Ohio STRONG START TO FINISH

Co-Requisite Math Implementation Forum Report

Table of Contents

Introduction 4

Co-Requisite Implementation Forum Charge 6

Why Co-Requisite Remediation? 7

What is Co-requisite Remediation? 9

Math Co-Requisite Approaches 11

Research and Lessons from the Field Late Registration 13

Institutional Implementation 17

Challenges and Considerations 21

Recommendations 23

Co-Requisite Forum Members 28

References 29

Introduction

The goal of Ohio Strong Start to Finish (SSTF) is to increase student completion of credit-bearing gateway mathematics and English courses in their first 12 months of matriculation. There is a specific emphasis on closing the attainment gaps for students of color, adults over 25, rural students, and Pell-eligible students. The State of Ohio has an established goal that by 2025, 65% of Ohioans aged 25-64 will have a postsecondary credential of value. Innovative curriculum, proactive student counseling, and academic support provide essential services needed for Ohio to meet its attainment goals and to reduce gaps in achievement for underserved populations. Co-requisite development support is one such innovative curricular strategy.

Ohio Strong Start to Finish is a collaboration between the Ohio Department of Higher Education, the Inter-University Council, the Ohio Association of Community Colleges, 18 community colleges, and 12 universities in Ohio that have committed to adopting evidence-based practices to increase the number of students who pass gateway mathematics and English courses within their first year in college.

At the beginning of the initiative, 33% of the students in the participating colleges and universities completed the gateway mathematics and English courses by the end of their first year. By 2021, Ohio SSTF wants 50% of students to complete the gateway courses aligned with the student's program of study by the end of the first academic year. Additionally, the Ohio SSTF project focuses on reducing the equity gaps in course completion by various demographic characteristics.

The Ohio SSTF project created five implementation forums to review best practices and to provide recommendations to meet its gateway course completion goal. The forums include:

- **Data**: Identifying consistent practice for data management and utilization regarding gateway course completion, co-requisite remediation, degree pathway participation, and gateway course alignment to programs of study.
- **Equity & Inclusion**: Serving as a sounding board for ways to close the achievement gap between diverse groups of students.

- **Placement**: Addressing placement policies and practices to increase the number of gateway completers while closing achievement gaps.
- **Advising**: Ensuring structures support all students in registering for coursework in sequences to meet their academic and career goals.
- **Co-Requisite**: Outlining curricular approaches to advance the presence of co-requisite math and English supports for gateway completion with equitable results for all students.

Each of these forums is producing reports that include best practice research, exemplary implementation approaches, and concrete recommendations to the state and institution participating in the initiative. This document is one such report on math remediation from the Co-Requisite Forum.

Acknowledgements

This report was compiled by Scale Strategic Solutions for the Mathematics Co-requisite Implementation Forum.

This work was supported in part by Strong Start to Finish, Education Commission of the States. The views expressed in this publication are those of the author(s) and do not necessarily represent those of Strong Start to Finish, Education Commission of the States, its officers, or employees. Strong Start to Finish is an emerging network of committed postsecondary leaders and philanthropists, working together to change institutional practice and policy across the nation and bring equity to education. Our goal is to significantly increase the number and proportion of low-income students, students of color, and returning adults who succeed in college math and English and enter a program of study in their first year of college. For more information,visit www.strongstart.org.

Co-Requisite Implementation Forum Charge

The Co-Requisite Implementation Forum serves as an advisory group to the Ohio SSTF leadership teams and Ohio public institutions of higher education for the adoption of curriculum that increases completion of gateway mathematics and English courses while closing the achievement gap between diverse groups of students. The Co-Requisite Implementation Forum was charged with:

- Reviewing national and statewide research and trends on developmental education research and models of co-requisite remediation.
- Identifying successful models and practices of developmental education that increase completion of gateway classes in a student's first year of study.
- Reviewing the capabilities and challenges of Learning Management Systems, Student Success Management Systems, and/or Advising Systems for scheduling and supporting co-requisite remediation models.
- Providing guidance on adopting and implementing co-requisite remediation.
- Recommending state, ODHE, or institutional policy changes that support the implementation of co-requisite remediation.

The forum was organized into separate subcommittees for math and English to conduct research and draft recommendations. The subcommittees coalesced to highlight research, practices, and recommendations that were relevant to both subject areas.

Why Co-Requisite Remediation?

There is a growing concern about the poor completion rates of underprepared college students. Nationally, 68% of students starting at public two-year institutions and 40% of students beginning in public four-year universities in 2003-2004 took at least one developmental course.[1] Approximately 59% of two-year college students and 33% of the university students began with remedial math coursework. Traditional developmental education programming has disproportionally served underrepresented racial minorities and low-income students. Among African Americans in the cohort, 78% in public two-year colleges and 66% in public four-year universities started in remedial education. For Hispanic students, 75% in two-year colleges and 53% in four-year institutions took one remedial course.[2] In a Complete College America national study, 55% of Pell grant recipients were placed in developmental education.[3] Many of these students start college but never finish credit-bearing English and math courses.

The Challenge

Traditional developmental education pathways have not maximized student success. In math, having several layers of remediation courses before you enter a gateway course has led to significant student attrition. See Figure 1.

