



**CALU**



# **Developmental Math Education**

## **Executive Summary**

**July 2020**

**Final**

## I. Overview

The Developmental Math Education Redesign team was charged with reviewing current approaches to meeting developmental education math needs via adaptive learning platforms and other methods for potential broader systemwide implementation through shared services.

The team conducted a current state assessment focused on gathering, and analyzing data directly related to the policies, processes, procedures, and outcomes of developmental mathematics education in the State System. The goal of this exercise was to better understand the approaches to developmental mathematics education currently in place across the System and assess the degree to which these approaches to developmental mathematics education were aligned with national best practices and indicators of student success. This analysis, coupled with a review of national best practices and outcomes data, helped the team identify opportunity areas to improve student outcomes through the identification of pilot opportunities that align with Board affirmed metrics for student outcomes.

## II. National Best Practices

After review of national literature in Developmental Education Math, the following four key best practices were identified (in prioritized order):

1. *Multiple Placement Measures*: An approach to mathematics placement procedures that relies on a variety of indicators (SAT Math score and/or other standardized test scores, high school GPA, most recent mathematics course successfully completed, relevant transfer courses, placement test score) rather than just one indicator (SAT Math score, for example) to determine proper mathematics course placement.
2. *Co-requisite Models*: As an alternative to the traditional developmental mathematics, the co-requisite model embeds the developmental component within or positions it alongside/around the college-level mathematics course. Rather than being placed into a developmental-level course that does not count toward graduation, students are placed into the appropriate college-level course and provided with co-requisite learning supports that may take different forms (additional class time; mandated tutoring or supplemental instruction provided within or outside of class meetings; mandated participation in module-based, adaptive, interactive courseware; mandated co-requisite courses ranging from 1-3 credits; etc.).
3. *Math Pathways*: An approach that aligns mathematics with the student's educational goals. Rather than placing all "developmental" students into Basic Algebra, for example, students would be placed (in the most basic version of the pathways model) into an algebraic or a statistics-based course, depending on their major and educational goals. This approach can be combined with the Co-Requisite Learning Support Model.
4. *Adaptive Learning Platforms*: Technology products that utilize module-based instruction, adaptive questioning, and regular reassessments to develop students' (in

this case, mathematics) skills and position them for success in college-level mathematics courses.

The overarching goal of implementing the above best practices is to facilitate movement in the following critical success factors. When implementing the above strategies, a reporting frequency should be determined to assess measurable progress. It will be critical to identify a base measure before practices are implemented and agree upon thresholds for success.

Metrics to be measured include:

1. Minimize DFW rates
2. Maximize completion rates
3. Success in subsequent courses
4. Accurate and consistent placement

### III. Major Findings

The team identified the following major findings as a result of their work efforts:

#### A. Variation in processes and outcomes

System-level data across the 14 universities compares favorably to national averages for placement and completion rates.

	Placement Rate	Completion Rate
<b>PASSHE Average</b>	14.6%	81.1%
<b>National Average</b>	32.6%	58.0%

However, there is considerable variation in placement and completion rates across the individual universities.

	Placement Rate	Completion Rate
<b>PASSHE Max</b>	72.2%	96.4%
<b>PASSHE Min</b>	2.1%	56.8%
<b>Delta</b>	70.1%	39.6%

These variations are likely a sign of an inconsistent set of policies and procedures for placement across the system, as well as, inconsistencies in the definition of developmental mathematics courses among system universities (i.e., equivalent mathematics courses may be deemed developmental at one institution and not at another).

#### B. Traditional Developmental Education places the burden on the Student

Traditional developmental mathematics courses that are credit bearing but do not count for graduation are still widely in use across the system. This approach places a burden on students which results in a longer time to degree as well as lower persistence rates. This is

shown to directly affect the academic success of our students with a credential achievement gap of 15.2%.

### **C. PASSHE Universities are actively participating in the solution**

Several universities have embarked on pilot-like initiatives to improve their developmental mathematics outcomes, and these initiatives often include components related to best practices. This includes Kutztown University, which eliminated developmental education mathematics courses several years ago in favor of using an adaptive learning platform for placement and developmental skill building. Indiana University has fully embraced adaptive learning platforms with their comprehensive adoption for both placement and courseware. Overall, there is increasing interest in using a systemwide adaptive learning platform across the system. This focus on and adoption of national best practices create a student-centered approach built to help our students succeed.

## **IV. Pilot Opportunities:**

Four pilot recommendations were identified that align to the national best practices identified above (listed in priority order).

