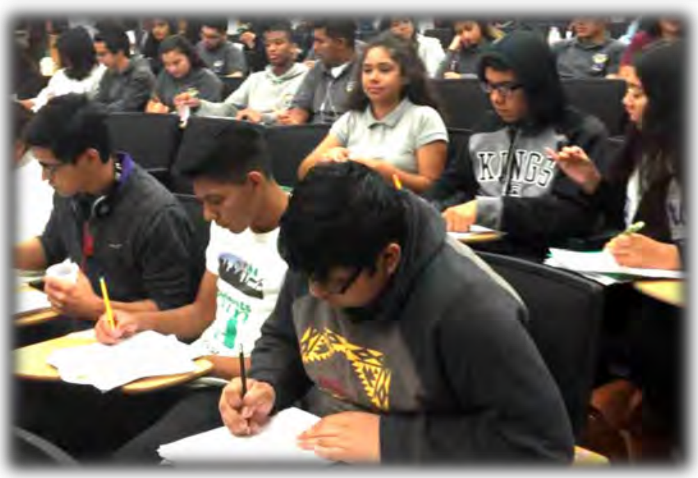
The Math Pipeline Readiness Project (M-PReP)

Year 1 Report

by Dr. Noelle Banuelos, Dr. Lynn Cevallos,
Dr. Pedro Cevallos, & Dr. Nicole Jackson



15902 Halliburton Road #243
Hacienda Heights, CA 91745

Tel: (310) 903-8022
Fax: (310) 954-9433

www.college-bridge.org
info@college-bridge.org

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Professional development and program evaluation were made possible through a generous grant by

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Suggested Citation:

Banuelos, N., Cevallos, L., Cevallos, P., Jackson, N. (2018). *The Math Pipeline Readiness Project (M-PReP): Year 1 Report.* Retrieved from Hacienda Heights, CA: college-bridge.org

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INTRODUCTION

The California State University (CSU), the largest four-year public university system in the nation, has historically struggled with low graduation rates (Jackson & Cook, 2016) mainly due to their incoming students' academic under-preparation (Hall, 2018). Similarly, the California Community Colleges (CCC), the largest system of higher education in the United States, has faced numerous challenges increasing their completion (associate degree/certificate or transfer) rates chiefly as a result of their inherent mandate to provide remedial instruction to all students who need it (Beach, 2012). While both systems have cycled through different approaches to increase their completion rates, challenges related to students arriving unprepared for college have continually beleaguered the institutions.

THE NEED

Two major roadblocks students face on their path toward college graduation are math under-preparation and the lack of a post-secondary plan. Students who matriculate into college without being fully prepared in mathematics face a higher probability of dropping out in their first year (Scott-Clayton & Rodriguez, 2015). Similarly, arriving on a college campus without a cogent strategy hinders students' progress toward graduation. This is particularly acute for underrepresented (low-income, minority, and first-generation) college students who tend to face multiple barriers simultaneously (Page & Scott-Clayton, 2016). Dropping out of college exacerbates the cycle of trans-generational poverty by leaving students with educational loan debts and no degree to show for it. It also places California in the challenging position of being unable to address its workforce development needs. Specifically, if current trends continue, by 2030 the state will face a workforce skills gap of close to 1.1 million college educated workers necessary to meet our economic demands (Johnson, Mejia, & Bohn, 2015).

Inadequate Mathematics Preparation

While math under-preparation greatly impacts graduation rates across the CSU system, the problem is particularly pronounced at their broad access campuses (Jackson & Kurlaender, 2014). Two CSUs with the highest math remediation and lowest graduation rates are California State University, Dominguez Hills (CSUDH) and California State University, Los Angeles (CSULA). While the rate of degree completion for all majors is low, math under-preparation compounds the issue for students attempting STEM majors (see Table 1 below). CSUDH and CSULA are both designated as Hispanic Serving Institutions (HSI), meaning that their enrollment of undergraduate full-time equivalent students is at least one-fourth Hispanic and half or more of these Hispanic students have incomes at or below 150% of the poverty line (Li & Carroll, 2007). As such, these two CSUs serve mostly under-represented students (URS) from urban communities in Greater Los Angeles.

Table 1. CSU Fall 2017 Math readiness and 2011 Cohort cumulative graduation rates for 4, 5, and 6 years for all majors and STEM.

	Math Remediation (Fall 2017)	4-Year Graduation	5-Year Graduation	6-Year Graduation
CSUDH (All Majors)	56.9%	6.0%	29.9%	42.9%
STEM Majors	Not available	3.5%	27.9%	39.5%
CSULA (All Majors)	39.8%	6.5%	31.3%	47.1%
STEM Majors	Not available	4.6%	26.7%	41.7%
CSU-Wide (All Majors)	25.4%	19.2%	47.3%	59.2%
STEM Majors	Not available	15.2%	44.8%	59.1%

(California State University, 2018a, 2018b)

Similarly, statewide at CCCs, 80% of students arrive unprepared for college-level mathematics with only 40% of them completing their associate degree/certificate or transferring to a four-year university within six years. In contrast, of the 20% who arrive college math ready, 72% complete their degree/certificate or transfer within six years. When the data are disaggregated for low-income and minority students, 92% arrive unprepared with 33% of them completing/transferring within six years (California Community Colleges, 2018; Rodriguez, Cuellar-Mejia, & Johnson, 2018).

Students in rural communities depend particularly heavily on CCCs due to low eligibility rates for four-year universities. For example, in the San Joaquin Valley A-G completion rates[1] are 26% -- compared to 55% for LAUSD and 45% for the State average (Boris, 2018) and only 23% of their students take the SAT (Boris, 2018) – compared to 49% nationwide and 60% statewide (National Center for Education Statistics, 2015). As a result, most students who decide to pursue a bachelor's degree in the Central Valley must first begin at a CCC and then transfer to a 4-year institution.

The college math readiness issue can be tracked back into California's public high schools using data from the California Assessment of Student Performance and Progress (CAASPP)[2]. The CSU and CCC use students' 11th grade scores as an early indicator of college math readiness. The data are presented in four levels with level four defined as college math ready. Students who score a four on their CAASPP may enroll directly in a college-level math course without the need for placement testing or additional support courses. The last three years of statewide CAASPP scores, presented in Table 2, which illustrates the low rates of college math readiness, specifically for URS.

Table 2. Historical CAASPP College Math Readiness (Level 4) Rates

	2015 Rates	2016 Rates	2017 Rates
All Students	11%	13%	13%
Ethnicity			
Black/African American	3%	3%	3%
Hispanic/Latino	4%	5%	5%
White	17%	18%	19%
Asian	40%	43%	44%
Economic Status			
Economically Disadvantaged	5%	6%	6%
Not Economically Disadvantaged	19%	22%	22%

(CAASPP, 2017)

In K-12, the state implemented the Common Core State Standards for Mathematics (CCSS-M) in an effort to better prepare students. So far, this effort has resulted in a slight decrease of one percentage point in college math readiness since 2013 (Warren, 2018).

Lack of a College Plan

High school counselors are the most critical source of college knowledge for students (Belasco, 2013), yet three systemic barriers hinder their ability to help students with the transition into college: (1) school finances, (2) counselor training programs, and (3) competing demands for counselors' time (Avery, Howell, & Page, 2014). First, high schools have historically not funded counselor positions at adequate levels. The American School Counselor Association (ASCA) recommends a counselor-to-student ratio of 1 to 250. California's average is triple that with one counselor for every 760 students – with high poverty schools having ratios even higher than that (Clinedinst & Koranteng, 2017). Paradoxically, students with the highest needs meet with their counselors the least amount of time (Avery et al., 2014). Second, most pre-service counselor training programs in this nation do not prepare their candidates with the knowledge and skills to

[1] A-G are the minimum requirements necessary to be eligible to apply to the University of California (UC) and CSU systems. https://www.ucop.edu/agguide/a-g-requirements/index.html

[2] https://www.cde.ca.gov/ta/tg/ca/

develop, implement, and evaluate college-readiness programs. The majority of university-based school counselor preparation programs focus on teaching prospective school counselors how to provide individual therapy and intervention to students – without explicitly focusing on the key aspects of college counseling. In fact, most pre-service school counselors are typically trained in conjunction with prospective marriage/family and mental health counselors. Even when universities require field practicum experiences, many school counseling candidates satisfy these requirements through individual counseling sessions which often are not required to be in a school setting (Hines & Lemons, 2011). Third, school counselors nationally only spend an average of 21% of their time engaging in postsecondary admission counseling (Clinedinst & Koranteng, 2017). Bruce & Bridgeland (2012) capture their typical workday:

> in addition to supporting students' social-emotional and academic development, counselors provide administrative support, fill in for teachers, coordinate tests, and act as a liaison between schools and communities, among many other responsibilities. Although their efforts do not go unnoticed by administrators, many counselors and administrators alike believe that changes should be made to counselors' job responsibilities to attain the goal of an education system in which all students graduate from high school ready to succeed in college and career (Bruce & Bridgeland, 2012, p. 12).

The problem is augmented by the lack of PD for high school counselors on how to effectively help students apply to, enroll in, and transition into college (Bruce & Bridgeland, 2012). In this context, it is clear why most students do not graduate from high school with a coherent strategy to navigate their transition to college graduation. High school seniors are overwhelmed by the numerous and complex choices they must make in a short amount of time (Ross, White, Wright, & Knapp, 2013). This problem is particularly amplified for under-represented students as Denley (2014) explains:

> First generation, low–income and minority students often do not have the advice system that surrounds students whose parents or other relatives have been to college. Information is certainly available to these students, but without knowledge of the structure and nomenclature of higher education they are unable to even frame the questions that would enable them to become informed. (Denley, 2014, p. 62).

As a result, one-third of first-generation college students matriculate into college without choosing a major compared to 13% of students from households with familial college knowledge (Chen & Carroll, 2005). Those students who do choose a major, most often do it with limited information on how to successfully complete that program (M. Kirst & Venezia, 2004) or realize too late that their expectations for their area of study are incongruent with the reality of the career options in that field (Smith & Wertlieb, 2005).

THE INTERVENTION

The Math Pipeline Readiness Project (M-PReP) was designed to increase college graduation rates by (1) improving math readiness rates through the vertical alignment of high school math courses from grade 9 – college and (2) supporting high school seniors in the development of a college transition plan (CTP). All work is predicated on Communities of Practice (CoP) comprised of K-12 math teachers or counselors working in collaboration with their higher education counterparts to develop, implement and evaluate innovate, outcome-based programs.

Math Readiness CoPs

Two types of CoPs were developed to address the math readiness dilemma: (1) math departments working to vertically align their grades 9-11 math programs to college rigor, and (2) math teacher/professor teams providing dual-enrollment Statistics and Pre-Calculus courses on the high school campus. The dual-enrollment courses allow the high school math department to align their grade 9-11 courses to their local CSU or CCC mathematics program.

Math Department CoPs. Since the CAASPP scores measure students' proficiency of the Common Core State Standards in Mathematics, the primary focus of the math departments is to improve instruction as evidenced by CAASPP. The M-PReP seeks an annual increase of 15 percentage points in the rate of students meeting or exceeding standards annually. The math departments engage in professional development to align their math programs, create common assessments, analyze student data, create interventions, and evaluate their efforts. The alignment of grades 9-11 predicates the alignment to the dual-enrollment courses. The M-PReP supports a teacher at each site to serve as a Math Lead who works with the M-PReP Math Specialist to plan, implement and evaluate the PD. The Math Lead also connects the work of the dual-enrollment CoPs to their entire math department.