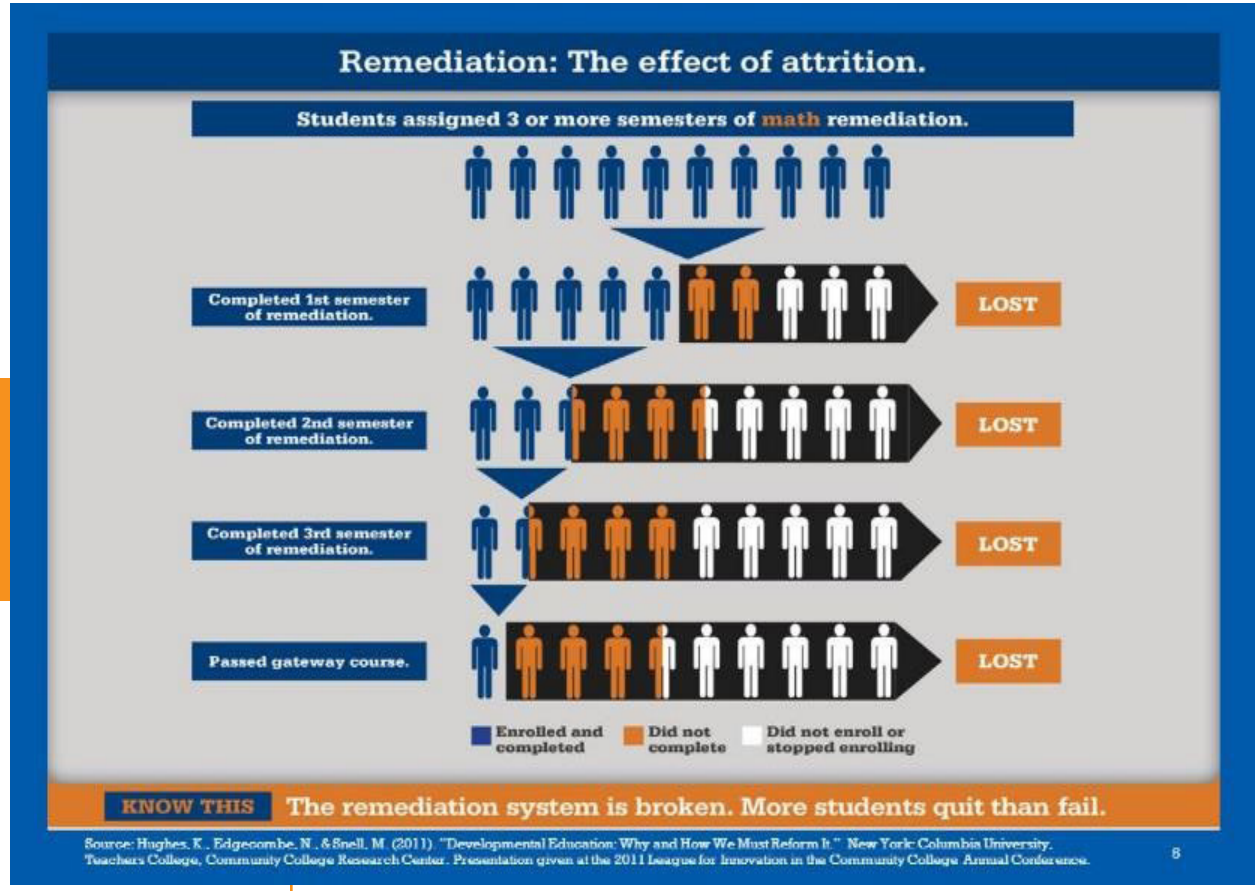


Figure 1: Traditional Math Developmental Education Leads to Few Students Completing the Gateway Course.

The Community College Research Center found that if 10 students are assigned three semesters or more of remediation before they get a chance to take a gateway course, only one student of the original 10 students goes on to complete the gateway course. According to Strong Start to Finish, two out of five developmental education students take on debt, at an average rate of $3,000 per course, for classes that do not earn them college credit.[4]

Acknowledging that the traditional remediation system was broken, states and institutions have been testing alternatives. An evidence-based solution that has emerged is co-requisite remediation. Research comparing corequisite and prerequisite courses' success in increasing gateway course completion has found that corequisite remediation significantly improves outcomes for students. This remains true across race/ethnicity, gender, disability status, English language learner status, and Pell Grant eligibility.

What is Co-requisite Remediation?

Co-requisite models eliminate traditional pre-requisite, non-credit developmental courses that underprepared students must pass before taking English and mathematics courses required by a student's program of study. The idea behind co-requisite instruction is to increase math and English gateway course completion in the first year by providing underprepared, entering students the opportunity to take college-level math and English courses with support from a concurrent course or lab that offers "just-in-time" academic support.[5] See Figure 2.[6]

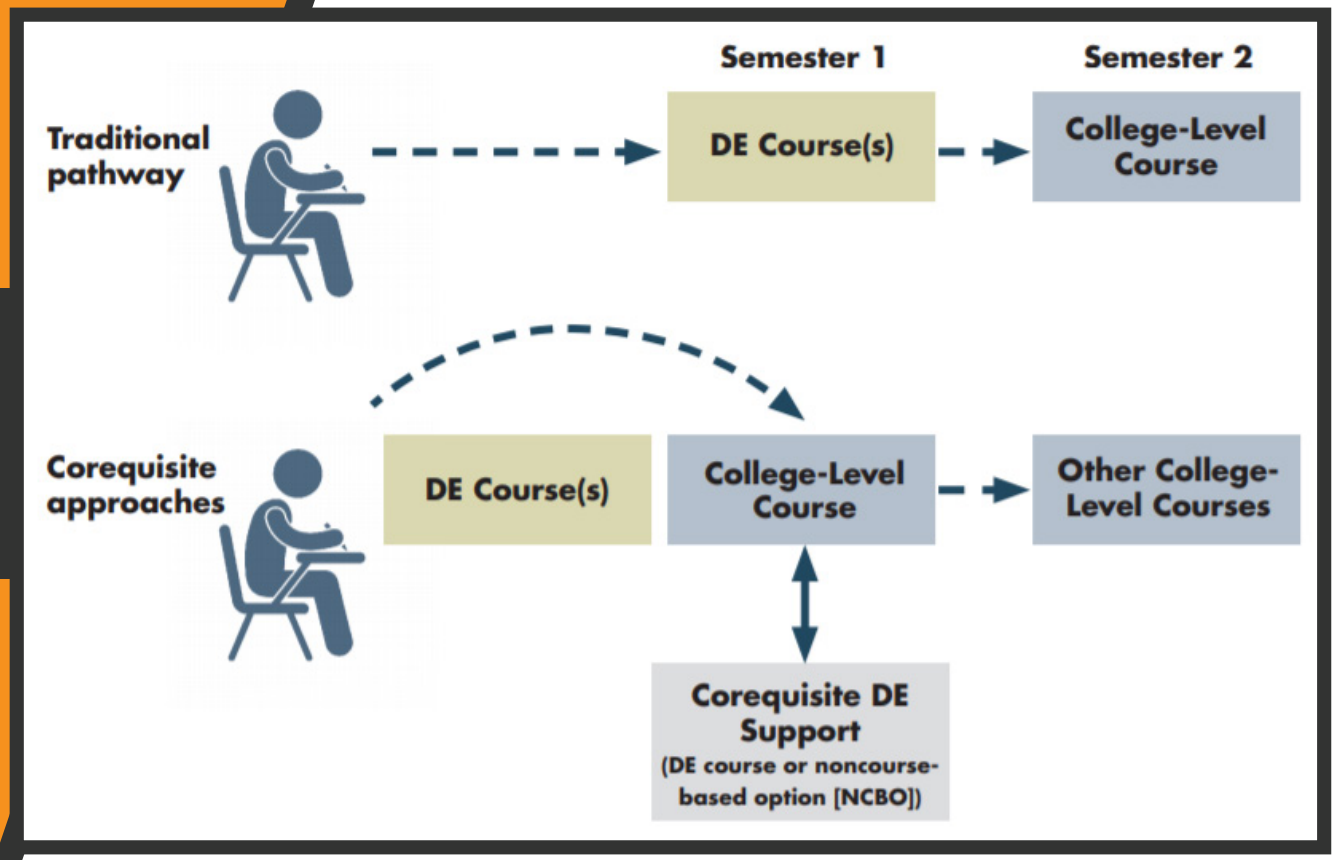


Figure 2: Comparison of Traditional Remedial Course Pathway and Co-requisite Course Approach

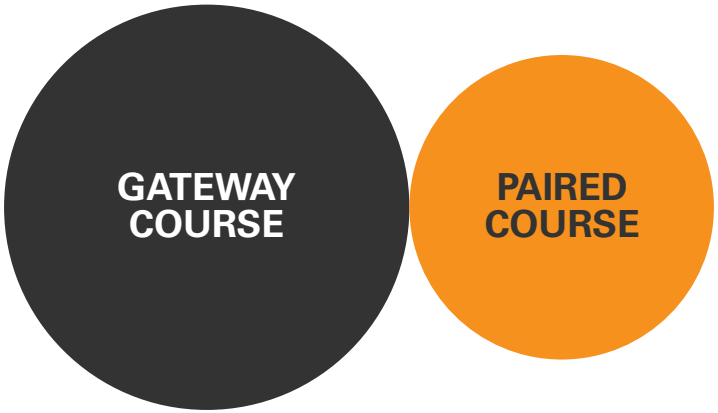
Practitioners have also emphasized the alignment of co-requisite remediation design with the learning objectives of the gateway course and programs of study. In some traditional developmental courses, the learning objectives may have been independently formed apart from the objectives of the gateway course; those developmental education objectives may have focused on remediating what students may not have obtained in secondary education. The forward-looking learning objectives of co-requisite design are seeing greater success in passing gateway courses.

