

## Math Transition Courses in Context Preparing Students for College Success

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Increasingly, state departments of education, school districts, and high schools are recognizing that many students graduate from high school underprepared for college-level coursework in mathematics (Bailey, Jeong, & Cho, 2010). Nationally, 59 percent of students who enroll in community colleges place into developmental (or remedial<sup>1</sup>) math courses, and 33 percent of students who enroll in public four-year colleges do so as well (Chen, 2016). Students who begin college in developmental courses are considerably less likely to earn a degree (Attewell, Lavin, Domina, & Levey, 2006). One solution to this problem is to make sure that students graduate high school prepared for college-level work. States and localities have therefore begun to develop high school transition curricula as a means of reducing the number of students who require remediation in college.

In 2017, the Community College Research Center conducted a national scan of transition curricula in all 50 states and the District of Columbia, resulting in a research brief that provides a high-level summary of transition curricula characteristics and availability (Fay, Barnett, & Chavarín, 2017). We found that transition curricula are offered as a part of secondary school programming in 39 states—10 more states than in 2012-13, when a similar scan was conducted. Seventeen states offer transition curricula through state initiatives, while in 22 states, the curricula are offered in particular localities. Thirty-nine states offer transition curricula in math, the focus of this brief.



### **TRANSITION CURRICULA:**

**Transition curricula are courses, learning modules, or online tutorials typically developed jointly by secondary and postsecondary faculty and offered no later than 12th grade to students at risk of being placed into remedial math or English in college. In this brief, we mainly discuss semester or year-long transition courses.**

## Methods

This study draws on data from five sources—in-depth interviews, documents provided by interviewees, research literature, online resources, and information collected from CCRC's 2017 national scan of transition curricula—to describe the design, implementation, and effectiveness of math transition curricula and how they fit into the current educational reform landscape. With respect to the interviews, CCRC researchers conducted telephone interviews with individuals from eleven states (AL, CA, FL, IL, KY, MA, NH, NC, OK, TN, TX) where math transition courses are widely offered. We spoke with persons who were involved in the oversight, development, or implementation of math transition curricula in their state.

# Math Transition Curricula in Seven States

**Table 1.**

Information About Math Transition Curricula in Eleven States

State	Program/ Course Title	Scope of Implementation	Key Notes About Implementation	Assessment Used for Placement (score indicated for placement into transition program, when known)
AL	The Essentials of College Mathematics	Statewide	Schools throughout the state use the Southern Regional Educational Board (SREB) curriculum, but educators have the autonomy to select which components best meet the needs of their students.	ACT (16-19 on math section)
CA	Math Transition Course (course names locally determined)	Local	California State University (CSU) supports high schools creating math transition courses aligned with CSU standards. Many of the locally developed courses are open and available to other schools statewide. Algebra II is a prerequisite for all transition courses.	Smarter Balanced (2 or 3 on math section)
FL	Math for College Readiness	Local	State legislation requires the implementation of courses at the local level; districts and high schools decide on specific content, textbooks, and methods of instruction.	Florida's Postsecondary Education Readiness Test (PERT)
IL	Transitional Math Courses	Statewide	State legislation requires the development of three different math transition courses. <sup>a</sup> These courses are being developed by the Center for P-20 Engagement at Northern Illinois University.	ACT, SAT, and/or high school GPA
KY	Math Intervention (course names locally determined)	Statewide	High schools are required to provide an intervention for students underprepared in math; they may choose to use course materials developed by the Kentucky Department of Education.	ACT (less than 19 on math section)
MA	ACCUPLACER Prep Program	Local	Students use online modules curated by JFYNetWorks to prepare for the ACCUPLACER.	ACCUPLACER diagnostic test
NH	Senior Math Course	Statewide	A state-level team developed the course for non-STEM majors using math competencies identified by the Community College System of New Hampshire.	ACCUPLACER (less than 63 on the Elementary Algebra section)
NC	EDReady Online Course	Statewide	State legislation requires provision of transition courses to high school students who are not college ready. The state is in the process of redesigning their existing transition courses to incorporate more online resources.	Multiple measures (typically a high school GPA of 2.6 or greater)
OK	Southern Regional Education Board (SREB) Curriculum	Local	Schools use the SREB Math Ready curriculum but make local modifications.	ACT (less than 19 on math section)
TN	Seamless Alignment and Integrated Learning Support (SAILS)	Statewide	SAILS uses five online modules formerly used by Tennessee colleges for remediation. Courses are taught in high schools by high school teachers supported by a college field coordinator.	ACT (less than 19 on math section)
TX	College Prep Mathematics Course	Statewide	State legislation requires every district to offer a college preparatory course for students who are deemed not college ready. One option is to use a course developed by the Dana Center at the University of Texas at Austin, which integrates algebra, quantitative reasoning, and statistics.	Texas Success Initiative Assessment