Dual Enrollment CoPs. The M-PReP includes three dual-enrollment CoPs: (1) CSU Statistics, (2) CSU Pre-Calculus, and (3) CCC Statistics. The CSU Statistics program, which began in 2013, launched under the name South Los Angeles Math (SLAM) Project; the CSU Pre-Calculus program launched in 2017. Despite extending beyond South Los Angeles the programs are widely known as SLAM Statistics and SLAM Pre-Calculus. The rural version will launch with a CCC Statistics program in the fall of 2018.

Unlike most dual-enrollment courses, SLAM is an intervention for CSU-bound students who have not demonstrated college math readiness prior to 12th grade. The dual-enrollment courses are co-taught by a college professor and high school teacher with the former focusing on the college content and the latter providing additional support in pre-requisite content. The courses are stretched to a high school calendar to allow ample time for the support teacher to provide intervention. The courses are offered on the high school campus during the regular school day to integrate into the high school curricula.

The unique focus on under-prepared high school students is two-fold. First, it allows the high school teacher to learn the weaknesses students have that need to be strengthened into the grade 9-11 courses. It also allows students who were not college math ready to earn college credit and continue in the math sequence in college without the need for support classes or a readiness test.

The SALM Statistics course was designed for students who do not plan to pursue STEM degrees; the SLAM Pre-Calculus program was designed for STEM-bound students. The latter seeks to improve outcomes in Calculus and improve the rate of students earning STEM degrees.

College Counseling CoP

The third category of CoP is composed of the M-PReP College Counseling Specialist, high school counseling leads from each site, and college advisors from each CSU. The team focused on supporting students' development of a College Transition Plan (CTP and tracking their progress through graduation. The M-PReP Specialist facilitated PD with the CoP while building capacity within each site to institutionalize the program. After 12th grade, when students transition to institutions of higher education, the work will be handed off to the postsecondary partners. The students will participate in orientation and summer bridge programs (as available and appropriate) to fine-tune their college plans.

THEORETICAL FRAMEWORKS

M-PReP builds upon two theoretical frameworks: Academic Disjuncture Theory and College Readiness Indicator Systems (CRIS). Academic Disjuncture Theory postulates that the overarching barrier to college access and success is "the deeply-embedded chasm that separates K–12 from postsecondary education in the United States" (M. W. Kirst & Usdan, 2009, p. 5). These theorists contend that a seamless educational pipeline between K-12 schools and higher education is key to the unfettered progress of students between educational segments. Currently the systemic disconnections are most pronounced in the areas of curricula, assessments, financial processes, data systems, and accountability (Brown & Niemi, 2007; Domina & Ruzek, 2012; Kurlaender, Jackson, & Howell, 2012). M-PReP attempts to fuse K-12 and higher education together by bringing high school teachers and college professors to work collaboratively to decrease the high rates of mathematics remediation.

The College Readiness Indicator Systems (CRIS) are valid, reliable, and actionable indicators of three dimensions of college readiness: academic preparedness, academic tenacity, and college knowledge (Borsato, Nagaoka, & Foley, 2013; College Readiness Indicator Systems, 2014). This study is predicated upon the activities, resources, processes, and outcomes at the individual (student), setting (school), and systemic (inter-segmental partners) levels. Academic preparedness includes content knowledge and skills as well as cognitive strategies instrumental to succeed in credit bearing courses in college. Academic tenacity encompasses the underlying beliefs, attitudes, and values that drive student achievement coupled with behaviors of active participation and perseverance. College knowledge embodies the information, skills, and behaviors that foster college access and success. On an individual level, we gauge M-PReP students' personal development toward college readiness through their dual-enrollment pass rates, study skills, persistence, expectations for future, and college knowledge. Similarly, on a setting level we investigate M-PReP's instructional coherence and rigor. Systemically, we delineate the best practices for increasing college access and success for under-represented students from both urban and rural communities.

EVALUATION

Evaluation Design

The evaluation of M-PReP is a multi-year effort in alignment with its program delivery. The evaluation design incorporates a mixed-methods longitudinal approach for two overarching purposes: (1) formatively, to inform the program and promote continuous quality improvement of services and support to schools, teachers, and students; and (2) summatively, to determine the effectiveness of M-PReP in achieving its intended outcomes and to learn best practices for increasing college access and success for under-represented students from urban and rural school districts. Mixed methods in evaluation allow for a comprehensive study into the "what" (quantitative) and the "how and why" (qualitative) factors that influence success for these specific populations. Further, a longitudinal approach is the most appropriate in tracking student outcomes from high school through college, to assess college readiness, persistence, and completion.

Given the scope of M-PReP in working at the school and department levels, in addition to its targeted student selection and placement, an experimental design is neither feasible nor logical in achieving the evaluation purpose. Rather, the naturalistic context requires a design that does not burden or impose negatively upon students' progression. Therefore, under the mixed-methods design, data collection and analysis were built into the project and resulted in more authentic data and findings. M-PReP's logic model was also used as a guide in designing the evaluation and data collection. The M-PReP logic model was developed to ensure a shared understanding of the underlying theory of the program, provide structure to the relationships between activities and outcomes, and promote a shared understanding among stakeholders. (See Appendix A for the logic model.)

Evaluation Questions

The evaluation is anchored by the following questions:

1. In what ways did participation in the M-PReP dual-enrollment course impact:
   a. students' college math readiness levels on the Early Assessment Program (EAP)?
   b. students' knowledge of fundamental mathematical concepts?
   c. earned college credit in math (pre-calculus, calculus, statistics)?
   d. college readiness
2. In what ways have PD opportunities and/or other forms of support contributed to student success in mathematics?
3. In what ways did M-PReP influence teacher practice related to:
   a. collaboration?
   b. use of assessments and data?
   c. application of PD content?
4. What changes, if any, did leadership teams make at their schools as a result of their experience with M-PReP?
5. In what ways did the development and use of a College Transition Plan (CTP):
   a. influence counselors' practice, and
   b. promote students' progress toward college graduation?
6. What impact did M-PReP dual-enrollment courses have on students':
   a. matriculation?
   b. persistence?
   c. university graduation rates?
   d. community college completion (Associate degree/certificate or transfer) rates?
7. What successes and challenges did each school experience with M-PReP?
8. How might the fidelity of M-PReP implementation be balanced with future adaptation in urban and rural communities?

Site and Student Selection

Site Selection. The M-PReP was set in Los Angeles, Tulare, and Kings counties with Los Angeles piloting an urban model and Tulare-Kings launching a rural version in the fall of 2018.

The urban model includes two CSUs working in collaboration with five urban high schools – two from a large school district, two medium, and one charter. The sites include three large comprehensive high schools and two small schools with one charter and one magnet. Both CSUs are minority-serving institutions with low math readiness and graduation rates. All five high schools were chosen based on three criteria: (1) CAASPP Level 4 rates below the state average, (2) under-represented minority rates above the state average, and (3) rate of low-income students, determined by qualification for the state's free or reduced-price meal program, above the state average (see Table 3 below).

Table 3. Urban Site Selection Criteria from the 2016-17 school year

	Statewide	School A	School B	School C	School D	School E
CAASPP Level 4 (College Math Ready)	**13%**	2%	7%	4%	9%	6%
Minority (African American or Hispanic)	**60%**	98%	99%	100%	93%	89%
Qualify for Free or Reduced-Price Meals	**58%**	89%	97%	95%	84%	85%

(CAASPP, 2017)

Student Selection. The M-PReP serves two groups of students at the school: (1) all students in grades 9-11, and (2) seniors in dual-enrollment SLAM courses. The former is served indirectly through PD for the entire math department to align their courses to college. The latter are chosen through a student selection process that our previous research suggests is the most important, and misunderstood, element of the program.

SLAM's structure as a dual-enrollment program lends itself to misunderstandings. It is important to reiterate that the SLAM program is an intervention for CSU-bound students who have not demonstrated college readiness and, based on multiple measures, are likely to require math remediation in college. The fact that students can earn college math credit leads folks at the high schools to conclude that the program is for their top students, similar to Advanced Placement (AP) courses. Ironically, students eligible and appropriate for AP should be ineligible for SLAM. Challenges with the selection of students led College Bridge to develop a formal Student Selection Process for sites to follow (see Appendix B). The process requires repeated participation from site administration, as well as the entire math and counseling departments. All members of this group have an active role in setting student selection criteria and participating in the recruitment and final selection processes. This process also serves as professional development for teachers, counselors, and administrators to learn how to use multiple measures for student advisement and math placement practices.

Data Collection and Analysis

Various methods were used to collect the qualitative and quantitative data necessary to address the series of evaluation questions. A summary table of data, methods, and sources for this first year is presented next. A more comprehensive description of data, methods, and purpose appears in Appendix C.

Table 4. Summary of 2017-18 Evaluation Data Collection Methods and Sources

Primary Data Collection	Data Source
• Online End-of-Course Student Surveys	• M-PReP dual-enrollment SLAM students
• Online CAASPP Experience Student Survey	• All 11th grade students at M-PReP schools
• Online End-of-Year Survey	• Teachers, counselors, administrators at M-PReP schools
• Post-PD Session Survey	• Participants of PD sessions at M-PReP schools
• Instructor Interview	• Teachers/Professors of dual-enrollment SLAM courses
• Collaboration Observation Rubric	• Participants of PD/meetings with M-PReP teachers
Secondary Data Collection	**Data Source**
• MDTP Assessment scores	• M-PReP dual-enrollment SLAM students
• Math CAASPP scores	• All students in M-PReP schools
• AP Math Exam scores	• All students in M-PReP schools
• High school math courses and grades	• All students in M-PReP schools
• Dual-enrollment SLAM course grades	• M-PReP dual-enrollment SLAM students

Analyses of quantitative data from scaled survey items, exam scores, and course grades were largely descriptive. Appropriate inferential analyses for pre-post comparisons, such as t-tests and analyses of variance (ANOVA), were conducted with statistical software. Qualitative data from interviews, open-ended survey questions, and observations were coded for important and relevant themes and emergent categories. All data with personally identifying information were collected with proper permissions, including IRB and data use agreements. Data were transmitted and stored following applicable Family Educational Rights and Privacy Act (FERPA)[3] regulations.

[3] FERPA is a Federal law that protects the privacy of student education records. The law applies to all schools that receive funds under an applicable program of the U.S. Department of Education. https://www2.ed.gov/policy/gen/guid/fpco/ferpa/index.html

FINDINGS

Since many of the findings relate to quantitative measures that determine students' college math readiness, educators in California use three acronyms interchangeably: SBAC, CAASPP, and EAP. The Smarter Balanced Assessment Consortium (SBAC)[4] is the public agency that creates the online Common Core State Standards (CCSS) assessment system for grades 3-8 and 11 used in California's public schools. The 11th grade test is the only one that determines college readiness. The California Assessment of Student Performance and Progress (CAASPP)[5] system is the state's comprehensive accountability measure; one of its components that applies to most students is the SBAC assessments. Finally, the Early Assessment Program (EAP)[6] is a set of multiple quantitative measures that the CSU and most CCCs use to determine college readiness in math and English. The CAASPP score that students earn on their 11th grade SBAC is a metric of the EAP.

RQ 1. In what ways did participation in the M-PReP dual-enrollment course impact:
a. students' college math readiness levels on the Early Assessment Program (EAP)?

Overall, students at M-PReP schools demonstrated positive trends in CAASPP/EAP outcomes.

This first research question was addressed through a review of the 11th grade CAASPP student scores and a survey of students' experience with the SBAC assessment taken during spring 2018. Table 5 presents the distribution of 11th grade students and Performance Levels overall and for each of the five M-PReP schools. A Performance Level of 4 ("Standard Exceeded") and 3 ("Standard Met") are the levels at which schools most often base achievement goals.