In conducting a review of recent literature, "best practice" does not suggest a prescribed, packaged model that a college or state would borrow and immediately implement. Rather, the state of the art suggests building a strong foundation for implementing co-requisites as part of a well-rounded intervention that more heavily considers an individual student's program of study and future goals. The capacity of faculty and leadership at an institution, in addition to the available resources and technology, plays an important role in the type of model that a college or university may choose to implement.

Math Co-Requisite Approaches

Co-requisite developmental education is delivered in various forms, which are categorized here into three math models informed by the work of Complete College America, RAND Corporation, and an inventory of practices in Ohio public institutions.

Figure 3: Paired Course Model

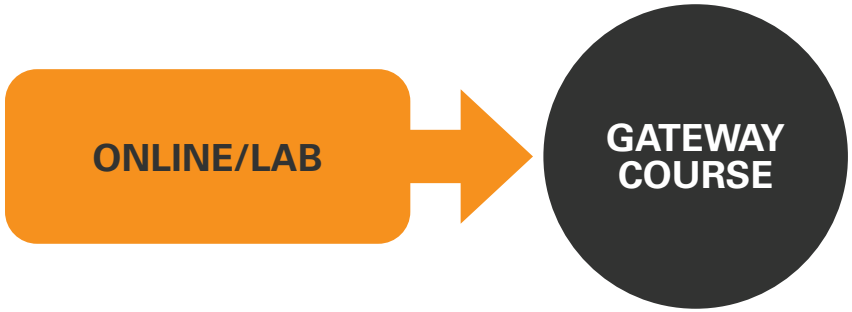


Paired Course Model: Provides support skills in a separate course aligned to the learning objectives of the gateway course. The separate course and the gateway course are paired in the same semester.

Figure 4: 101 Plus Model

101 Plus Model: Offers academic support as an extension of the gateway course. This may also be called the extended instructional time model. The additional support may be delivered just-in-time or front-loaded within the gateway course.

Figure 5: Technology-Mediated Support Model



Technology-mediated Model: Requires students to complete online/lab support. In the technology-mediated support model, institutions require students to participate in developmental education supports that primarily rely on technology-mediated instruction (e.g. ALEKS) through work on computer-adaptive modules in lab settings. This is commonly called the emporium model.

Each of these models has implementation variations, including registration processes, credits assigned to the co-requisite portion, assignment of same or different instructors for co-requisite course, integration of students who were underprepared with students who did not need remediation, and instructional delivery mode.

Research and Lessons from the Field

Statewide Strategies

Nationally, 22% of students in developmental education complete an associated math gateway course within two years of enrollment. The success rate almost triples – in a shorter timeframe– in states with co-requisite remediation. Within one year of enrollment and co-requisite math remediation, math gateway course completion was at 63% in Georgia, 64% in Indiana, 61% in Tennessee, and 62% in West Virginia.

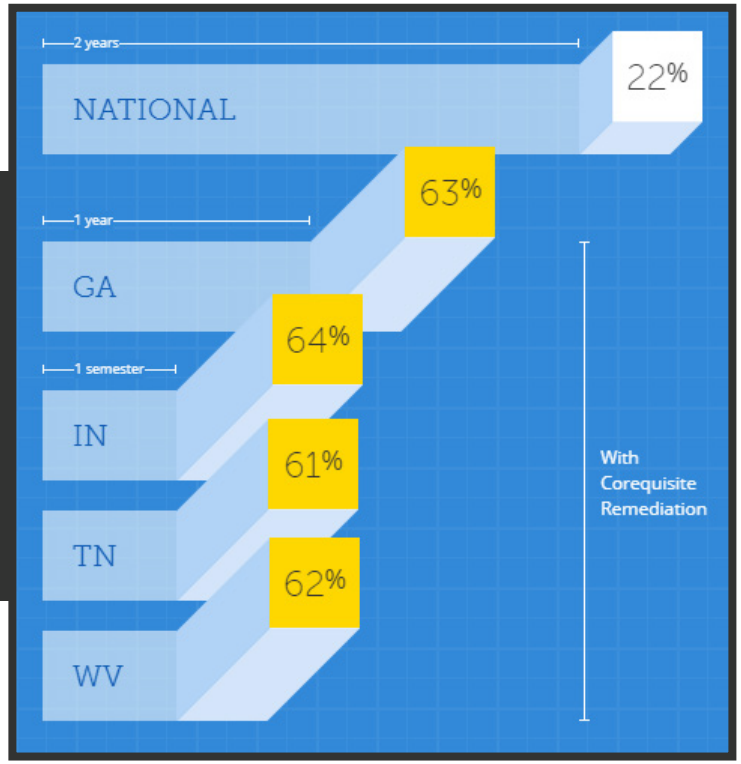


Figure 6: Percent of Students Enrolled in Math Remediation Who Complete the Associated Introductory Gateway Course

Before co-requisite remediation, gateway math completion within two years of enrollment was 20% in Georgia, 29% in Indiana, 12% in Tennessee, and 14% in West Virginia.[7]

Tennessee found double digit improvements of completion rates in the co-requisite model compared to former pre-requisite remediation models when disaggregating results by ACT math sub scores.[8]

The University System of Georgia (USG) has also been monitoring statewide implementation for many years. It saw impressive rises in completion when disaggregated by race.

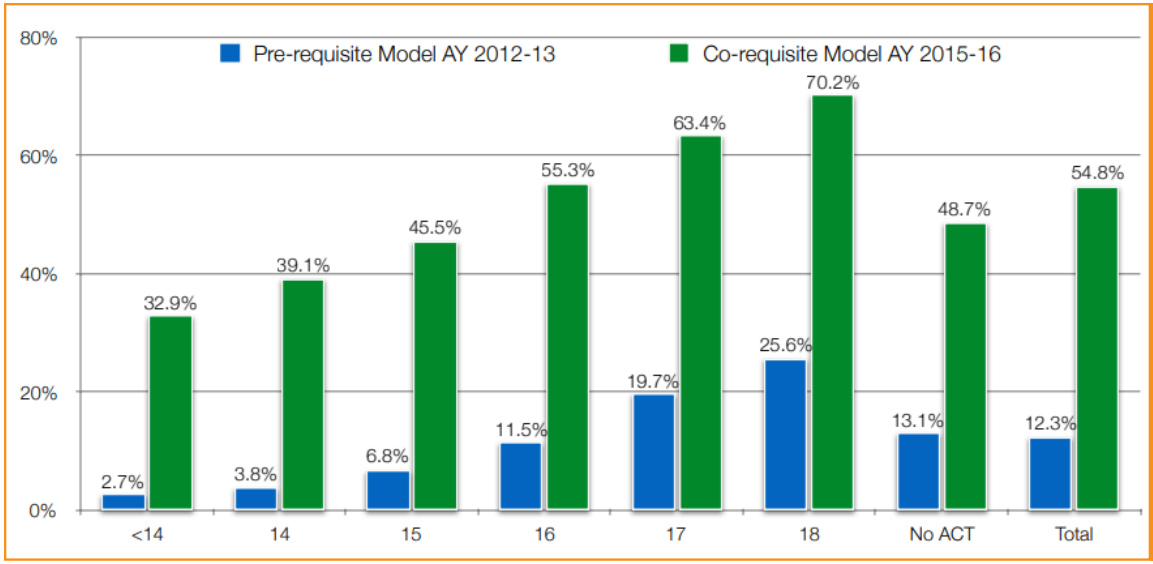


Figure 7: Completion of Gateway Math by ACT Sub-score for the College System of Tennessee Students, Pre-requisite Model 2012-13 vs Co-requisite Model 2015-16 [5]