<sup>a</sup> The courses are Transitional STEM Math, Transitional Quantitative Literacy/Statistics, and Transitional Technical Math.

Table 1 provides an overview of math transition curricula offered in the 11 states. A number of different approaches to improving math readiness are in use, and there is a considerable amount of experimentation with varied approaches underway. In some states, fully developed courses, such as those created by the Southern Regional Education Board (SREB) or the state of New Hampshire, are available for adoption or adaptation. In other settings such as North

Carolina and Tennessee, a largely computer-mediated approach is used to allow students to focus on identified gaps in their math knowledge and skills. In these cases, colleges or high schools generally obtain online math instructional materials from national vendors. In all but one of the 11 states, year-long or semester-length transition courses are offered that count for high school credit. In the remaining case (Massachusetts), modules are infused into regular high school courses, usually for one class period a week.

Our interviews revealed that transition courses and the measures used to place students into them are most often developed collaboratively by high school and college faculty. We also learned that, while the implementation, assessment, and regulation of the courses are often mediated by state-level representatives, there is substantial variation in the amount of state-level versus local control in decisions related to course design and implementation.

## Effectiveness of Math Transition Curricula

Only limited research on math transition courses has been conducted to date, and the evidence of effectiveness about them is so far mixed. Kane et al. (2018) conducted a study of Tennessee's SAILS program using both a difference-in-differences and a regression discontinuity design. They found that while students participating in the program were more likely than non-participants to place into a college-level math course and earn more college credits, participation did not improve math achievement or boost the likelihood of passing college-level math.

Mokher, Leeds, and Harris (2017) examined the effects of the Florida College and Career Readiness Initiative (FCCRI), the state's policy requiring college readiness testing and participation in the Math for College Readiness course in 12th grade for targeted students. Using a regression discontinuity design, the authors found a higher likelihood of enrolling in college-level courses following participation in the transition course, yet no evidence that students' pass rates in these courses improved.

Research on New York City's At Home in College math course<sup>2</sup> that used a difference-in-differences design found that participation yielded a small positive and significant effect (1 percentage point) on passing a math gatekeeper course within one year of college entry and a small positive and significant impact (1 credit) on the number of college course credits earned in the first year (Trimble, Pheatt, Papikyan, & Barnett, 2017). A companion study on West Virginia's former transition course using a regression discontinuity design found negative impacts from participation in it, possibly because the course offered was less rigorous than alternative math course options such as conceptual math or trigonometry (Pheatt, Trimble, & Barnett, 2016).

Finally, research has shown that students' ACT scores in Arkansas and Mississippi improved after completing SREB's<sup>3</sup> Math Ready transition course. Among 545 students who completed Math Ready in 2016, 62 percent improved their math or science ACT scores, a gain that was statistically significant. The average improvement was 2.4 points in math and 3.5 points in science (Southern Regional Education Board, 2017).

## Trends in the Development Math Transition Curricula

Here we discuss the design and implementation of math transition curricula, with a focus on five major trends or factors identified through our ongoing research and current understanding of the K-12 and higher education sectors. We consider the alignment of curricula, the impact on transition course design of policies on the number of years of high school math that are required for graduation, the use of different student assessments, varied delivery methods for math instruction, and evolving views on how to best make math relevant to students.

### Transition courses must take into account both high school and postsecondary curricular priorities—which are not always aligned.