Table 5. 2017-18 CAASPP 11th Grade Math Performance Levels across M-PReP Schools

CAASPP Performance Level	TOTAL (N=1,421)*	School A (n=359)	School B (n=115)	School C (n=129)	School D (n=401)	School E (n=417)
4	8%	5%	16%	9%	8%	7%
3	20%	14%	23%	26%	20%	22%
2	29%	25%	30%	25%	30%	31%
1	44%	56%	31%	40%	41%	41%

*There were 1469 11th grade students in total, 48 did not have a CAASPP score.

As seen in Table 5, significantly less than half of the 11th graders across the schools scored at the achievement goal levels. Table 5 below shows how 11th grade students' scores may have demonstrated movement across performance levels since their previous SBAC test in 8th grade. While most students tend to remain in the same level, it is important to note that there may be movement within a level that is undetected due to the range in scores specific to each level. Further, students at higher performance levels tend to remain at that level. Nevertheless, about 20% of students across the schools moved up 1-2 levels in the direction of meeting the standard.

[4] http://www.smarterbalanced.org/
[5] https://www.cde.ca.gov/ta/tg/ca/
[6] https://www.calstate.edu/eap/

Table 6. Changes in CAASPP Math Performance Level from 8th grade to 11th grade – Overall

	TOTAL (N=1,214)	School A (n=302)	School B (n=103)*	School C (n=103)	School D (n=345)	School E (n=361)
Moved **up** 2 levels	2%	2%	1%	9%	2%	1%
Moved **up** 1 level	20%	19%	17%	27%	19%	22%
Remained same level	63%	68%	63%	60%	64%	58%
Moved **down** 1 level	13%	10%	17%	3%	14%	18%
Moved **down** 2 levels	1%	1%	2%	---	0.3%	1%

*One student moved up 3 levels.

11th grade students in the M-PReP dual-enrollment SLAM Pre-Calculus course outperformed counterparts on CAASPP assessment.

CAASPP performance levels were analyzed further to determine if there were differences between students in dual-enrollment SLAM Pre-Calculus courses and students in "regular" Pre-Calculus courses. Only 11th grade Pre-Calculus students with 2015 and 2018 were compared.

Table 6 presents the results of an ANOVA in which 11th grade 2018 CAASPP math scores were compared across the two Pre-Calculus groups, while controlling for the effects of previous 8th grade 2015 CAASPP scores. This particular step was important as students in the M-PReP course, on average, had higher 2015 performance levels than their counterparts due to variations in the student selection practices at the schools. Nevertheless, after controlling for prior levels, there was a statistically significant difference in performance levels between the two groups.

Table 7. ANOVA Results of Differences in CAASPP Performance Levels across Pre-Calculus 11th Grade Students in M-PReP Schools (N=248)

	n	2015 Math CAASPP M (SD)	2018 Math CAASPP M (SD)	F	p
M-PReP Pre-Calculus course	57	2.79 (.75)	3.07 (.80)	4.08	.045*
Other Pre-Calculus course	191	2.36 (.85)	2.68 (.69)		

*p<.05

Student experiences with the SBAC assessment provided necessary insight into future preparatory and instructional strategies.

A SBAC survey was developed to gather information on 11th grade students' experience in preparing for the math assessment, perceptions of difficulties associated with the assessment, and opinions of what additional knowledge and skills could have contributed to their success. Findings from this survey provide insight into the story behind the scores, areas in which students may have demonstrated successes or challenges related to this assessment. The survey results were also used for programmatic purposes to inform future test preparation strategies and professional development opportunities at the five schools. A total of 589 11th grade students across the five M-PReP schools completed the survey.

Table 8 presents key findings related to practice with various tools and strategies and frequency of their use, as described by student respondents.

Table 8. Tools and Strategies for SBAC Preparation (N=589)

Percentage of students that used the following tools **at least monthly** in their classrooms	
Desmos (graphing tool)	47%
Graphing calculator (other than Desmos)	67%
Laptop (during math class only)	34%
Tablet (during math class only)	16%
Percentage of students that reported using specific types of SBAC-related practice in their math classrooms	
Following and understanding instructions for SBAC math questions	52%
Using worksheets to practice solving SBAC math questions	67%
Working directly on computers/tablets to practice SBAC math questions	42%
Using other tools (e.g., equation editor, graphing calculator) directly on computer	32%

Graphing calculators were used more often in 11th grade math classrooms. Math practice using worksheets was the most often used strategy for SBAC preparation, despite the fact that it is a computer-based assessment.

Students were also asked about specific problem types, not content, to gain further insight into their perceived difficulty and preparation. The problem types included "matching tables," "multi-select," and "combined multi-select." These types were chosen based on their frequent use in SBAC math assessments.

Figure 1 presents the percentage of students who reported preparing for these problem types in their classroom prior to the assessment. Multi-select problem types were practiced most in these 11th grade classrooms.

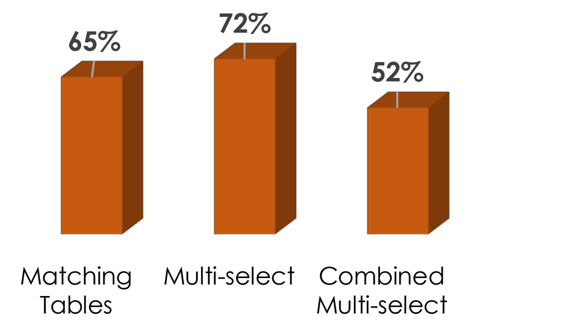

Figure 1. Preparation for Various SBAC Question Types

In addition to their preparation, students were also asked about their perceived level of difficulty with the above problem types (understanding the instructions and inputting their answer). Both of these issues have been noted by math teachers as potential challenges that may interfere with answering particular math problems correctly. Students also provided their opinions on what (information, skills, knowledge) might have helped them to succeed on the assessment.

Table 9 shows that the Combined multi-select problem types were perceived as more challenging in terms of understanding instructions and inputting answers. Interestingly, as shown in Figure 1, it was the least practiced in the classrooms. Further, 49% of the students perceived the Equation Editor (a tool used during the assessment) as somewhat challenging or difficult to use.

Table 9. Level of Ease and Difficulty on Problem Types (N=550)

Problem Type	Understanding Instructions		Understanding how to input answer	
	Easy	Some challenge/ difficult	Easy	Some challenge/ difficult
Matching tables	63%	37%	54%	46%
Multi-select	54%	46%	54%	46%
Combined Multi-select	36%	64%	39%	61%

The three most common challenges reported by students in taking the assessment included comprehending the questions/instructions, understanding topics and concepts that were not familiar or reviewed before test, and perceiving the test as difficult. When asked if there was any math knowledge they wished they had known prior to the test, the most common responses were related to specific math content (e.g., word problems, equations) and opportunities for more practice and review. Other skills students wished they had prior to the assessment included time management and mechanisms for coping with stress. In general, students believed that more practice and review, especially with topics learned in previous courses and word problems) would have better prepared them for the SBAC assessment.

b. students' knowledge of fundamental mathematical concepts?

M-PReP students in dual-enrollment SLAM courses demonstrated significant gains in knowledge of fundamental math concepts.

Students' knowledge of fundamental mathematical concepts was measured through the Math Diagnostic Testing Project (MDTP)[7] assessment. In 1977, the Mathematics Diagnostic Testing Project (MDTP) was created by CSU and UC. MDTP's overarching purpose is to promote and support student readiness and college math success. It accomplishes this by developing diagnostic readiness tests aligned to the Common Core State Standards (CCSS) and providing these diagnostic instruments to secondary schools in California at no cost. Students in M-PReP's dual-enrollment SLAM Statistics course completed the Second Year Algebra Readiness Test, which included concepts aligned to geometry and first-year algebra. Students in dual-enrollment SLAM Pre-Calculus were assessed by the Math Analysis Readiness Test which gauges their preparation for the material they will cover. While the MDTP was developed primarily as a diagnostic tool, the readiness test was used in this study to measure growth in student knowledge of math concepts. In addition to informing instructional practice, it served as another indicator of the positive outcomes attributed to dual-enrollment course participation.

Matched data from SLAM students in four of the five M-PReP schools were available for comparisons. As shown in Table 10, there were significant gains in scores overall, as well as in each of the individual components. These gains indicate that participation in the M-PReP's SLAM courses contributed to improvement in students' knowledge of fundamental math concepts.

[7] https://mdtp.ucsd.edu/

Table 10. Pre- and Post-Assessment Differences across Students in Dual-Enrollment SLAM Courses (N=102)

MDTP Test Sections	Average (M)	SD	t	p
TOTAL - PRE TOTAL - POST	12.05 16.40	5.53 8.01	-6.54	.000**
Exponents/Radicals/Logs - PRE EXLR - POST	2.29 2.84	1.30 1.65	-3.27	.001**
Functions and Graphs - PRE FNGR - POST	2.08 3.17	1.60 2.08	-5.82	.000**
Geometry - PRE Geometry - POST	1.16 1.87	1.03 1.37	-4.52	.000**
Linear Equations - PRE LINR – POST	2.18 2.92	1.47 1.66	-4.53	.000**
Polynomials/Quadratic Eq - PRE POLQ - POST	2.11 2.92	1.44 1.85	-4.64	.000**
Rational Expressions - PRE RATL - POST	2.24 2.66	1.21 1.62	-2.65	.009**

*p<.05, **p<.01

Similar gains emerged across three of the four schools, with minor variations. Students at School B did not reveal any statistically significant differences overall or across the individual components. This may have been due to the fact that the pre-test version was given to the students in School B three months into the school year, as opposed to the start of the school year. Three months of instruction prior to the pre-test most likely influenced any true differences in scores.

c. earned college credit in math?

Over two-thirds of students enrolled in M-PReP's dual-enrollment SLAM courses earned college credit in math.

During the 2017-18 school year, 210 students across the five schools (11th and 12th graders) enrolled in SLAM courses. Table 11 displays the pass rates by school and course. These students have earned college credit in math.

Table 11. SLAM Course Pass Rates for 2017-18

	TOTAL (N=129)	School A (n=26)	School B (n=10)	School C (n=28)	School D (n=83)	School E (n=35)
SLAM Pre-Calculus	**67%**	15%	50%	75%	83%	91%
	TOTAL (N=81)	School A (n=58)	School B (n=23)	School C	School D	School E
SLAM Statistics	**70%**	59%	100%	---	---	---

College credit in math was also earned by students in 2017-18 who enrolled in advanced placement math courses (e.g., AP Calculus) and scored a 3 or higher on the exam. These percentages are presented in Table 12. The totals are based on the number of students who took the exam, not the number of students who were enrolled in the course.

Table 12. 2017-18 AP Exam Scores (3 or Higher) for Students in M-PReP Schools

	TOTAL (N=262)	School A (n=29)	School B (n=53)	School C (n=15)	School D (n=51)	School E (n=114)
Passing AP Exam Scores	**32%**	10%	21%	20%	53%	35%

Note: Based on data provided by the respective school districts.

d. college readiness?

Across the five M-PReP schools, 24% of 12th graders were "college math ready."