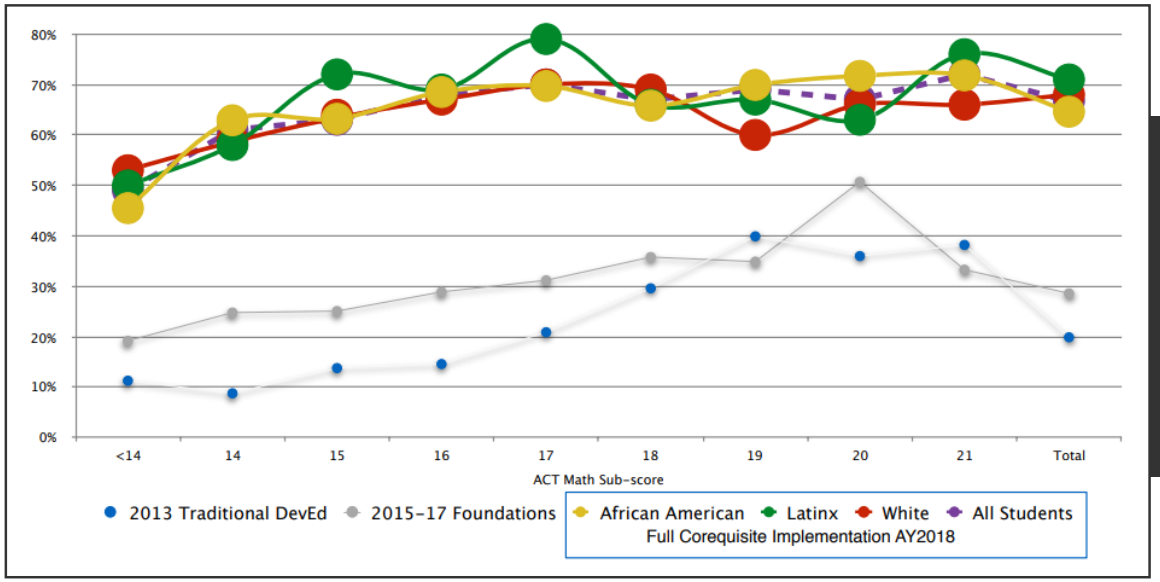


Figure 8: USG System-wide Comparison of Success in Gateway Math Classes Disaggregated by Race [5]

California has statewide policy focused on placement into transferrable, college-level gateway courses. Five early adopters in the state saw promising statistics course completion rates with co-requisite support, even when considering the students' high school GPA and classes.[9]

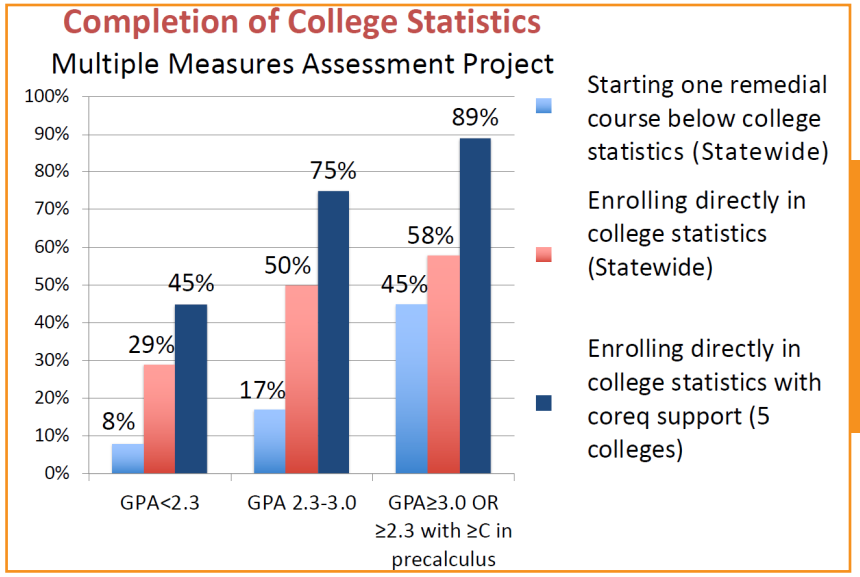


Figure 9: Gateway Statistic Completion Rates by GPA Based on Remedial Needs

While only one college in the data set had implemented co-requisite support for California's Business-STEM (BSTEM) Math gateway course[10], course completion was higher for those who enrolled directly into the transferrable course than for those who started with a non-transferrable pre-requisite course, regardless of their high school GPA and course-taking history.

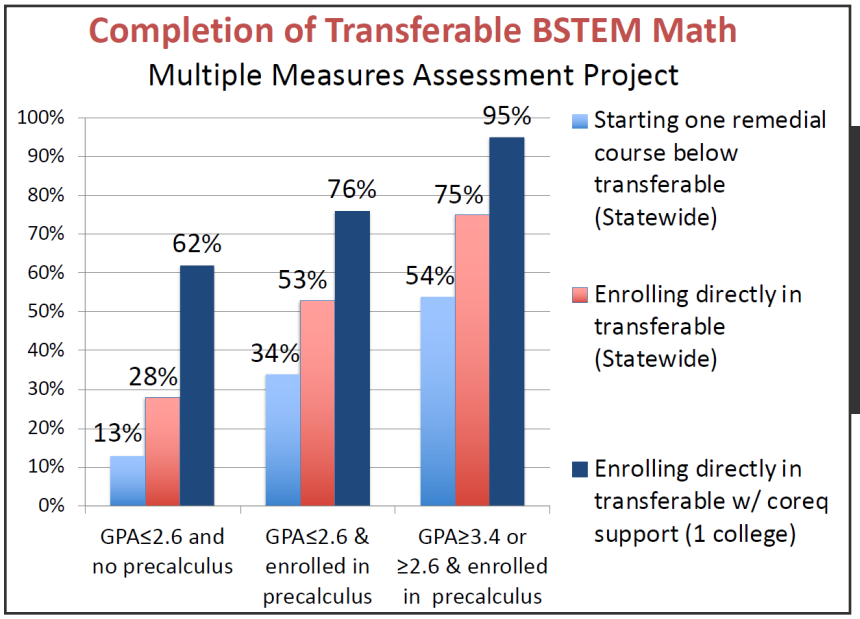
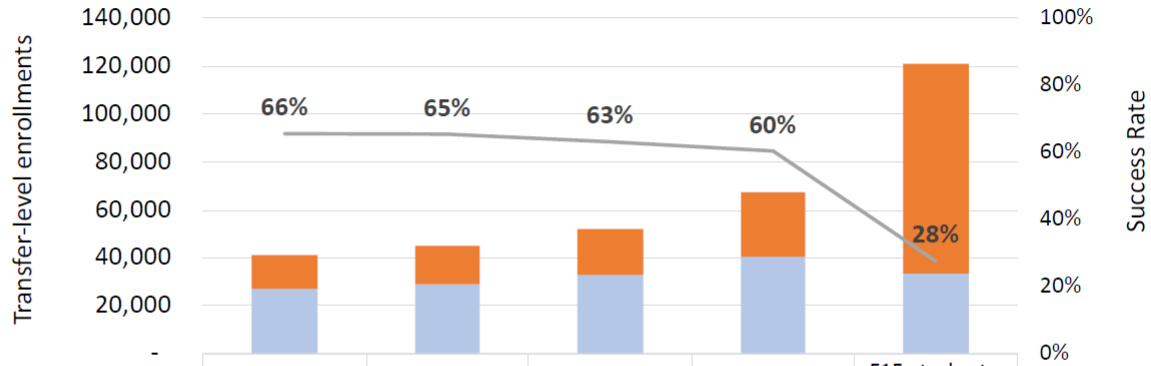


Figure 10: Success Rates of Transfer-Level Business-STEM Math Students by High School GPA Range and Course Taking

As more students have entered directly into a variety of math transfer level (TL) courses in California, they have much higher success rates in the gateway course than those who were in pre-requisite remediation in fall 2015.[11]



	Fall 2015 students starting in TL	Fall 2016 students starting in TL	Fall 2017 students starting inTL	Fall 2018 students starting in TL	F15 students starting in below TL as of F18
TL Non-Successes	14,157	15,522	19,196	26,804	87,528
TL Successful Completion	26,986	29,289	33,056	40,776	33,438
TL Success / Completion Rate	66%	65%	63%	60%	28%

Figure11: Number of California Students Entering Credit-Bearing Gateway Courses by Success or Non-Success in Completing Gateway Course

Institutional Implementation

In 2017, the Texas Legislature passed a bill to require that public two- and four-year institutions redesign their pre-requisite developmental courses into a single-semester co-requisite for most underprepared students.

