Fellows of Harvard College. The opinions expressed are those of the authors and do not represent views of the Gates Foundation. The authors would like to thank Abbie Alexander, Andrea Beesley, Robert Denn, Emily House, Mike Krause, Jeanette Tippett, and Nate Schwartz for their feedback and support. The authors also thank Marc Johnson for his contributions to an earlier version of the literature review for CEPR.