College readiness was examined in two ways. The first was in terms of "college math" readiness, or more specifically, how many 12th grade students met one or more of the criteria necessary to move on to college-level math courses once they matriculate into college. The determining criteria included:

- A score of 3 or higher on an AP math exam
- Passing a SLAM course (Pre-Calculus or Statistics) with a C- or higher
- A score of 4 on the 11th grade SBAC assessment
- A score of 3 on the SBAC assessment plus passing an approved 4th year of high school math with C- or higher (Math course must have Algebra 2 or IM3 as a prerequisite)

Data from 12th grade students across the five high schools were reviewed to determine college math readiness. It is possible for students to meet more than one criterion. For example, a student may score a 4 on the SBAC assessment and have passed a dual-enrollment course. Table 13 presents the counts of students, overall and by school, that were considered college math ready. The first column contains an unduplicated student count. Subsequent columns present the counts of students meeting each, noting that in many cases there was duplication across one or more criteria.

Table 13. Counts and Rates of College Math Ready 12th Graders across M-PReP schools

	Total Count of 12th grade Students	Unduplicated Count of College Math Ready Students	Criteria for College Math Readiness			
			AP Score 3+	Passing Dual-enrollment	2017 CAASPP Score 4	CAASPP Score 3 + passed 4th yr math
TOTAL	1,272	24% (310)	62	88	101	153
School A	271	24% (65)	2	37	13	24
School B	97	48% (47)	4	28	17	20
School C	109	40% (44)	3	10	9	30
School D	349	17% (58)	21	3	26	25
School E	446	22% (96)	32	10	36	54

Note: Based on data provided by the respective school districts.

Overall, only about one quarter of the 12th graders were considered "college math ready." In this first program year, these rates represent a baseline measure of college math readiness for 12th graders across the five M-PReP schools. It is anticipated that continued work with these schools will lead to higher rates as the project progresses.

M-PReP SLAM students reported high levels of preparedness and college readiness.

College readiness was also explored as an overarching construct, extending beyond course grades and exam scores. There is widespread discussion in the literature about college readiness, or students' ability to succeed in college based on academic preparation as well as other cognitive, attitudinal, and behavioral factors believed to be necessary for successful post-secondary transition and completion. To better understand college readiness and its many intersecting facets, various frameworks have been developed which have been used to further its study and impact (Borsato, Nagaoka, & Folley, 2013; Conley, 2007). These have been particularly useful in studying barriers to college completion among traditionally under-represented students as studies have shown that gaps in college readiness skills jeopardize college completion for these populations (Ramsey-White, 2012).

Within M-PReP, college readiness was defined in terms of indicators, or representations of attitudes, skills, and behaviors that were expected to be in place as students were in the process of transitioning to college and throughout their college career. These college readiness indicators were based on the domains of academic preparedness, college knowledge, and academic tenacity (Borsato, Nagaoka, & Folley, 2013) as well as cognitive strategies and contextual awareness (Conley, 2007). Survey items based on these indicators were developed in this first project year and were administered to high school students enrolled in the SLAM math courses in 2017-18. These students were not only exposed to the rigors of a college-level class but also had the opportunity to work with a college professor and visit a college campus. It is anticipated that continued study of college readiness will also be included as part of the College Transition Plan (CTP) process as M-PReP progresses.

Across the five schools, 183 students completed provided responses regarding how prepared they felt on various aspects related to college readiness and success (see Table 14).

Table 14. Perceptions of College Readiness among Students in M-PReP Courses (N=183)

	Very prepared	Prepared - doing okay	Not very prepared - need a little help	Not prepared at all
Managing your time for studying and homework	21%	60%	17%	2%
Passing high school math classes with 'B' or better	33%	36%	26%	6%
Having strong study skills and habits	17%	49%	30%	5%
Knowing how to communicate with teachers, counselors, etc. to get information you need	39%	45%	14%	3%
Creating a plan when faced with school challenges	25%	50%	22%	3%
Understanding what is expected/needed to be successful in a college class	45%	44%	9%	2%

Overall, students in dual-enrollment courses felt prepared to be successful in college. As shown, very few of these students believed themselves to be completely unprepared on any of the college readiness indicators. Students appeared to feel most prepared understanding what is expected to be successful in a college class (89%). This is not surprising given their recent SLAM course experiences. Similarly, 84% of students felt prepared to communicate to get information they need. This may have been facilitated by the fact that the SLAM professors offered office hours, on occasion, and other forms of communication to students (that may not have been available to them from their previous high school teachers). Over one-third of students (35%) did not feel as prepared in terms of strong study skills and habits. This was consistent with open-ended responses in which many students reported needing better study skills and habits to be ready for college. Other open-ended responses addressing additional information or skills that students would need to be ready for college included time management, organizational skills, and financial knowledge/management. The CTP curriculum is designed to address and facilitate the development of these skills and is discussed in a later section.

RQ 2. In what ways have PD opportunities and/or other forms of support contributed to student success in mathematics?

The PD opportunities for math teachers at M-PReP schools focused on two populations of students: (1) students in grades 9-11, and (2) students in the dual-enrollment SLAM courses. The PD was organized around a total of seven CoPs. Five CoPs included of the high schools' math departments with their work focused on improving instruction for students in grades 9-11 as evidenced by math CAASPP scores. The remaining two CoPs are the teams of college professors and high school teachers providing either Cal State LA's Quantitative Reasoning with Statistics (MATH1090) or CSUDH's Pre-Calculus (MAT153) course, each evidenced by pass rates of their respective college course.

Teachers from dual-enrollment courses unanimously credited the job-embedded PD as contributing the most to student success in the course.

The PD for SLAM teachers has the same structure for both the Cal State LA Statistics and CSUDH Pre-Calculus programs and consists of two components: (1) up to 50 hours out-of-school time for the entire team, and (2) four units of one-on-one job-embedded PD. The focus of the former is planning and discussions around curriculum, pedagogy, and assessments that include team-grading for all major assessments. The latter utilizes a co-teaching model where the professor comes to each high school to plan and co-teach with the high school teacher during year one.

The teachers in both programs unanimously credited the job-embedded PD as contributing the most to student success in the course. Both programs utilized the same, intentional pedagogical approach (problem-based inquiry) and structures (collaborative groups) for the job-embedded PD. The goal was to create a college-like environment where students are accountable for their own learning. One professor explained, "I felt that the one thing that worked well was taking more of an inquiry approach to things where we were trying to help them figure out the mathematics rather than just telling them about the mathematics." The rationale for the approach was explained further by a second professor who stated:

> Instead of the instructor putting up an example and then just walking through it, the example is put up and the students work in pairs or groups to attempt the problem before it's discussed by the instructor. This form of active learning is a really important and effective component so that the students are not just passively receiving the material; they're actively engaged throughout the lecture process.

The practice of the student as an active learner provided key information to help the instructors gauge their learning. A third professor described that the questioning techniques "allowed me to get into their thought process and knowing their thought process, I was able to give the correct questions to guide them to where I need them to be." Guiding them was the start; the deeper learning was evidenced with the transfer of knowledge. The same professor observed that, "after a while, the students caught on with my questioning and instead of them correcting the students presenting, they would start asking the students questions themselves." The students' questioning strategies provided the instructors a deeper look into thought processes that demonstrated understanding of mathematical concepts.

The teachers echoed the professors' observations that the approach improved student learning. One teacher explained that the professor, "would actually make the students think a lot, which I liked, because it helped them really understand what was going on." The change in classroom dynamic was described by a second teacher who reflected, "It was a huge difference. My kids became more exploratory. They took charge in the classroom." The change in student behaviors was further illustrated by a third teacher who explained the transition she witnessed in her classroom:

> I was happily surprised at how the students were able to conquer or attack difficult questions. Because in the beginning they were very hesitant but then as time continued they were able to look at a question and be perseverant. They did not give up on questions that any other pre-calculus kid would look at and would say, 'no this is too wordy, too long, I'm not gonna do it.' But these kids were able to attack it.

As teachers observed the impact the pedagogical approach had on the students, they began working to change their practice. One teacher admitted, "I was accustomed to direct teaching, so I wanted to give practice to build their knowledge but [the professor] said let them try the hard questions and see where they get stuck. That was challenging for me." In fact, the teachers rarely tried implementing the strategies at the onset of the PD. Instead, they observed at first and then eventually began the new practice. Another teacher explained, "I took notes while he was teaching and most of my notes were how he's leading the questions; when students get stuck how he's re-questioning them instead of giving the answers and how he's leading them in the right direction." Simply stated by a third teacher, "I had the opportunity to observe [the professor] teach and I think that really helped me become a better teacher."

In the support days when the professor was not present, students continued to participate in academic discourse in peer groups while the high school teacher honed their pedagogical practice. In many instances the skills collided such as in one teacher's class when she observed that "when the professor was not here they would ask each other questions." She further recalled, "A student actually mentioned that the reason he learned more about what we were working on was because he would help out somebody else with the materials." All of the teachers in the program claimed that the peer collaboration was a key component of the program that contributed to student success.

Whereas the PD for the SLAM CoPs were uniform, the PD for math departments were quite the opposite. Since the SLAM CoPs were either provided outside of school time or job-embedded within the SLAM classroom, uniformity was easy. Conversely, the PD for math departments had to fit within the school PD calendar and, as such, competed with a plethora of groups and agendas jockeying to use that time. The original plan was to provide eight uniform PD sessions for the sites that focused on CAASPP math goal setting, data analysis, and progress monitoring. In reality, the one-size-fits-all plan had to be adapted to the contexts at the sites.

M-PReP's PD sessions were perceived as useful and incorporated effective research-based elements, such as modeling, feedback, and collaboration.

The research literature shows that effective professional development, or professional learning experiences, incorporate various elements such as a focus on content, integrates active learning strategies, supports collaboration, uses modeling, and provides opportunities for feedback and reflection (Darling-Hammond, Hyler, & Gardner, 2017). These elements were incorporated into M-PReP PD sessions conducted at the school sites, many of which have been evaluated.

Participating math teachers during a sample of the PDs were asked to complete post-questionnaires. Table 15 presents how teachers perceived the general structure and facilitation of the PD sessions.

Table 15. Participant Perceptions of Math Professional Development Opportunities (N=34)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The stated goals of the PD were met.	68%	21%	9%	0%	3%
There was ample time during the PD to engage with my colleagues.	50%	26%	15%	3%	6%
There was time during the PD to reflect on and process how content may be used in my instruction.	41%	35%	15%	6%	3%
The tools/strategies that were shared today will help me inform future instruction.	62%	24%	9%	0%	6%

The findings show that, overall, the PD sessions were perceived as structurally sound by meeting stated goals and allowing for participant engagement and reflection. Participants also responded to the usefulness of the content and its applications. The majority of teachers agreed that the tools and strategies shared would help inform their instruction.

Participating teachers also described aspects of the PD that they found useful, which also showed alignment to research-based effective practices. For example, some teachers appreciated the opportunities for collaboration. Comments included that the time to "collaborate with higher and lower levels of math" was useful; breakout sessions…allowed us to collaborate with colleagues in the way we see fit", "the time to collaborate was appreciated."

Opportunities for feedback and reflection were also perceived as very useful elements of the PD. Many teachers shared similar thoughts on what was useful about the session: "getting great feedback from my colleagues because it helps me think about the things I need to fix and focus on," "authentic discussions within the department," and "discussing our thought process." Modeling was another effective practice that some participants found useful. One teacher commented: "I like how [facilitator] not only explained the strategy but he also modeled it and made us be part of it." Another teacher found that "looking at sample performance tasks" prior to creating their own was particularly useful.

RQ 3. In what ways does M-PReP influence teacher practice related to:
a. collaboration?

Research-based effective elements of collaboration are incorporated into M-PReP's PD and support opportunities to promote COPs.