As part of this movement, the Texas Success Center was established at the Texas Association of Community Colleges to help colleges and universities as they made the transition to co-requisite models.[4] The Texas Success Center conducted interviews with six exemplary institutions nationally that implemented co-requisite course designs and presented demographic data on the student populations as well as "insights into the challenges, reform practices, and philosophical shifts that contributed to successful co-requisite implementation."

Snapshots about each of the successful programs are included below. See the infographics on the following pages.[12]

Angelo State University
Texas

TYPE OF COURSE	STUDENT MODEL	COURSE DESIGN	CLASS STRUCTURE	INSTRUCTOR MODEL
✓ STEM	✓ JUST-IN TIME	✓ COHORT	25 CLASS SIZE	SAME INSTRUCTOR
✓ QUANT	INTEGRATED REVIEW	COMINGLE	6 HOURS PER WEEK	DIFFERENT INSTRUCTOR
STATS	SEQUENCED REVIEW		3 DAYS PER WEEK	✓ INSTRUCTOR & STUDENT ASSISTANT
✓ FINITE MATH (BUSINESS)				

CAMPUS-WIDE DEMOGRAPHICS

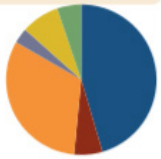
PART-TIME STUDENTS · FULL-TIME STUDENTS · WHITE · BLACK · HISPANIC · ASIAN · INTERNATIONAL · NOT REPORTED/OTHER

RESULTS	PHILOSOPHICAL SHIFTS	SUCCESSFUL REFORM PRACTICES	CHALLENGES	TAKEAWAYS
Before Only 24% of students passed a gateway course after three semesters **Fall 2017** 423 students enroll in T-sections 73% of students in Finite Mathematics and Contemporary Mathematics earn gateway credit 65% of students overall earn gateway credit	**Before** If students faltered in developmental math, they should not be in college. Remedial students are not part of the college experience. **After** Faculty and administrators are anxious for students to succeed. The stigma of remediation is removed from faculty and student perceptions.	**Institutional vision and administrative support** **Engage innovative faculty** **Improve placement to ensure College Algebra is not default gateway course for all students** **Cohort model for underserved populations produces "college experience"**	**Scheduling** **Faculty Load** **STEM Success** **Continuing to improve outcomes for students with varying backgrounds**	**This could be huge.** Corequisites offer the college experience to first-generation and underserved populations, who have been denied that experience thus far. **Success depends on the dedication of the people making the change.**

Cuyamaca College
California

TYPE OF COURSE	STUDENT MODEL	COURSE DESIGN	CLASS STRUCTURE	INSTRUCTOR MODEL
✓ STEM	✓ JUST-IN TIME	✓ COHORT	45 CLASS SIZE	✓ SAME INSTRUCTOR
QUANT	INTEGRATED REVIEW	COMINGLE	6 HOURS PER WEEK	DIFFERENT INSTRUCTOR
✓ STATS	SEQUENCED REVIEW		2 DAYS PER WEEK	INSTRUCTOR & STUDENT ASSISTANT
✓ FINITE MATH (BUSINESS)				

CAMPUS-WIDE DEMOGRAPHICS



PART-TIME STUDENTS · FULL-TIME STUDENTS · WHITE · BLACK · HISPANIC · ASIAN · TWO OR MORE RACES · NOT REPORTED/OTHER

RESULTS	PHILOSOPHICAL SHIFTS	SUCCESSFUL REFORM PRACTICES	CHALLENGES	TAKEAWAYS
Fall 2013 Only 23% of students passed a Transfer Math course in 2 years 6% Black, 15% Hispanic, 16% White students earn Transfer Math credit in 2 years **Fall 2016** 67% of students in fall cohort earn Transfer Math credit with support 55% Black, 65% Hispanic, 76% White students earn Transfer Math credit with support	**Before** "Pipeline of Doom" remedial students are not getting out of multiple semesters of middle-to-high-school mathematics. What we are doing is not working. **After** Change the mindset completely: **Believe in student capacity.** When that is the focus, design everything around supporting student success.	**Teach topics in context of "parent" class** **Faculty gauge individual needs of each classroom and adjust teaching.** **Make data-informed and research-based decisions** **Admit there's a problem, come up with a plan, and trust that the new plan is better than the old way - it can't be worse!**	**Keeping communication open between counselors** **Communicating with other departments with math prerequisites** **Considering which students really need Intermediate Algebra** **Continually educating faculty to inform them of the positive outcomes possible with corequisite models**	**More students will realize education's promise!** Higher education will be more accessible and more equitable for all students, not just those who have traditionally benefited in the previous system.

Ivy Tech Community College
Indiana

TYPE OF COURSE	STUDENT MODEL	COURSE DESIGN	CLASS STRUCTURE	INSTRUCTOR MODEL
STEM	✓ JUST-IN TIME	COHORT	12 COREQ CLASS SIZE	SAME INSTRUCTOR
✓ QUANT	INTEGRATED REVIEW	✓ COMINGLE	7 HOURS PER WEEK	✓ DIFFERENT INSTRUCTOR
STATS	SEQUENCED REVIEW		2 DAYS PER WEEK	INSTRUCTOR & STUDENT ASSISTANT
FINITE MATH (BUSINESS)				

CAMPUS-WIDE DEMOGRAPHICS

RESULTS	PHILOSOPHICAL SHIFTS	SUCCESSFUL REFORM PRACTICES	CHALLENGES	TAKEAWAYS
Before Between 50-60% of students were achieving college-level credit	**Before** Faculty saw students three semesters in a row. Students were described as "remedial."	**Communication between instructors and students**	**Meeting the needs of campuses with varying sizes**	**The reframing of developmental education has a positive effect on student's self-esteem and success.**
Fall 2015 71% of students enrolled in corequisite model earned college-level credit. Corequisite students are on average out performing stand-alone students.	**After** The conversation shifted to "What level are you?" and "Which pathway are you on?" Students are now described as STEM students or QUANT students, rather than "remedial" students.	**Hierarchy of support systems**	**At smaller campus, class size presents a financial burden**	The comingle design and smaller corequisite class size creates an environment conducive to learning.
		Each campus has a corequisite leader	**Funding for adjunct professors who commit extra time out of class**	**Students have support not only from faculty, but from their classmates.**
		The comingle design encourages collaboration between students on different levels	**Initially struggled with marketing corequisite model via advisors**	