New America’s online tool, *Mapping College Ready Policies 2015-16* (New America, 2015), shows that there is considerable variation in states’ definitions of college readiness, making it difficult to create curricula that fully address college readiness. Moreover, there are still separate sets of K-12 standards and college expectations in many states and localities. Further, a high school diploma may be considered a terminal degree for some students, making the idea of college readiness less relevant for some. Yet, as educators and policymakers become increasingly concerned with preparing high school graduates for college, efforts have begun to improve the alignment of high school 12th grade and college first-year curricula.

In some states, transition courses are explicitly designed to better align K-12 and college expectations. In Tennessee, the Seamless Alignment and Integrated Learning Support (SAILS) program initially used local colleges’ actual college developmental math courses until the beginning of the 2017-18 academic year, when colleges began using a corequisite developmental education model.<sup>4</sup> Rather than continuing to use local course variations, Tennessee further improved K-12/postsecondary alignment in 2017, when the transition course content was standardized statewide. This was done in part to provide high school math preparation that gives students the flexibility to attend any public college in the state, not just the college closest to their high school. Our interviewee from Tennessee spoke about this:

*We didn’t want students to have to be tied to the region [where] they were in high school. We wanted them to be able to move around the state as they chose. Now we know that wasn’t a huge portion of the population. But nonetheless we wanted to give them that opportunity.*

In other settings, courses are created or adapted to make sure that both college entry and high school graduation expectations are met. For example, in California, high schools and districts work with representatives of California State University to create or adapt courses that address the required math standards at both levels.

A particular alignment question has arisen in relation to the need to have the National Collegiate Athletic Association (NCAA) approve math transition courses so they can be taken by high school students seeking to become student athletes in college. In both Texas and Alabama, math transition courses draw lower enrollments in part because the NCAA views the courses as “remedial” in that they revisit material taught in earlier grades. A specific concern in Texas, according to our interviewee, is the perception that transition courses do not emphasize algebra, which is widely considered necessary for students to be college ready.

When standards change at either the high school or college level for any reason, transition courses may be affected. For example, in both Texas and Illinois, there is a movement toward the use of multiple math pathways in college; under this system, students are able to choose to study math subjects most related to their major or program of study. Work recently began in these states to align the high school math transition courses with these alternative pathways.

## High school graduation requirements impact how math transition courses are designed and whether students enroll in them.

Just as college readiness definitions vary by state, so too do the years of mathematics instruction and the specific courses that are required for students to earn a high school diploma, as shown in Table 2.

**Table 2.**  
State Math Requirements for High School Diploma

State	Years of Math Required	Specific Courses Required
AL	4	Algebra I, Geometry, Algebra II with Trigonometry or Algebra II, and a math-credit eligible course
CA	2 <sup>a</sup>	Algebra I
FL	4	Algebra I, Geometry, and two math electives
IL	3	Algebra I and a course with geometry content
KY	3	Algebra I, Geometry, and Algebra II
MA	4	Algebra I, Geometry, Algebra II (or Integrated Math equivalent), and a math elective
NH	3	Algebra I
NC	4	Math I, Math II, Math III, and a fourth math course aligned with future career/college plans
OK	3	Algebra I, Algebra II, and Geometry
TN	4	Algebra I, Algebra II, Geometry, and a fourth higher-level math course
TX	3	Algebra I, Algebra II, and Geometry

<sup>a</sup> California is one of only a few states that require only two years of math for high school graduation; however, California public colleges require three years of high school math that includes algebra, geometry, and intermediate algebra content.

State math requirements influence transition course design and whether credits earned for them are counted as math or elective credits. Alabama's transition course meets students' fourth year of math requirement for the purposes of high school graduation. However, it is not offered to students interested in attending a four-year college, as the course is not acceptable for admission into four-year colleges in the region. In Kentucky, three years of math are required to earn a high school diploma, while transition courses are offered as a fourth-year math elective for students identified as underprepared according to their state assessment results.

Illinois requires schools to *offer* a math transition course, but students may choose whether or not to enroll in any math course in their fourth year of high school. Similarly, New Hampshire requires only three years of math in high school. Through interviews with New Hampshire state representatives, we learned that many students do not take math at all in their fourth year of high school and are thus entering into college without having taken math for a full year. The New Hampshire transition course was explicitly designed to fill that gap, offering students a college-preparatory math course in their senior year of high school. However, interviewees from both Illinois and New Hampshire remarked that students often do not want to take a senior-year math course if it is not required.