Effective collaboration is the cornerstone of M-PReP's work with teachers and schools. There is no single theory of collaboration and much of the literature uses this term broadly to encompass a variety of strategies and activities. "In fact, the term has been used so ubiquitously that it is in danger of losing all meaning" (DuFour, 2004, p. 31). Nevertheless, collaboration is regarded as a vital component of school reform (Gajda & Koliba, 2007). M-PReP's development and facilitation of collaborative structures through CoPs is a goal of the project as it promotes common goals and achievement of shared outcomes.

In order to better understand the role and impact of collaboration and CoPs, a review of the research literature revealed several necessary elements and structures shown to be effective. The National Staff Development Council standards for learning communities are predicated on interpersonal collaboration toward the goal of improvement in school (National Staff Development Council, 2001).

M-PReP staff worked together to identify and define collaboration and its applications for communities of practice in the initial step toward determining its viability and effectiveness. Figure 2 highlights the relationship between collaboration and effective communities of practice (Gajda, 2004; Gajda & Koliba, 2007; Wenger-Trayner & Wenger-Trayner, 2015).

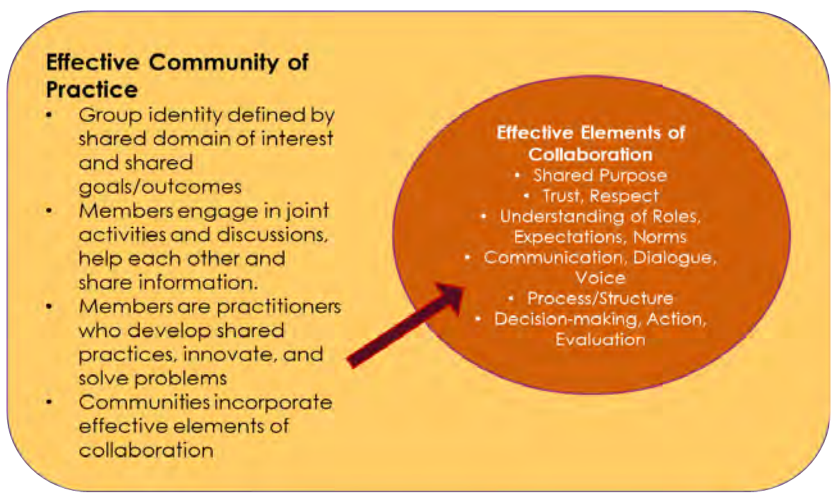

Figure 2. Graphic representation of relationship between Collaboration and Communities of Practice

Teachers reported positive influence of collaborative efforts on their instructional practice (and by successive approximation, student outcomes) which emphasize the important role collaboration plays in M-PReP's effectiveness.

The presence of key collaborative elements in M-PReP's work was assessed in two ways, from the perspective of the participants through survey and interview and through direct observation in meetings and PD opportunities.

Eleven math teachers from four of the five M-PReP schools responded to a series of survey questions at the end of the program year on their perceptions and participations in the collaborative structures. The first set of questions related to collaboration within their respective math departments and across departments (at the other project schools). The level and frequency of collaborative opportunities within the departments varied across the schools. Those teachers who reported more opportunities, shared that they collaborated with other math teachers in their departments related to data analysis, goal setting, pacing, lesson planning, and creating common assessments. A subgroup of these teachers added that they collaborated at times with other math teachers outside of the usual structured settings (e.g., department meetings). These included before and after school, prep hours, and during lunch. Across department collaborations were reported as less frequent, if at all. A small subgroup of teachers shared a few structured opportunities for cross-department collaboration, such as grade-level meetings and via AVID workshops.

Math teachers were asked to describe ways in which these collaborative efforts may have impacted their instructional practice. The majority of teachers responded positively and shared both instructional and student outcomes. One teacher's response highlighted elements of collaboration that were most effective in achieving outcomes: "[Collaboration] has helped me and my colleagues share common goals so that we are teaching the same textbook pages and give the same homework assignments. Allows us to see how rigorous the course should be taught and keep everyone to high standards. It has given us more reflection and meaningful decisions of our teaching practices of what's working and what's not." Teachers also described how the collaboration efforts helped them to reflect on their own practice ("helped to see variations in teaching practices") and compare strategies for best results. Two teachers also reported that this collaboration has led to better student performance, as one teacher responded, "My students did way better than last year. Students demonstrated they have mastered standards. Our goal was met."

Surveyed teachers were asked about the presence of research-based collaboration elements in their work with College Bridge during this program year, such as PDs, work groups, planning meetings, or similar opportunities. Table 16 presents these results.

Table 16. Math Teacher Survey Responses on Collaboration Elements (N=11)

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The purpose and expected goals of each PD/meeting were always made clear.	27%	64%	0%	9%	0%
Participants always exhibited appropriate behavior and respect for the group.	36%	45%	18%	0%	0%
The environment was always safe and non-judgmental.	27%	45%	18%	9%	0%
Participants were always encouraged to share opinions and give feedback.	45%	36%	18%	0%	0%
Participants' opinions and perspectives were treated respectfully.	27%	45%	27%	0%	0%
Participants were always actively and collectively engaged in discussions and/or decision making (when applicable).	36%	27%	36%	0%	0%
There were many opportunities for participants to share individual experiences to stimulate discussion and feedback.	36%	36%	18%	9%	0%
There were many opportunities for participants to develop strategies for achieving common goals or objectives.	27%	27%	45%	0%	0%
Any successes or accomplishments were due to the collaborative efforts of the participants.	36%	27%	36%	0%	0%
PD and/or meeting outcomes were more enhanced through the collaboration of the participants.	45%	36%	18%	0%	0%

The majority of teachers agreed that effective collaborative elements were present. Teachers experienced shared goals and expectations (91%). Teachers perceived environments as respectful (81%) and non-judgmental (72%). Sharing opinions and feedback was encouraged (81%) and opportunities to share individual experiences to stimulate discussion were available (72%). Areas for continued development, or where fewer teachers were in agreement, included participants as "always" active and collective engagement in discussions (63%), successes as outcomes of collaborative efforts (63%), and opportunities to develop strategies to achieve common goals/objectives (54%). Generally, 81% of teachers agreed that collaboration enhanced the outcomes of the PD or meeting. Teachers who were "neutral" in many of their responses tended to be those who reported engaging in less collaborative opportunities this year.

Interviews with M-PReP's dual-enrollment SLAM teachers also included discussions of the benefits of collaboration and the CoPs. Teachers spoke positively about the supportive environment with all having opportunities to provide input and feedback as well as share classroom and instructional experiences. This sharing, in particular, was found to be very helpful and teachers expressed that they would like more opportunities to do so. Teachers also reported that grading as a group was useful and would like to meet more often.

A collaboration rubric was developed based on research-based elements (Gajda & Koliba, 2007; Woodland & Hutton, 2012) and finalized through a calibration process.[i] The purpose of the rubric was to provide a guide and framework for the observation as well as minimize bias and subjectivity. The areas of focus included "shared understanding," "decision-making/action," "communication/dialogue," "data utilization," and "structure." Each focus area contained a series of specific elements and a scale for assessing level of implementation. The data from the rubric was also used to inform and improve future collaborative opportunities.

During this first year, the collaboration rubric was used during five meetings facilitated by a College Bridge staff member. Across all of these meetings, the collaborative elements were in place, modeled, and implemented were at expected (or high) levels. Minor exceptions were related to some participants not staying for full meetings or not fully communicating as expected. It is anticipated that in the upcoming project years, the rubrics would be used to assess collaboration in meetings facilitated by teachers, faculty, or others to contribute to the effectiveness of the CoPs.

Looking across the implementation of activities and evaluation findings related to collaboration, M-PReP has laid a solid foundation in this program year for continued work and efforts toward building capacity for collaborative structures and communities of practice among teachers and schools. Initial findings that revealed positive influence on teacher practice (and by successive approximation, student outcomes) only serve to emphasize the important role collaboration plays in M-PReP's effectiveness.

b. use of assessments and data?

Math teachers in the M-PReP schools reported more expanded and effective use of assessments and data in their practice.

Building the capacity for math teachers for improved use of assessments, development of assessment strategies, and analysis of student data was one of the key elements of M-PReP in working with and across the five schools. Data were collected through interviews with teachers and professors of the SLAM dual-enrollment courses as well as a survey administered to all math teachers in M-PReP schools.

Interviews with SLAM teachers (n=6) included questions on assessments and their use during the 2017-18 school year. These assessments included formal quizzes and tests as well as projects and presentations, all of which were aligned to the curriculum and instruction. All teachers found the course assessments to be useful and effective in highlighting types of mistakes and areas in which students needed the most help. Teachers reported using the assessments (and data) in determining pacing, guiding instruction, and focusing practice. One teacher shared how she performed an error analysis with her students and had them generate their own problems to further their understanding. The professors described the effectiveness of the presentations, which included "library walks" which showcased various problems, opportunities for students to earn points through critically reviewing presentations of their peers. The effectiveness of the presentations emerged through the opportunities to observe student thought processes, hear their explanations, facilitate peer feedback, and gain a more nuanced understanding of students' knowledge.

Surveyed math teachers across the five schools (n=16) were asked about their perspectives on the use of assessments and data in connection to their work with College Bridge during this school year. One emerging theme across the responses related to a better understanding of the need for and outcomes of data analysis. One teacher shared how working with assessments and data this year has prompted reflective thinking. "I started asking myself if students are not understanding the question because of a language barrier or because it was worded in a strange way. Since working with College Bridge, I felt that I reflect a lot more to the point where I am reflecting on my reflection of my data analysis." Other teachers shared that their analysis and use of data has been expanded beyond what they had done previously. One teacher shared, "Before working with College Bridge, we used data at our school to inform instruction. working with College Bridge has helped us get access to more data points that we could use to inform instruction." Another shared that this work has prompted them to "create intervention strategies" based on the data. Three teachers, however, did not ascribe any influence or positive change to their work with data. One teacher shared, "I have not yet seen data that tells me something that I did not already know." These teachers also shared that they had not been able to fully engage in all collaborative efforts (e.g., planning meetings, work groups, etc.), which may have attributed to the lack of reported influence.

c. application of PD content?

Teachers perceive the PD content, presented in sessions as well as job-embedded, as meaningful and are able to articulate application into their practice.

As described earlier in RQ2, PD took place in sessions/workgroups and job-embedded classroom opportunities. Descriptions of how M-PReP PD content from sessions/workgroups would be translated into instructional practice and/or applied in the classroom was another indicator of how M-PReP influenced teacher practice. Similarly, dual-enrollment teachers discussed how what took place during job-embedded PD influenced their current and future practice.

Math teachers were asked to describe this application after their participation in a sample of six PD opportunities offered by College Bridge at their schools. Topics included creating performance tasks and SBAC-related strategies. All 34 teachers were able to describe a specific application of content in their classroom. For example, descriptions included direct use with students, such as implementing "I notice/I wonder" strategy when working with math problems. Other teachers described implementing new tools such as PD team-developed performance tasks, and the Item Bank to re-assess students and promote mastery of standards.

Dual-enrollment teachers also credited the job-embedded PD as a learning experience for them and described how they would or might apply what they have learned in future teaching. Facilitation style, inquiry methods, and how students were engaged were commonly noted by teachers as something they learned and would like to include in their own teaching style. Opportunities for observation of teaching and feedback from the professor also provided teachers with meaningful information to apply to their practice. These findings, combined with those presented earlier (see RQ2) on the positive contributions of the PD to student outcomes, provide evidence for the effectiveness of M-PReP PD.

RQ 4. What changes, if any, did leadership teams make at their schools as a result of their experience with M-PReP?

Positive changes were made by leadership teams at most M-PReP schools, specifically related to student selection and placement in dual-enrollment courses.