Roane State Community College
Tennessee

TYPE OF COURSE	STUDENT MODEL	COURSE DESIGN	CLASS STRUCTURE	INSTRUCTOR MODEL
✓ STEM	✓ JUST-IN TIME	COHORT	24 COREQ CLASS SIZE	SAME INSTRUCTOR
QUANT	INTEGRATED REVIEW	✓ COMINGLE	6 HOURS PER WEEK	✓ DIFFERENT INSTRUCTOR
✓ STATS	SEQUENCED REVIEW		2 DAYS PER WEEK	INSTRUCTOR & STUDENT ASSISTANT
FINITE MATH (BUSINESS)				

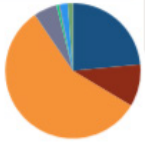
CAMPUS-WIDE DEMOGRAPHICS

RESULTS	PHILOSOPHICAL SHIFTS	SUCCESSFUL REFORM PRACTICES	CHALLENGES	TAKEAWAYS
Before Only 20% of students passed a gateway course after three semesters	**Before** Developmental education represents a leaky pipeline where students are lost along the way.	**Institutional support for faculty members**	**Initially getting faculty to adhere to common curriculum schedule between the two courses**	**The flexibility of the comingle model allows students to enroll in the course that best meets their schedule.**
Now 68% of students enrolled in corequisite model pass gateway course within one semester. The 68% is comparable to the success rate for students who do not require developmental education, which is in the low 70% range.	**Now** The corequisite model prevents leaks by shortening the developmental education pipeline and providing well-aligned curriculum and support.	**Establishing a uniform curriculum schedule for all course sections**	**Meeting the needs of the Sails Initiative students, who can bypass developmental math with high school credit**	**Students need to have the same educational experience.**
		The comingle design offers more flexibility for 8 campus sites		

San Jacinto College
Texas

TYPE OF COURSE	STUDENT MODEL	COURSE DESIGN	CLASS STRUCTURE	INSTRUCTOR MODEL
✓ STEM	✓ JUST-IN TIME	✓ COHORT	25 COREQ CLASS SIZE	SAME INSTRUCTOR
✓ QUANT	INTEGRATED REVIEW	COMINGLE	7 HOURS PER WEEK	✓ DIFFERENT INSTRUCTOR
✓ STATS	SEQUENCED REVIEW		5 DAYS PER WEEK	INSTRUCTOR & STUDENT ASSISTANT
FINITE MATH (BUSINESS)				

CAMPUS-WIDE DEMOGRAPHICS



PART-TIME STUDENTS · FULL-TIME STUDENTS · WHITE · BLACK · HISPANIC · ASIAN · AMERICAN INDIAN/ALASKA NATIVE · NATIVE HAWAIIAN OR OTHER PACIFIC ISLANDER · INTERNATIONAL · NOT REPORTED/OTHER

RESULTS

Before
Developmental education was not working for many, disproportionately worse for underserved students

Spring 2016
74% of students are successful in College Algebra corequisite model

Erased the performance gap between White and Hispanic students

PHILOSOPHICAL SHIFTS

Before
Developmental education is a recipe for success if students follow it.

After
Students thrive in communities.

The students may not be college-ready, but the school needs to be student-ready.

Understand the student population and modify instruction to support students.

SUCCESSFUL REFORM PRACTICES

Focus on active learning and community building in the classroom

Foster collaboration between college and developmental faculty

Lay out cultural expectations of corequisite course at start of semester

Pair experienced faculty and new-to-corequisite faculty in apprenticeship teaching model

CHALLENGES

Be aware of limiting reach of students entering STEM careers

Fostering buy-in with student services and new-to-corequisite instructors

Branding time-intensive coursework for students

Subsequent course performance - how to trickle up pedagogical changes to STEM sequence

TAKEAWAYS

Just-in time models will change the future!

Change management matters!

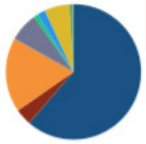
Next generation innovators will come up with even more models to explore.

Even though corequisites cannot replace years of algebra, corequisite students are better off than before.

University of Nevada-Reno
Nevada

TYPE OF COURSE	STUDENT MODEL	COURSE DESIGN	CLASS STRUCTURE	INSTRUCTOR MODEL
✓ STEM	✓ JUST-IN TIME	✓ COHORT	50 CLASS SIZE	✓ SAME INSTRUCTOR
✓ QUANT	INTEGRATED REVIEW	COMINGLE	4-5 HOURS PER WEEK (QUANT: 4; STEM: 5)	DIFFERENT INSTRUCTOR
STATS	SEQUENCED REVIEW		4-5 DAYS PER WEEK (QUANT: 4; STEM: 5)	INSTRUCTOR & STUDENT ASSISTANT
FINITE MATH (BUSINESS)				

CAMPUS-WIDE DEMOGRAPHICS



PART-TIME STUDENTS · FULL-TIME STUDENTS · WHITE · BLACK · HISPANIC · ASIAN · AMERICAN INDIAN/ALASKA NATIVE · INTERNATIONAL · TWO OR MORE RACES · NOT REPORTED/OTHER

RESULTS

Spring 2013
After completing the corequisite Pre-Calc 1 course, 238 students enrolled in Business Calculus.

Of those students, 74% passed with a C or higher.

Fall 2016
87% of students enrolled in the QUANT model earned college-level credit

82% of students enrolled in the STEM model earned college-level credit

PHILOSOPHICAL SHIFTS

Before
All developmental education students were required to take Intermediate Algebra for a semester **before** their gateway course.

After
The shortened sequence prioritizes the necessary content from Intermediate Algebra for students to be successful in a college-level course.

SUCCESSFUL REFORM PRACTICES

QUANT: 1 developmental credit of Intermediate Algebra + 3 credit college-level course

STEM: 2 developmental credits of Intermediate Algebra + 3 credit college-level course

By utilizing the same instructor, faculty has the freedom and flexibility to treat courses as one whole class.

CHALLENGES

The impact of an odd number of credits on funding and staffing

The tension to balance resources between developmental education students and non-developmental education students, led to an increase in class size from 25 to 50.

TAKEAWAYS

Student engagement is higher.

Students are more engaged because they see on the syllabus that they are working on college-level material that counts towards their degree.

Students have more structure and support because they are required to meet four to five times a week compared to two times.

Challenges and Considerations

These state and institutional examples assert the evidence of the value of co-requisite remediation in advancing student success, dramatically and in an equitable fashion. However, the work does not come without its challenges. Some of those challenges are:

- **Co-requisite supports for STEM math**: Success in designing and delivering co-requisite supports for algebra and calculus for STEM programs of study has been inconsistent. Gains have been shown in some institutions and not others. Institutions that have struggled have still found some success in lessening the number of pre-requisite courses even when pre-requisite algebra has not been eliminated. The University of Cincinnati has been featured nationally for its College Algebra success with co-requisite remediation.[13]
- **Scheduling**: Student registration and room scheduling becomes more complex in the co-requisite delivery model, especially with paired course models. Many institutions have found what has worked, but it is a change from the typical business processes.
- **Advising**: Informing advisors of the new approach to co-requisites and convincing students that more math credits in a single term will make them successful is a paradigm shift. Advisors also need to be engaged so that they have a full understanding of math pathways and alignment to programs of study.
- **Online delivery**: With the transition to online learning in spring 2020 due to the COVID-19 pandemic, additional best practices need to be identified for delivering co-requisite remediation virtually with strong student outcomes. Online or hybrid delivery dynamics need to include instruction and assessment as well as connection to advising and wrap-around services for students.