## College assessment and placement policies affect which students are targeted for transition courses.

The use of the SAT, ACT, ACCUPLACER, or state-specific assessments to determine the need for enrollment in a math transition course is widespread among states in our study. The cut scores used to select students for a transition course, we found, are often aligned with community colleges' and public four-year colleges' requirements for placement into college-level or developmental courses. Further, the cut scores may be affected by state legislation aimed at reforming remediation at the college level. Changes to policies on assessment and developmental placement therefore influence placement into transition courses.

For example, in Florida, Senate Bill 1720, which passed in 2013 and was enacted in 2014, made college placement tests and developmental education courses optional for those who have earned a high school diploma (Hu et al., 2014). An implication of this legislation is, according to an interviewee, that the transition course first developed and implemented in 2008, and required in 2012-13, is much less frequently being offered as students no longer face the prospect of having to take remedial courses in college. Our interviewee from New Hampshire stated that there is growing momentum at the postsecondary level to remove all traditional developmental courses in community colleges. This move could have implications for transition course implementation at the high school level, not unlike what happened in Florida.

In Alabama, state representatives have chosen to place students with ACT scores of 16-19 into transition courses, a decision made through discussions with local community colleges. According to an interviewee, the cut score of 19 on the ACT is used because students who score at or below this would be placed into developmental education courses in community colleges. The minimum score of 16, meanwhile, provides greater assurance that students who enroll in Alabama's rigorous SREB transition course will be successful.

New Hampshire uses the ACCUPLACER for both placement into the course and to determine whether course completers are college ready. Students in 11th grade who score less than a 63 on the Elementary Algebra portion of the ACCUPLACER (also the colleges' developmental placement cut score) are placed into the transition course. At the end of the course, students re-take the ACCUPLACER to determine if they meet the minimum score required for placement into a college-level course. Students who score 63 or above may move on to take dual-credit courses in math.

Tennessee uses the ACT to place students into its SAILS program. All students in Tennessee take the ACT in 11th grade, which facilitates placement into the transition course in 12th grade. Students who score less than a 19 on the math portion of the ACT are placed into the course. If students pass the SAILS course, they are then eligible to be placed into college-level courses; in some cases, they may take a college-level math course as a dual enrollment course while still in high school.

## Some states emphasize the use of online instructional materials in their transition courses, but doing so requires adequate technology resources.

The use of computer-mediated instruction is especially popular in math transition courses as it allows students to spend time improving their skills in the specific areas where they do not meet college-ready benchmarks. In a number of settings, however, more traditional instruction is used in which students interact primarily with a teacher and each other. In our research, we found wide variation across states. Alabama, Kentucky, Florida, and New Hampshire, for example, rely mainly on traditional face-to-face instruction for the delivery of their math transition courses. Tennessee, Massachusetts, and North Carolina use technology-mediated courses—with the amount of time spent online varying to a considerable degree.

Multiple studies have found differences in student success rates in courses using fully online (Allen & Seaman, 2010; Xu & Jaggars, 2013), hybrid or blended (Jaggars & Bailey, 2010; Xu & Jaggars, 2011), or traditional face-to-face instruction (Jaggars & Bailey, 2010; Zhao et al., 2005). In general, college-level students in fully online courses have been found to be less successful than those in face-to-face sections of the same course (Xu & Jaggars, 2013). However, online courses taught under the supervision of a high school teacher may be different. In a set of high schools and colleges studied in Tennessee, Fay (2017) found that 79–97 percent of high school students completed the online transition courses, while only 47–65 percent of college students completed them.<sup>5</sup> She also observed that many high school students liked the online format and the opportunity to work at their own pace.

In Massachusetts, the Boston-based nonprofit organization JFYNetWorks matches students with selected online modules that they complete to address areas of weakness identified through an initial assessment of their skills. Students generally spend time on this work during regularly scheduled math courses. Our Massachusetts interviewee said,

*We fold them into the regular courses. This goes on in 11th grade and 12th grade. And that varies from school to school. It depends on what the school can deal with, how much flexibility they've got in their schedule, and also, how many computers they have.*

While technology-mediated math transition courses function in a diagnostic way and work to address individual students' needs, access to the technology needed to complete these courses can be a challenge. Students of color, low-income, and first-generation college students have the highest rates of placement into developmental education courses (Chen, 2016), and they also are more likely to attend high schools that are under-resourced.