### **a. Multiple Placement Measures:**

Nationally, under-placement and over-placement in developmental math education can impact student success as measured by DFW rates in the developmental course, credit completion rates, persistence rates, and even credential completion. National research is lacking on the effectiveness of a multiple measures approach as compared to a single assessment approach that includes opportunities for remediation and reassessment or an approach that incorporates both multiple measures and an assessment product.

Specifically, within PASSHE there is a lack of uniform, standardized approaches to mathematics placement. As a result, placement policies and procedures vary from institution to institution, resulting in significant variation in placement rates. A student who matriculates at one PASSHE university might be placed into developmental mathematics according to that institution's policies and procedures, but had that same student matriculated at a different PASSHE institution, the student might not have been placed into developmental mathematics. Research is needed to determine the most effective method for mathematics placement

**Pilot Opportunity:** The developmental math education project team was approached in October 2019 with the opportunity to participate in a RAND study comparing multiple measures to ALEKS PPL for mathematics placement. This study is seeking funding from National Science Foundation's Improving Undergraduate STEM Education (IUSE) grant opportunity, Level III, Engaged Student Learning, RFP.

The proposal was submitted on December 4, 2019, funding is anticipated to be awarded in June 2020, and randomization would begin in Fall Semester 2021.

**b. Co-Requisite Models:**

The Co-Requisite Learning Support Model can be designed in various ways, but often such a model involves identifying students who need developmental support (in mathematics, for example) and then placing such students directly into the appropriate college-level course (one that counts toward graduation), with mandated learning support embedded in or accessed alongside the college-level course. System universities do not typically employ a mandatory, co-requisite component embedded within or alongside college-level courses in order to deliver developmental mathematics learning support. It is much more typical for system universities to place students into developmental-level mathematics courses that do not count for graduation. Published research indicates, however, that greater student success can be achieved through the implementation of a co-requisite approach to providing developmental mathematics learning support.

**Pilot Opportunity:** In early November 2019, the developmental math education project team was approached by Strong Start to Finish (SSTF) to pursue funding within the SSTF Seeding Site Grant Program. This grant program is designed to provide targeted technical and strategic assistance to support ongoing efforts of systems preparing to implement developmental education reforms at scale. Based on the work of the developmental math education redesign team, the PASSHE application was focused on crafting systemwide guidelines for developing co-requisite mathematics learning support that can be implemented at scale. The guidelines will include best practices for curriculum design, learning support implementation, and assessment. Strong Start to Finish is supported by Education Commission of the States and encourages change at scale by incubating the development and promoting the dissemination of actionable, evidence-based policy and practice about student entry to and success in their initial year of college to bring equity to education.

**c. Adaptive Learning Platforms:**

Adaptive Learning Platforms are interactive learning products that adapt to the student's performance by assessing the student's knowledge base, determining gaps in that knowledge, and then creating individualized learning modules to address those gaps. Such products may be used for course placement, remediation through upskilling and reassessment, and/or courseware. Students may work independently while using the interactive platform, or they may do so in conjunction with instructors or tutors in a classroom or lab setting.

Half of the system universities are currently using an adaptive learning platform called ALEKS PPL, a McGraw-Hill product, though the individual universities have not implemented the platform in a uniform way. The other universities are not using an adaptive learning platform for placement purposes. Some rely on a single measure (SAT math score) for mathematics placement, while others use a faculty-designed placement test that students may attempt only once. If an adaptive learning platform is adopted within the PASSHE system for mathematics placement purposes, students will have the opportunity to remediate and re-test, preparing more of them for placement in college-level mathematics courses.

**Pilot Opportunity:** A near system-wide implementation of the ALEKS software can be piloted and studied within the RAND Multiple Measures Study (described above), as a critical component of this study will be the standardize implementation of ALEKS PPL across 9 institutions. Through this study the System will gain knowledge including barriers to implementation and anticipated costs.

d. **Math Pathways:**

The Math Pathways approach involves identifying the appropriate mathematics courses for degree / program completion that align with a student's educational/career goals as well as their academic preparation. In its simplest version, the Math Pathways approach steers students toward an algebraic or a statistical math pathway given the student's major (or educational goals, if the student lacks a declared major). This approach is an alternative to placing all students into the same developmental-level course (Basic Algebra, for example) regardless of their majors. At universities that lack a Math Pathways approach, students may be placed into a mandated course that does not align well with their educational and career goals. This pilot would work to prove that a university that provides Math Pathways for students that align with their academic goals will see improvement in course completion rates and lower DFW rates, particularly for students who need developmental support.

**Pilot Opportunity:** A full pilot scope was not defined by the Redesign team for Math Pathways. However, there is an opportunity for this best practice to be addressed within the Co-Requisite pilot by placing students directly into college level courses, aligned with the student's academic goals, with embedded mandated supports.