- **Technology access**: In hybrid and online delivery, students also need consistent access to technology, including hardware and internet connection. Access for economically disadvantaged students must be a priority, as along with reliable internet access in rural communities.
- **Funding**: Depending on funding streams and design, the impact of co-requisites on revenue generation may be challenging, although long-term benefit of retention and completion is a benefit in performance-funding models. State funding models as well as institutional financing have to be reconsidered in light of strategic moves to co-requisite remediation.
- **Faculty workload**: This new way of teaching may shift faculty workload, particularly if the gateway instructor is also providing the co-requisite support.
- **Faculty displacement**: Co-requisite remediation displaces developmental faculty who do not have the qualifications to teach college-level math. Understanding the impact in terms of morale, trust, professional development opportunities, and staff costs is crucial.

To advance outcomes for students, these challenges are being tackled and new strategies to address these problems are emerging. Co-requisite implementation should not only be thoughtful about these challenges, but also about complementary components to the remediation structure. Co-requisite remediation is most successful as a part of a systemic approach to completion. This includes pathways[14] that:

- **Match gateway course placement with students' programs of study.** Statistics typically fits students in social and health sciences programs. Quantitative reasoning works for humanities majors; and algebraic and calculus-related courses prepare STEM majors. Other gateway courses, such as Math for Elementary Educators or Finite Math, are also specific to fields of study.
- **Pro-actively advise students.** This may include utilization of early alert systems on student academic progress, milestones at which advisors reach out to students, and intentional, consistent relationship building between advisors and students.
- **Provide a variety of academic and social supports.** Today's students may have a variety of barriers ranging from transportation to childcare to time availability. Institutions must prepare to serve the whole student in partnership with community resources.
- **Promote learning behaviors and supportive faculty attitudes.** Institutions should encourage a growth mindset to build student confidence in their ability to improve their academic performance; increased connection to the institution; comfort in interacting with faculty and staff for help; and perceived purpose for taking gateway courses.[15]
- **Utilize research-based teaching strategies.** Instructors advance learning for underprepared students with solid pedagogy, active learning, and lessons based on real-life scenarios.[16]

Recommendations

The benefits of co-requisite remediation in math clearly outweigh the challenges, particularly in having students complete gateway coursework. Continued learning nationally and within Ohio can identify solutions to mitigate existing challenges and maximize the benefit of co-requisite remediation. In addition, co-requisite remediation should be executed as a part of a holistic guided pathways strategy leading to degree completion. The recommendations to pursue co-requisite remediation are as follows:

General (Math and English)

1. **Strategic Alignment**: Institutions should publicly identify co-requisite remediation as an institutional priority. Institutions should review and strengthen, if necessary, the alignment of their co-requisite developmental education programmatic goals and their general institutional goals. If either set of goals is unclear or ineffective in guiding curricular decisions, then the institution should take steps to revise or rewrite and realign those goals.
2. **Class Size, Instructor Assignment, Scheduling, and Credit Hour Guidance**: As knowledge of what works best in co-requisite supports becomes available, institutions and the Ohio Department of Higher Education (ODHE) should collaborate to provide guidance on co-requisite design and structures. Standards and recommendations from national bodies, such as the Conference on College Composition and Communication (CCCC) and the Council of Writing Program Administrators (WPA), should be referenced. All stakeholders in determining policy recommendations and policies themselves should consider the impact on student success, student workload, teacher workload, common planning

among teachers, and funding streams. Guidance should be provided in the following key areas:

a. Class size for co-requisite supports;
b. Same instructor assignment for co-requisite and gateway delivery;
c. Scheduling of co-requisite offerings, particularly guaranteeing enough available sections of co-requisite supports in the first semester; and
d. Credit hour allocation in order to help diminish any stigma attaching to "remediation" and "developmental education."

3. **Academic Mindset and Faculty Support of Learning Behaviors**: Institutions should advance efforts to enhance student learning behaviors and academic attitudes and mindsets, especially but not limited to the first year of college. Strategies must outline the role of faculty and support services staff members in supporting learning behaviors. These academic mindsets and other non-cognitive factors may include:

   a. Attitudes and perceptions toward learning and ability, including a growth mindset, high self-efficacy, and grit (determination and persistence); and
   b. Academic behaviors and study skills, including but not limited to goal setting, taking responsibility for one's own learning, self-advocacy, self-motivation, time management, and other self-management skills, such as self-monitoring.

4. **Professional Preparation and Development**: Institutions should promote professional preparation and development of their permanent and temporary faculty for best teaching and learning practices in co-requisite education, including understanding the various factors that impact college student success and co-requisite remediation, including but not necessarily limited to "non-cognitive factors." Professional development priorities should include but not be limited to:

   a. Effective pedagogy for particular subjects and courses;
   b. Advancing learning outcomes for special populations, including students with learning disabilities and English as a Second Language learners; and
   c. How to incorporate instruction on learning behaviors and non-cognitive factors into coursework.

5. **Strengthen the Pool of Qualified Instructors**: The State of Ohio and its institutions of higher education should explore an initiative to prepare and qualify anyone with a master's degree or higher who wishes to apply to teach co-requisite math or co-requisite English. Informal "accreditation" of this sort could be accomplished through graduate-level coursework and/or through state-sponsored summer programs — and could be provided fully online or through a hybrid curriculum.
6. **Equity-minded Approaches**: Co-requisite remediation strategies and the student support systems around them must be equity-minded to eliminate student success disparities by race, ethnicity, gender,

socio-economic status, disability status, and English language learner status. Resources should be effectively allocated to support underprepared students, students with physical and online access barriers to college (transportation, technology, etc.), students with work and parenting responsibilities, and more.

7. **Initiating the Work**: Information gained from early adopters and national initiatives about starting co-requisite remediation should be promoted to institutions that have not yet fully implemented co-requisite strategies. These institutions need to understand the advantages of co-requisite models over pre-requisite remediation and the importance of additional resources for academic processes and student support processes such as registration, scheduling, and advising.
8. **Continuum of Academic Support**: Recognizing the evidence supporting both co-requisite remediation and comprehensive student academic and personal support services, institutions should develop and implement those support services for all their students. Institutions should develop and implement support services for students throughout their entire college careers. Institutions should ensure effective working collaborations among their co-requisite developmental education programs and the units providing those support services. Such services should include English and math tutoring and coaching services, general academic tutoring and counseling services, and programs aimed at teaching students' effective academic behaviors and study strategies.
9. **Online Delivery**: Institutions should continue to explore and share best practices for delivering co-requisite support with online or hybrid instruction. Instructors should consider synchronous and asynchronous delivery options based on their content and objectives. Virtual delivery of support services, such as advising and counseling, should also be strategically integrated into online and hybrid delivery approaches.
10. **Technology Access**: Campuses should also enhance student access to technology hardware and the Internet, especially for economically disadvantaged and rural populations. ODHE and institutions of higher education should identify and leverage resources to close the digital divide.
11. **Assessment**: Ohio institutions should collaborate to identify best practices in assessment with a special focus on the following questions:
    a. How do instructors assess learning outcomes with integrity in online and remote settings?
    b. How do we refine what knowledge students are asked to demonstrate based on the relationship of the co-requisite support to the gateway course and the program of study?
    c. Is there an opportunity to assess student meta-cognition and academic mindset to improve delivery of supports for student learning?
12. **Program Evaluation and Continuous Improvement**: Institutions should develop and implement systematic, ongoing formative evaluation of their co-requisite remediation programs and service providers, if they

do not already have such an evaluation in place. Evaluation analysis may address student retention, persistence to subsequent courses in the sequence, results for students in co-requisite coursework versus those who are not in co-requisite supports, and eventual degree completion. Institutions should provide support for programmatic or curricular reforms called for by that systematic formative evaluation. Ohio institutions are encouraged to share their data on student outcomes related to co-requisite remediation for collective learning.