## Some states are developing math transition courses that emphasize relevance to students' education and career goals.

Increasingly, questions are being raised at the postsecondary level about whether college algebra or its equivalent should be the required math course for all students. According to Gordon (2008), 80 percent of students in algebra-heavy math courses do not need to study this content to be successful in their future major or program of study. Moreover, Getz et al. (2016) have reported that postsecondary mathematics, as currently structured, is a barrier to degree

completion because so many students are unable to pass required courses. An increasingly favored alternative is the math pathways approach advanced by the Charles A. Dana Center and the Carnegie Foundation. These organizations propose that students focus on the type of math content that will be relevant in their programs, careers, and personal lives. Similar kinds of ideas are appearing in the design of some math transition courses.

In one example, the Dana Center at the University of Texas at Austin offers an innovative math transition course. The center is broadly known for offering students different math options—at the college level, students choose among math pathways in algebra, statistics, and quantitative reasoning. After the Texas state legislature mandated that a math transition course be made available for students who are not deemed college ready in their senior year of high school, the Dana Center developed a transition course, College Mathematics Prep, which is aligned with the math pathways approach and also incorporates some of the non-cognitive skills needed in college. Whereas, according to our interviewee from Texas, it would have been relatively easy to simply adopt the developmental education curriculum from colleges for use in high schools, the course developers reasoned:

*Why would we put something we know is not working in higher ed into K-12, especially when we want students to be prepared for all math placements, not just college algebra?*

There are other ways to make math more relevant and engaging for students. The idea that math should be taught in the context of specific areas of interest or career goals has existed in both secondary and postsecondary education for some time (Stone, Alfeld, & Pearson, 2008). In both Illinois and North Carolina, efforts have begun to offer math transition courses that prepare students for college in specific career areas. Illinois is offering Transitional Technical Math as one of its three transition course options. In North Carolina, there is work underway to create courses aligned with specific career areas. Our interviewee from North Carolina stated,

*We'll have some of the assignments in there contextualized around [several career areas] ... whatever they happen to be at the time. Right now it's allied health, advanced manufacturing, business, and college transfer.*

## Conclusion

Each year, many recent high school graduates begin college without the knowledge and skills needed to excel in college-level math courses. Poor alignment between high school and college-level expectations and coursework underlies much of this problem. Research shows that passing required college math courses is a particularly difficult barrier to earning a college degree; many students never finish college as a result of failing college math courses. Transition curricula focused on math, offered in the senior year of high school, represent an important and increasingly popular intervention that aims to help students become ready for college by the time they graduate from high school.

Based on interviews and other data, this brief outlines key elements of math transition curricula in 11 states. Math transition curricula may be structured around actual developmental courses used at colleges, or they may be created to address both college and high school math standards. Their design and students' willingness to enroll in them are affected



by various circumstances, including the number of years of high school math required for a diploma and recent legislative measures. Some transition curricula are aligned with math pathways options and may incorporate contextualized learning. In some cases, transition curricula may also be used along with other college readiness interventions, such as dual enrollment programs.

The research reported here suggests that educators from the K-12 and higher education sectors appreciate the value of transition curricula to prepare students for college, and that they continue to think in innovative ways about this relatively recent intervention.

## Endnotes

1. We use the terms *developmental* and *remedial education* interchangeably in this brief.
2. This course is part of the City University of New York's Lessons in Navigating College Transition, which was formerly known as the At Home in College program.
3. As discussed by Barnett, Fay, Trimble, & Pheatt (2013), SREB was a leader in the early development of transition curricula.
4. Corequisite developmental courses are offered to college students who are academically underprepared, generally in English or math. The students enroll in a college-level course along with a companion developmental course in which they are offered extra help to meet the requirements of the college course.
5. Both the high schools and the colleges in Tennessee used the same set of modules before the fall of 2017. They were originally developed by the college system for use with developmental education students.

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