To address this research question, each M-PReP school is discussed separately to highlight any changes made by the respective leadership teams and the context within which those changes may have been made.

School A

Low pass rates for seniors caused the school's leadership to question if the proper students had been selected for the pre-calculus course. Based on a comparison of outcomes at the other four sites, two future changes were identified: the student selection process and opening the course to juniors.

It was determined that the student selection process was flawed and did not match the process used at the other sites. A decision was made to adopt the uniform student selection process that involves a collaboration between counseling and math departments and mandatory parent involvement.

The second change to the pre-calculus program is to include juniors in the 2018-19 school year. Initially, the program was designed for CSU-bound seniors who have not demonstrated college readiness by grade 12. Additionally, the Common Core is structured such that only students on an accelerated pathway would be eligible for a pre-calculus course in grade 11. Theoretically, students on an accelerated track would not require remediation and the course was restricted to seniors in the two schools that had been offering the SLAM Statistics course in the past as the same model was implemented. In the three schools new to SLAM, teachers and administrators pointed to low AP Calculus pass rates for seniors and recommended the SLAM Pre-Calculus course for select juniors. That decision fared well for juniors as evidenced by both their SLAM Pre-Calculus pass rate (90%) and 75% meeting or exceeding standards on CAASPP proficiency (75%). As such, Schools A and B opted to offer the class to juniors in the 2018-2019 school year.

School B

Although not as extreme as School A, School B also had low pass rates in the SLAM Pre-Calculus course. Similarly, School B will open up the course to juniors in the 2018-2019 school year, but their administration took an additional step to view the longitudinal data for last year's students to determine other factors that may have impacted the pass rates. A large number of students from School B participate in a summer acceleration program each year at a local community college that allows them to complete a course in their math sequence. Through M-PReP, School B is analyzing the outcomes of students who participate in the summer program to determine how to best use the program for continued student success in math.

School C

The leadership team at School C did not make any changes as a result of their experience with M-PReP. Unlike the other four sites, School C tracks students' math progress longitudinally and provides just-in-time remediation. Incoming freshmen with weak math skills take a support class while before- and after-school tutoring and math boot-camps occur regularly. The area of concern for School C is the low pass rate for their students on the AP Calculus exam. The leadership at School C is hopeful that the SLAM Pre-Calculus program will improve student outcomes in Calculus. As such, they are waiting for the AP Calculus outcomes from year two to determine what changes may be made at the site.

Schools D & E

Unlike the other three sites, the math teachers from Schools D and E had little to no prior professional development focused on aligning their curriculum and assessments to the SBAC. Additionally, the math departments at both sites were structured into Professional Learning Communities (PLCs) around the math courses provided. This led to teachers working within their PLC but not aligning their work across grade levels and to the SBAC. Further, the common assessments currently in place were also not aligned to SBAC. The math teachers at both schools requested professional development to vertically align their curriculum and assessment to SBAC in collaboration with their department and the other site. Together, they developed a revised assessment strategy that was approved by their site administration and district. The new comprehensive SBAC Assessment plan is provided in Table 17 below.

Table 17. SBAC Assessment Plan

Course	Start-of-Year Readiness	Semester 1 Benchmark	End-of-Year Benchmark
Integrated Math 1 (IM1)	MDTP* High School Mathematics Readiness Field Test	New SBAC Aligned IM1 Benchmark	New SBAC Aligned IM1 Final
Integrated Math 2 (IM2)	MDTP* Integrated Second Year Readiness Test	New SBAC Aligned IM1 Benchmark	New SBAC Aligned IM1 Final
Integrated Math 3 (IM3)	CAASPP Interim Comprehensive Assessment (ICA)	New SBAC Aligned IM1 Benchmark	New SBAC Aligned IM1 Final

*Readiness tests developed and provided by MDTP

The new assessment plan is paired with professional development sessions that will guide the teachers in the analysis of the data, development of intervention plans, and evaluation and revision of their plans.

RQ 5. In what ways do the development and use of a College Transition Plan (CTP):
a. influence counselors' practice,

Counselors' collaboration, development, and implementation of the CTP in this first year influenced the knowledge and practice among many high school counselors.

CTP began formation in November 2017 with the recruitment and hiring of the College Bridge College Counseling Specialist. In January 2018, one school counselor from each M-PReP school and partner university joined the counseling CoP, making a total group of eight people. The group began planning meetings in February 2018. Due to the limited amount of remaining time available in the academic year, the group decided to focus on creating a CTP for 12th grade students about to graduate and transition immediately to college. The group met both in person and online, with sections of each lesson being completed in between meeting sessions.

Successes of the CTP in this first year included implementing PD opportunities for counselors and addressing unmet student needs. During CoP meetings, counselors learned more in-depth about the college transition process. The Counselor at School C was the only team member who was already implementing college transition lessons as part of her job responsibilities. This team member helped introduce the idea of CTP to the remaining sites.

The establishment of collaborative structures was intended to guide and facilitate the work of the counselors as they developed the CTP curriculum and process. Collaboration took place with other counselors as well as with school teachers, even extending outside of planned bimonthly meetings for at least half of the counselors surveyed. Such additional collaborations included planning and organizing recruitment meetings for the next school year, do in-class presentations for SLAM students on developing college plans, and student selection for upcoming SLAM courses. These counselors shared that these collaboration efforts impacted their counseling practice positively, in terms of improved student selection efforts and supporting students in becoming college bound. One counselor reported, "It helped me understand the program and the outcomes…I didn't understand the desired outcome, but now that I do, I can support in terms of scheduling…" Another counselor shared, "The thought process for working with students to help them become and stay college bound is evolving into a greater collaborative process with all stakeholders – to identify and support students."

Challenges for the first year included time to collaborate, develop, and implement the curriculum.

There were challenges in both the creation and implementation of the CTP curriculum. Time was a major challenge in this first year. To create the CTP, counselors were asked to work on lesson development outside of their normal work week hours. While each counselor expressed interest in doing so, the result was that only a few were able to find the time to produce usable curriculum.

Implementation of the CTP was hindered by limited access to the classroom time needed to conduct the lessons. Classroom teachers denied access to instructional time due to various reasons including, double booking with college professor, needing additional time for test review or other lesson plans. There were two classroom teachers that allowed no classroom access at all, claiming there simply was no time available for CTP lessons.

Not all counselors fully engaged in the collaborative process this year, with other counselors or with school teachers. These counselors also reported little to no impact on their practice, likely a result of their minimal levels of collaboration. Meeting times and other scheduled commitments was the primary challenge reported by these counselors. Counselors were asked for their opinions on how to get more counselors involved in the CTP implementation process. In response to how to get more counselors involved in the CTP process, surveyed counselors shared that more information (e.g., training, PD) should be provided to all site counselors well as ensuring a greater understanding of the goals and desired outcomes of the program. As one counselor stated, "I believe more counselors just need to understand the goal of the program. If we could see where the need was and if their expertise was really needed, I can see them feeling like an important part of the process. Also, showing how this program is ultimately helping our school become better and have greater results." Getting buy-in from school administrators was another suggestion to encourage counselors to be more involved in the process.

b. promotes students' progress toward college graduation?

Counselors reported positive student outcomes, such as college readiness, of CTP implementation at their schools.

The goal of the CTP was to prepare students to maximize their experience of orientation and transition to the anticipated college of attendance. Given that college orientations are large, overwhelming events, the CTP was designed to highlight important areas of the process and allow students to preview and discuss this information in a smaller group setting and safe space.

Development of the CTP curriculum was the focus of the counselors' work with College Bridge. The curriculum consisted of four lessons: (1) Overview of college graduation requirements, including general education and courses required for the major (2) How to plan a college course schedule (3) Mapping out a four-year course plan and (4) How to adjust if plans are changed/interrupted. These four lessons were taught once per week in May 2018 during class time at each site. The lessons were taught by the college counseling specialist and/or the site school counselor.

When asked how this curriculum added to the existing college preparation services offered at the school, all surveyed counselors reported positive student outcomes that included researching potential majors, developing four-year college plans, understanding college class schedules and requirements, and navigating the college system. One counselor shared, "The CTP curriculum helped to see the end goal and place it at the forefront. I thought it was a great way to get the students to do the pre-work before they get to college." Specific activities within the curriculum were viewed as particularly useful toward promoting student progress toward college graduation, such as ordering transcripts and accessing class schedules. Another counselor shared an important learning outcome: "I think students learned about what to expect in their future college life. They also learned about the importance of developing a college four-year plan."

M-PReP students exposed to the CTP curriculum reported positively on indicators of college readiness.

A total of 139 students received curriculum lessons on college graduation requirements, including general education and courses required for the major and how to create a semester college course schedule. These students also reviewed a four-year course graduation plan for their major at their anticipated college of attendance. Of the 139 students, 26 completed the process of taking the sample four-year plan and tailoring it to their personal choices of elective courses and other flexible items within the plan.

Overall, as demonstrated by SLAM student survey responses, 75% of students perceived themselves as prepared to create a plan when faced with school challenges and 89% reported that they understood what was expected/needed to be successful in a college class (see Table 13). These findings provide support for this first-year implementation of the CTP curriculum.

RQ 6. What impact did M-PReP dual-enrollment courses have on students':
a. matriculation?
b. persistence?
c. university graduation rates?
d. community college completion (Associate degree/certificate or transfer) rates?

In this first program year (2017-18), there were both 11th and 12th graders that participated in the dual-enrollment courses. College matriculation for the 12th graders began in August 2018, which falls within the second program year and all data and relevant findings related to this evaluation question will be addressed in the Year 2 Evaluation Report.

RQ 7. What successes and challenges did each school experience with M-PReP?

M-PReP was implemented in five schools in this first program year. Each school has its own "story" and the organizational context of each contributed to the successes and challenges of M-PReP and the achieved outcomes in 2017-18. In response to this research question and to provide a framework for understanding successes and challenges, each school and its relationship to College Bridge is briefly described.

Table 18 presents a demographic overview of each M-PReP school. These data were retrieved from DataQuest[8] and, unless otherwise noted, are from the 2017-18 school year.

Table 18. Demographic Overview of M-PReP Schools

	School A	School B	School C	School D	School E
Enrollment Size	1,857	534	1,007	1,868	1,941
Race/Ethnicity					
Hispanic/Latino	92.4%	99.1%	93.3%	92.4%	87.7%
African American	5.6%	0.2%	6.0%	0.6%	0.5%
White	1.3%	0.4%	0.4%	0.4%	0.4%
Other	0.7%	0.3%	0.3%	6.6%	11.4%
Student Enrollment					
Free/Reduced Lunch	95.9%	93.4%	93.2%	85.9%	87.6%
English learners	25.1%	3.0%	17.7%	9.4%	7.9%
Students w Disabilities	14.8%	2.4%	7.6%	12.4%	11.4%
CAASP Results (Math) Met/Exceed Standards	18.6%	40.2%	35.7%	27.2%	27.9%
Graduate Count (2016-17)	308	102	123	432	420
Completion of UC/CSU required courses by graduates (2016-17)	52.6%	73.5%	99.2%	33.8%	43.3%

Source: California Department of Education.

School A

School A is a large, comprehensive high school in a large urban school district. Prior to M-PReP, School A was a flagship school for the SLAM Statistics program. Overall the lowest performing school served by the program, their students consistently demonstrated the largest gains in performance in SLAM. In the year prior to SLAM, 17% of School A's students who matriculated to a CSU were deemed college math ready. Over four years the average CSU math readiness rate for SLAM students was 78%, whereas the rate for students outside the program was 29%. The

[8] https://data1.cde.ca.gov/dataquest/

administration and SLAM teacher were eager to expand the Statistics course into the larger Math Pipeline Readiness Project. School A was the first site chosen for M-PReP.