13. **Sustaining Statewide Efforts:** ODHE should sustain the study and development of co-requisite supports for students. These recommendations may be considered and carried forth by groups and structures such as the Ohio Mathematics Initiative, the Ohio Articulation and Transfer Network, the Ohio English Initiative, the Ohio Writing Program Administrators, and/or others. The State of Ohio should devote website resources to Teaching Co-requisite Remediation in Higher Education, providing extensive information and resources, and ongoing listservs for math and English instructors and would-be instructors, in order to share experiences and knowledge.
14. **Aligning to Increase College Preparedness**: Advance preparation strategies for students before they enter college. The instructional connections and pathways from high school to college – including College Credit Plus, summer bridge programming, and high school math redesign – should be fortified. This may also include high school-to-college articulation forums or task forces to develop and implement practices to address non-cognitive issues that can undermine student success, and practices to identify and encourage implementation of effective means of achieving college-readiness.
15. **Following the Research**: The State of Ohio and its institutions of higher education should promote peer-reviewed research into the following:
    a. The comparative effectiveness of the various co-requisite mathematics models and the various configurations of co-requisite English programs, as well as into other factors impacting student success, such as "non-cognitive" factors; and
    b. The effectiveness of the above co-requisite mathematics models and co-requisite English configurations on the academic success of students at different levels of developmental placement, including the most challenged students.
16. **Needs and Listening to the Voice of Students**: Institutions should identify creative, dynamic ways to garner resources to meet student needs based on the requests and concerns voiced by students, especially students who receive remedial supports. Institutions should take the initiative to invite and capture student voices and their input in various forms.
17. **Serving the Most Underprepared Students**: In addition to following the research on the most challenged students, a special report on the approaches and strategies that work best for the most underprepared students would be a helpful tool for the field.

Math Specific

1. **STEM Math Pathway**: Co-requisite remediation for STEM-major gateway courses, e.g. College Algebra or Pre-Calculus, needs a distinct approach that best supports students who will take more math-related courses after the gateway course. Ohio should continue to monitor best practices nationally as well as harness lessons from our local colleges and universities for appropriate co-requisite support design in gateway courses aligned to the STEM programs of study that also result advanced math course and degree completion.
2. **Course Level Examination of Co-requisite Design**: Institutions should consider a review of co-requisite design principles and results for different gateway courses see what instructional strategies as well as curricular designs may different courses based on the content learning objectives. Lessons differ among such courses as Quantitative Reasoning, Statistics, College Algebra. Pragmatic logistics for co-requisite supports related gateway courses that may serve fewer students (e.g. Math Elementary Educators, Discrete Math) should also be reviewed.

Co-Requisite Forum Members

Laura Anderson, Miami University, *Math*
William Breeze, Cleveland State University, *English*
Sharon Burns, University of Cincinnati, *English*
Kitty Burroughs, Bowling Green State University, *English*
Lori Carlson, Youngstown State University, *Math*
Anthony Edgington, The University of Toledo, *English*
Andrea Faber, Rhodes State College, *Math*
Karl Hess, Sinclair Community College, *Math*
Linda Hunt, Shawnee State University, *Math*
Erin McGuire, Central Ohio Technical College, *English*
Regina Randall, Columbus State Community College, *Registrar*
Michelle White, Terra State Community College, *Math*
Nancy Wright, Cincinnati State Technical & Community College, *English*

Calista Smith, Ohio SSTF Co-Requisite Math Implementation Forum Facilitator
Gerald Nelms, Ohio SSTF Co-Requisite English Implementation Forum Facilitator
Thomas Sudkamp, Ohio SSTF Director, Ohio Department of Higher Education
Stephanie Davidson, Ohio SSTF Representative, Ohio Department of Higher Education
Candice Grant, Ohio Mathematics Initiative, Ohio Department of Higher Education

References

1 Chen, X. (2016). Remedial Coursetaking at U.S. Public 2- and 4-Year Institutions: Scope, Experiences, and Outcomes (NCES 2016-405). U.S. Department of Education. Washington, DC: National Center for Education Statistics. Retrieved [date] from https://nces.ed.gov/pubs2016/2016405.pdf

2 Chen, X. (2016). Remedial Coursetaking at U.S. Public 2- and 4-Year Institutions: Scope, Experiences, and Outcomes (NCES 2016-405). U.S. Department of Education. Washington, DC: National Center for Education Statistics. https://nces.ed.gov/pubs2016/2016405.pdf

3 Complete College America. Co-requisite Remediation: Spanning the Completion Divide, http://completecollege.org/spanningthedivide/

4 https://strongstart.org/about/the-imperative-to-change

5 Corequisite Support. Complete College America. https://completecollege.org/strategy/corequisite-support

6 Daugherty, Lindsay; Gomez, Celia; and Gehlhaus Carew Diana. (2018). Designing and Implementing Corequisite Models of Developmental Education: Findings from Texas Community Colleges. Santa Monica, CA: RAND Corporation. https://www.rand.org/pubs/research_reports/RR2337.html

7 Complete College America. Co-requisite Remediation: Spanning the Completion Divide, http://completecollege.org/spanningthedivide/

8 Denley, T. (2020) Presentation for Learning Network Convening. Strong Start to Finish. Miami, FL

9 Hern. K. (2019) "Learning form California's AB 705: The Opportunities and Limits of Reform Mandates" Center for Analysis of Postsecondary Readiness Reimagining Developmental Education Conference. New York, NY

10 The RP Group. (2019)Access, Enrollment, and Success in Transfer-Level English and Math in the California Community College System (2019), https://rpgroup.org/Portals/0/Documents/Projects/MultipleMeasures/Publications/AccessEnrollmentSuccess.pdf?ver=2019-10-07-074817-793

11 Access, Enrollment, and Success in Transfer-Level English and Math in the California Community College System, 2019 with unpublished supplemental analysis of data from Fall 2015 as cited by Terrence Willett in presentation "Research Informing AB 705" (2019) Center for Analysis of Postsecondary Readiness Reimagining Developmental Education Conference. New York, NY

12 Dunigan, Christina; Flores, Kristina; Haynes, Madeline; Rangel, Chelsea; Velchoff, Amy; and Warren, Joanna. Design Principles for Corequisite Mathematics: An Exploration of Corequisite Models for Texas Colleges and Universities in Response to State Legislative Change (House Bill 2223). Texas Association of Community Colleges. https://tacc.org/sites/default/files/documents/2018-07/lbj_hb2223_corequisite_support.pdf

13 Odekar, V. (2020) "Jump in College Algebra Pass Rates." Points of Interest from Strong Start to Finish. https://strongstart.org/deepening-understanding/resource-library/jump-college-algebra-pass-rates

14 https://dcmathpathways.org/sites/default/files/resources/2020-03/guided-pathways-brief_march-2020.pdf

15 Denley, T. (2020) Presentation for Learning Network Convening. Strong Start to Finish. Miami, FL

16 Zachary, E., Barnett, E. Boatman, A. (2019) Paving the Way to Better Higher Education Outcomes: finding From the Center for the analysis of Postsecondary Readiness. American Education Research Association Conference. April 2019. Toronto, CA. https://postsecondaryreadiness.org/wp-content/uploads/2019/04/CAPR_AERA2019_FINAL-1.pdf

Ohio Department of Higher Education | 25 South Front Street | Columbus, Ohio 43215 | www.ohiohighered.org