Successes. Of the 65 seniors who graduated college math ready in 2018, 57% did so through the SLAM program compared to 1% through the AP program. Despite the challenges, the administration and teachers at School A found value in the SLAM program and worked to improve implementation for their students. Beginning in the Spring of 2018, the administration took a hard look at the challenges from the prior year and collaborated with College Bridge to address the issues. First, the student selection process was reviewed and revised. Implementation still had some issues but administration continues to review the process and identify improvements for the following year. Second, the SLAM Pre-Calculus program was reset. A new Pre-Calculus teacher was identified by College Bridge and approved by School A's administration. The new teacher was heavily involved in the student selection process as well as the professional development for the program. For the 2018-19 school year the Pre-Calculus course has 34 students from well over 50 applicants. The Statistics course continues to offer two sections. Cumulatively, approximately one-third of School A's seniors are in the SLAM program.

Challenges. As School A began the expansion into M-PReP, things began to unravel. One cause, which became apparent later, was that the entire program was resting on the efforts of one individual – the SLAM Statistics teacher. When the program was limited to one class, the teacher worked closely with the senior student counselor and they personally interviewed each student who applied to the program. When the program expanded to three classes (one section of Pre-Calculus and two sections of Statistics) it became unmanageable for one person. The administration did select a teacher for the Pre-Calculus course but that individual did not engage with College Bridge for support with the student recruitment and selection process. The result was improper placement of students in the class for the 2017-2018 school year.

School A also experienced changes in leadership with the principal and an assistant principal leaving in the summer of 2017. The new administration was open to the SLAM courses, but not the other two components of M-PReP – the Math Department CoP PD or the College Transition Plan CoP. Time was not allocated for either; the CTP was conducted as much as possible with students after school.

The erroneous placement of the students and teacher in the SLAM Pre-Calculus class created escalating problems throughout the school year. Ultimately, the university did not approve the original teacher to continue teaching in the program in the 2018-2019 school year.

School B

School B, the smallest of the M-PReP sites, is a STEM-focused magnet school in a large urban school district. The campus is embedded within a large comprehensive high school with students participating in sports and some classes at the sister school. School B began implementation of the SLAM Statistics program one year prior to M-PReP.

Successes. 100% of the 25 students in the SLAM Statistics courses passed in 2017-18. Their teacher credited their success to peer collaboration, tutoring, and the addition of quizzes. Peer collaboration was utilized throughout the course during lectures, support days, and tutoring sessions. Their teacher shared, "When I was lecturing I also had them explain their questions to the class." She explained further, "I try to get them to do most of the talking. I think that they learn more when they're the ones talking. That way I know they actually understand."

The support days and tutoring sessions were also structured around peer collaboration. She reported that "having them work together and struggle together was very helpful" and" when they came for tutoring, it was mostly them helping each other out. They also came a lot for tutoring, every day."

The third component the teacher credited with the pass rate were quizzes that were implemented for the first time this year. She concluded, "I think all my students passed because they were able to get that time to collaborate. The [quizzes] also helped them score higher on the midterm and final as opposed to last year when they didn't have that information beforehand."

Challenges. School B's small size and math placement practices presented a challenge for expanding the SLAM program to Pre-Calculus. Of the 97 seniors in the 2017-18 school year, 31 took Pre-Calculus or Calculus in their sophomore year and an additional 40 in their junior year through summer acceleration programs or grade validation practices. Based on a University of California policy, a passing grade in one semester of a higher math course will validate the failure or omission of a pre-requisite course or courses. This left 25 eligible seniors who had four different senior-year courses to choose from. The result was ten students in the SLAM Pre-Calculus course, with half having previously failed Pre-Calculus or Calculus at least once – sometimes twice – in the previous two years.

Only half of the students in the SLAM Pre-Calculus class passed the course. The students cited difficulties with quadratic and linear equations in contrast to M-PReP students from other schools who found trigonometry the most difficult. One possible factor could be the math placement practice that quickly accelerates students to Pre-Calculus and Calculus with them repeating the course if they fail.

School C

School C is a small to medium-sized charter school that operates within a large, urban Charter Management Organization (CMO). The school had no prior relationship with College Bridge and had learned about the SLAM program through another school within the CMO that had successfully implemented the Statistics program in 2016-2017. School C contracted with College Bridge to provide the new SLAM Pre-Calculus program in 2017-2018 and joined the larger M-PReP program as the only charter school.

Successes. School C experienced success in all three areas of M-PReP. The pass rate of the SLAM Pre-Calculus course met the target with 75% of students earning a C or higher, 100% of SLAM 11th graders met or exceeded standards on SBAC, and 100% of SLAM students completed their CTP. The success of the latter is likely due to School C having a dedicated College Transition Counselor as this individual was instrumental in implementing the CTP.

Challenges. Unlike schools in the past, School C launched the SLAM Pre-Calculus program a year before the Statistics course. This presented an unforeseen challenge that was exacerbated by School C's smaller size and close-knit culture. The Statistics course was designed for students who did not like math and did not plan to take a fourth year of math in high school. Additionally, Statistics is a one-semester course that students completed before the winter break. Conversely, the Pre-Calculus course is a year-long course for STEM-bound students who have begun to struggle a bit in mathematics.

How these differences presented a challenge became apparent in March when the student recruitment process began for the Statistics course the following year. During this time, the SLAM Pre-Calculus students were grappling with the topics they reported were the most difficult in the curriculum; the final exam was also on the horizon. The students, who were known to like math and welcome challenging courses, were vocalizing their struggles to their peers. As a result, the target population for the statistics course were scared away from applying. College Bridge did not foresee this issue as we were accustomed to students eager to enroll in the Spring after their peers successfully completed the course in the fall. It should be noted that the Statistics students also complain about the difficulty of the course before the final but, in retrospect, report that the hard work was worth the effort.

Ultimately it took several attempts over four months to recruit students for the Statistics course. The most successful experience was when the professor provided prospective students with a sample lesson and the Pre-Calculus students successfully completed the course and changed their messaging.

Schools D & E
Schools D & E are large comprehensive high schools in a medium-sized urban school. In 2016, a school district employee reached out to the math chair at their local CSU to participate in a state-funded grant to create a senior-year college math preparatory program. The CSU directed them to College Bridge as they were leading the grant application. When the grant was not funded, the district contracted with College Bridge to provide the new SLAM Pre-Calculus program that was proposed in the grant. The previous grant proposal was revised into M-PReP and the district's board approved their school's role in the eight-year project.

School D Successes. School D had the most successful implementation and outcomes for the SLAM Pre-Calculus program of the five M-PReP sites. Their pass rate of 86% was actually five percentage points lower than School E's rate, however, the students selected for the program had lower past math performance. Of the seniors in the class, none were in accelerated tracks, all had Bs or Cs in their past math class and CAASPP levels of 1 or 2, classified as "not ready" for college mathematics. 75% of the seniors passed. For the 11th graders, only one scored level 4 on the 8th grade CAASPP. The most improvement was seen in the group of 11th graders who struggled with Honors Algebra 2 the previous year. All students passed with 71% improving their grades to As and Bs. Of the group of 11th graders who were not in Honors prior to M-PReP, 82% passed but all with lower grades than they had previously earned. One additional note is that the SLAM teacher at School D reported that the SLAM program was the best professional development she ever received and that she grew as a teacher more in the last year than the past ten combined.

School D. Challenges. The first year of M-PReP implementation was also a Western Association of Schools and Colleges (WASC) accreditation year for School D. The intensive accreditation process greatly limited the availability of administrators and math teachers to meet or participate in PD. The math PD was limited to two sessions. The meetings with the leadership team, counseling and math department regarding student selection in the SLAM program for the following year were sparsely attended and routinely cancelled.

The limited participation of the math and counseling departments resulted in misunderstandings around the purpose of the SLAM courses. Since these courses offered college credit, they were perceived as opportunities for gifted students and not the intervention for struggling students as they are designed. Ironically, School D had implemented the best student recruitment and selection process for SLAM the previous year. Unfortunately, those meetings, program discussions, and procedures were forgotten one year later. The miscommunication from the faculty and staff coincided with the same student selection challenge as School C (see above) making recruitment for the new SLAM Statistics course difficult.

Another challenge at School D was presented by an AP Calculus teacher who feared that the SLAM Pre-Calculus course would prevent students from being successful in AP Calculus. The Pre-Calculus program was developed by CSUDH to be a direct preparation for Calculus and stripped out content that did not serve the purpose to rebuild students' foundations in Algebra. Additionally, the course is problem-based to promote deep thinking and contains less practice than a traditional course. There is no memorization of facts. Stress was put on the SLAM teacher to build the curriculum up with the content, drills, and memorization that was intentionally taken out. This put her in a difficult position as she was required to adhere to the program for the study with fidelity.

School E Successes. School E had the highest SLAM dual-enrollment Pre-Calculus rate with 91% of students earning a C or higher. The student recruitment and selection process for both the SLAM Statistics and Pre-Calculus courses for the following year went smoothly as a collaboration of the administration, math and counseling departments.

Another success experienced by School E was their SBAC PD but the benefits only began to emerge at the end of the year. Unlike Schools A, B and C, Schools D and E had little to no prior training on the topic. The PD team assessed that Schools D and E were approximately three years behind the other M-PReP sites and additional intensive work was needed to bring them up to speed. In early 2018, College Bridge was awarded an additional grant through the CSU Chancellor's Office that included intensive SBAC PD for Schools D and E that would continue through the summer of 2018. The PD included vertically alignment of their math program to SBAC, a new assessment strategy for the Integrated Math (IM) pathway, new common assessments, and a PD plan to incorporate school-wide analysis of assessments and the development of intervention plans. Given School D's limited PD time due to WASC, it was not until the end of the year that School D and E had exactly the same needs. A new plan was developed with the math departments from both sites working as a team, as well as both schools' math PLCs working in collaboration. Teachers reported that this is the first time they have worked in this way with the other high school and they value the experience. Data on their collaboration will be reported in the M-PReP 2018-19 Evaluation Report.

School E Challenges. One major challenge at School E affected the Grades 9-11 math department PD and is also shared by three other M-PReP sites, one urban and two rural[9]. Prior to M-PReP, School E's math department had no previous professional development on the SBAC. Teachers across disciplines did, however, participate in PD that focused on identifying essential standards for the courses they teach. In math, School E follows the Integrated Math (IM) pathways for high schools with IM1, IM2 and IM3 intertwined as opposed to the traditional pathway of Algebra 1, Geometry, and Algebra 2. In choosing essential standards for IM1, IM2 and IM3 the teachers worked within their course-specific Professional Learning Community (PLC) and not as an integrated team. As such, there was also no alignment to the SBAC. The result at School E is a misalignment of the IM pathway to SBAC with the most divergence in IM2. The teachers at School E had invested a great deal of work into their essential standards, pacing and common assessments. The need to undue years of work was frustrating for the math department.

Overall Successes and Challenges

In addition to the successes and challenges experienced at each site, administrators and teachers had the opportunity to share their overall success and challenges in their work with College Bridge this past school year. These results are presented in aggregate.

Administrators from three M-PReP schools responded to survey questions regarding successes and challenges they experienced. One administrator shared how the PD has provided many opportunities for teachers to learn, share, and grow as professionals. Another administrator described the usefulness of pairing CAASPP data with college readiness and persistence data, which supported their school's goals. Helping students achieve success in college-level math was another reported success from this partnership. Reported challenges included inspiring appropriate students to accept the high expectations of college-level responsibilities and delays in the SLAM application process. One administrator suggested, "We need to do a better selling job to our students that they should embrace the post-secondary possibilities with individual commitment and new-found energy."

During individual interviews, SLAM teachers shared successes and challenges to teaching the courses at their respective schools. In terms of instructional successes, teachers spoke positively of the benefits of working with a college professor. Teachers were able to observe how content was taught at the college level using facilitation and discussion strategies that were not typically implemented at the high school level. Teachers learned techniques for inquiry and, at times, were able to receive feedback on their own instruction. In terms of student successes, teachers reported how students were exposed to rigor of college level courses and expectations, built confidence in themselves and their skills, and moved onward with stronger math skills and

[9] The rural school sites will be fully implementing M-PReP in 2018-19. The impact is currently being assessed and mitigated.

capability to conquer more difficult questions. Successful instructional strategies included having students work in collaborative groups and asking students probing and clarifying questions. Reported challenges varied across teachers, with those from the Statistics course noting challenges in teaching a "new" math vocabulary to students, to Pre-Calculus teachers sharing other student-related challenges such as too much variation in skill level and not doing homework. Instructional strategies that were not as successful included allowing too much time for independent work and expecting "quick" answers without time for deliberation or thought.

Professors shared similar successes and challenges in teaching the course. Successes also included students' expanding their interest in math, achieving greater understanding of concepts through real-world applications, and increasing exposure to the rigor and expectations of college courses. Active learning, collaborative groups, and inquiry were successful instructional strategies. Challenges perceived by the professors included some issues in student selection and placement in the class and only being present two days per week.

Math teachers who responded to the end-of-year survey (N=11) also described successes and challenges to working with College Bridge this year. Responses related to successes were both general (e.g., "Given access to more resources and teaching strategies.", "It was fun and a very interesting approach to Math.") and specific. One teacher shared, "I think a success is being able to understand the framework, standards, blueprints, and what SBAC expects from us. I'm more aware of different components now." Other successes included creating common assessments and performance tasks as well as understanding common assessment errors and trends. Reported challenges generally revolved around not having a full understanding of M-PReP's goals and outcomes. Not enough time to meet and collaborate was also a major challenge.

RQ 8. How might the fidelity of M-PReP implementation be balanced with future adaptation in urban and rural communities?

In this first program year, M-PReP was implemented in five urban school sites. Two rural sites have been selected and engaged in pre-implementation activities, such as information gathering and needs assessments, during this first program year. Full implementation of M-PReP in the rural schools will be in place for 2018-19. Therefore, this research question will be addressed in the Year 2 Evaluation Report.

LIMITATIONS

There were two major limitations to the evaluation of M-PReP in its first year of implementation. The first was related to data collection, specifically timing and responses size. This included administering surveys later than intended, not having ample time for follow-up to improve response size, and not maximizing all data collection opportunities available. This latter challenge was specific to missed opportunities to administer surveys during certain PD sessions or to observe collaboration during CoP meetings. Changes to staff and schedules were the most common reasons for these data collection limitations.

The second limitation was more related to project challenges (with schools, districts, teachers, etc.) which had some impact on the evaluation's ability to access data, follow the projected timeline, and generate outputs and deliverables in a timely manner. Given that this is the first implementation year, it is anticipated that both of these limitations will be moderated throughout subsequent project years.

RECOMMENDATIONS

The first year of M-PReP implementation experienced many successes, as demonstrated by the positive findings and outcomes, as well as challenges that typically come with working with multiple sites and contextual demands. Information gathered through implementation and evaluation were fed back into the program throughout the year to sustain the cycle of quality improvement. In review of Year 1, one major recommendation for improved M-PReP implementation emerged:

Begin with math alignment PD then add dual-enrollment courses the following year.

One major lesson learned this year is that when the unique approach of utilizing a dual-enrollment math course as an intervention strategy is brought to a high school it is completely misunderstood. High schools consistently attempt to allow their top math students access to the class. The fact that the college course serves as an exemplar used to align and strengthen their math program is lost. The focus remains solely on the novelty that there is a college math course on the high school campus.

While the dual-enrollment course also serves as a triage to get under-prepared students ready for college-level math, in this regard it is still a "wait-to-fail" method. The root of the problem that the dual-enrollment course is meant to address is limitations in the high school math program. Longitudinal data analysis conducted for the five M-PReP sites suggest math placement and course validation policies may negatively impact students' performance on SBAC and in upper-level math courses. Implementing the dual-enrollment course brings the focus on the course outcomes but away from the programmatic issues that precede the course.

In light of these findings, we recommend working on the systemic issues first with professional development focused on the alignment of curriculum and instruction to SBAC and pre-calculus. From this work the math department can identify weaknesses in the program and create interventions for students in pre-calculus as well as the pre-requisite courses. Then, in the following year, the school will be ready to implement the dual-enrollment course and properly use it to continually improve their math program.

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COLLEGE BRIDGE

Appendix A

MATH PIPELINE READINESS PROJECT (M-PReP) LOGIC MODEL

PROBLEM:
California high school students are not demonstrating math readiness directly resulting in lower college graduation rates.

GOAL:
To develop, implement, and evaluate a Professional Development model that will allow high schools to vertically align their math curricula to the rigors of college and develop college readiness plans for all students.

INPUTS/RESOURCES	ACTIVITIES	OUTPUTS	Short term OUTCOMES	Intermediate OUTCOMES	Long term OUTCOMES
Human Resources: • HS Math Teachers • Math Professors • Content Specialists • K-12, College Counselors • Program Evaluators Partners (LA Region): • 5 High Schools • 2 CSUs • College Bridge Funding: • MSDF Grant • In-Kind Donations from all Partners Research Base	Develop 3 Types of Communities of Practice Focused on College Completion: 1. HS Math Department 2. HS/College Math Dual Enrollment 3. HS/College Counseling • Set Outcome Goals • Develop School-Wide College Math Readiness Plans • Develop, Implement and Evaluate Curriculum and/or Assessments • Analyze data for program revision	• Participation in PD • PD-Based Student Work and Assessment Data • Implementation of Dual-Enrollment Math Courses • Curricular Materials • Assessment Materials • School-Wide Math Readiness Plans • Annual Site-Based Reports • Annual Project Reports	• CoPs Develop Action Plans, Outcomes • High School Teachers Teach College Courses Independently with a Pass Rate of at least 80% • Teachers effectively incorporate PD strategies/content into practice as demonstrated through student work • Students Demonstrate Increased Knowledge in Fundamental Concepts • Dual-enrollment Students Develop Personalized College Transition Plans • Leadership Teams Use Data to Inform Changes at the Schools	• Teams Demonstrate Positive Changes in Collaboration and Fostering of CoPs • Math Departments Align Curricula, Instruction, and Assessments to Rigor of College and SBAC • Teachers' Practice Demonstrates Changes in use of Assessments and Data • Annual Increases in Levels 3 and 4 of the CAASPP • 75% of STEM-Bound Students Go on to Pass Calculus	• Students in M-PReP dual enrollment courses show increase in CSU 4-, 5-, 6-graduation rates to 30%, 40%, and 55% respectively. • Students in M-PReP dual enrollment courses show increase in CCC 6-year completion (association degree, certificate, transfer) rate to 75% • Students demonstrate progress toward college graduation through use of CTP • Math departments and counselors demonstrate capacity for sustaining CoPs and M-PReP

Appendix B

M-PReP – SLAM Dual Enrollment
Student Selection Process

	Steps	People Involved	Due Date
1	Initial Site Meeting to set student eligibility criteria. Recommended as either two meetings (site leadership, followed by math & counseling teams) or one large meeting with admins, math and counseling together.	Led by CB Staff Administrators Counselors Math Teachers	
2	Run Potential Student Roster (based on criteria set in meetings above)	Counselor	
3	Information Session for students who meet criteria stated above (give interested students application and flyer)	Led by CB Staff Counselor	
4	Student Application Step 1 (students complete application and turn in to Math teacher to complete Recommendation section)	Math Teacher	
5	Student Application Step 2 (math teacher gives application to Counselor)	Math Teacher Counselor	
6	Review applications for Parent Meeting invite list (confirm criteria met, look for NOs on teacher recommendations)	Counselor (CB staff if needed)	
7	Parent / Student Information Night	Led by CB Staff Counselor Math Teacher (if needed)	
8	Parent Follow Up Contacts (for Parents who have pre-communicated that they are unable to attend scheduled Info Night)	Led by CB staff	
9	Determine if more student candidates are necessary	CB Staff Counselor	
10	Review of Applications and Final Student Selection	CB Staff Counselor Math Teacher(s)	

Appendix C – Data Collection

The following table provides a description of the purpose of each data collection activity during the 2017-18 project year. Data and results from these efforts were utilized in the evaluation and informed program quality and improvement efforts.

Primary Data Collection	Data Source	Purpose
Online End-of-Course Student Surveys	M-PReP dual-enrollment students	These surveys were administered at the end of each dual-enrollment course. They include questions on students' course experiences, perceptions of math skills, preparation and college readiness, and overall experiences.
Online CAASPP Experience Student Survey	All 11th grade students at M-PReP schools	This survey includes questions on preparation for the exam, types of practice, and perceived difficulty and understanding of various problem types and instructions. Students are also asked to reflect on what might be needed, such as skills and content, for them to be more successful on the exam. Overall experiences with the exam process are also asked.
Online End-of-Year Survey	Teachers, counselors, administrators at M-PReP schools	This survey includes questions related to the staff's perceived outcomes in their work with M-PReP throughout the year, such as data use and influence on practices. Questions on counseling and the CTP process are included specifically for counselors. Collaboration and its effects are also addressed.
Post-PD Session Survey	Participants of PD sessions at M-PReP schools	This survey is administered after a PD session and is intended to assess, through description, the usefulness of the session content, as well as the applicability of the content in the classroom. Scaled questions related to effective collaborative elements incorporated into the sessions are also included.
Instructor Interview	Teachers/Professors of Dual-enrollment courses	The interview questions are specific to course successes, challenges, potential improvements, outcomes, and student selection. Perceptions of the teacher-professor relationship and other collaborative experiences are also addressed.
Collaboration Observation Rubric	Participants of PD sessions/meetings with M-PReP teachers	This rubric was intended to directly observe the dynamics of CoPs and the implementation of effective collaboration elements. The data and results also serve to corroborate self-report data collected from other sources.
Secondary Data Collection	**Data Source**	**Purpose**
MDTP Assessment scores	M-PReP dual-enrollment students	MDTP assessments (both pre- and post- versions) were administered by the teachers during class hours. Teachers sent all score reports to College Bridge. Scores were subsequently analyzed to determine potential knowledge gain in fundamental math concepts.
Math CAASPP scores	All students in M-PReP schools	The CAASPP exam was administered by school staff to 11th grade students at each school site in the spring. These scores, along with previous 8th grade CAASPP scores for all students and 11th grade scores for current 12th graders, were provided in an Excel database by the district to College Bridge.
AP Math Exam scores	All students in M-PReP schools who took an AP Math exam in 2017-18	The AP exams were administered by school staff to students enrolled in AP math courses during the 2017-18 school year. Scores were provided in an Excel database by the district to College Bridge.
High school math courses and grades	All students in M-PReP schools	School districts provided all current and previous high school math courses taken (along with grades) for each student enrolled in the 2017-18 year. Course-taking patterns were used primarily for discussions with each respective school's leadership and teachers. These data were provided in an Excel database by the district to College Bridge.
Dual-enrollment course grades	M-PReP dual-enrollment students	Teachers determined end-of-course final grades for students in dual-enrollment courses. Teachers sent gradebooks directly to College Bridge.