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Non-academic Support Math Faculty Members Provide in Developmental Accelerated and Corequisite Support Courses in California Community Colleges

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Non-academic Support Math Faculty Members Provide in Developmental Accelerated and Corequisite Support Courses in California Community Colleges

A dissertation submitted in partial satisfaction of the

requirements for the degree Doctor of Education

by

David James Vakil

2021

ABSTRACT OF THE DISSERTATION

Non-academic Support Math Faculty Members Provide in Developmental Accelerated and Corequisite Support Courses in California Community Colleges

by

David James Vakil

Doctor of Education

University of California, Los Angeles, 2021

Professor Diane Durkin, Co-Chair

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To guide practitioners of rapidly evolving developmental math reform in community colleges, this study surveyed California community college math faculty who taught accelerated developmental courses or corequisite support courses. The survey was conducted during the early implementation phase of both course types, during spring and fall 2018 terms. This study measured faculty's self-reported provision of forms of non-academic support, frequency of implementation, and reasons faculty believed the support would help students succeed. The literature review guided grouping non-academic support into five forms: nurturing, helping students' motivation, providing a growth mindset theory of intelligence, helping provide social integration, and helping to provide sense of belonging in part to assist in combatting stereotype threat.

Respondents reported providing all five forms of support, with the most frequent support and the strongest and most varied strategies provided for nurturing scenarios. Respondents provided least frequent and fewest different strategies to support social integration and sense of belonging scenarios. However, overall in open-ended questions, math faculty most strongly foregrounded helping students to get or remain connected to others and to work with peers and college services, so as to not feel alone, which points towards understanding and desiring to provide sense of belonging support.

This study suggests that math faculty might benefit from professional development focusing on training to implement brief activities that strengthen students' sense of belonging, including readings about setbacks being common and temporary, remaining resilient, writing about math fears and concerns, and activities to help students find characteristics they share with peers.

The dissertation of David James Vakil is approved.

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2021

Dedication

This dissertation is dedicated to my wife, Carolee G. Vakil-Jessop.

It is further dedicated to my mother Margaret Chitty, as well as to my mother-in-law Judy Jessop, my stepson Joshua J. Casper, and my daughter-in-law Madelynn R. Sanchez.

I also dedicate this to my father Piyush Vakil, and

my father-in-law Mark A. Jessop,

who both left us too soon and during the preparation of this study.

Table of Contents

List of Figures

List of Tables

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This study never would have begun without my parents and their unending dedication to my education throughout my entire life. My love for math developed at an early age when my Mom encouraged me to learn beyond what was taught in the first-grade curriculum, working with me regularly to teach me what I later learned was algebraic concepts. My father, who was supportive as I began the UCLA Educational Leadership Program, unfortunately could not be here at the end. But was equally encouraging. He also often reminded me about the importance of school-life balance and having fun even while in a doctoral program.

I never would have conceived of attending graduate school or a doctoral program a second time without the advice, guidance, and nudging from my good friend, Cynthia Mosqueda. She introduced me to ELP, encouraged me to apply, and has been helpful throughout the years in the program.

My interest in this research topic was born from conversations with El Camino College math department faculty, who first helped me recognize the importance of affective domain work. Chief among these inspirers are Judy Kasabian, Susan Taylor, Sue Bickford, Jeff Cohen, Trudy Meyer, Susie Tummers, and Lars Kjeseth.

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My final word of thanks goes to all of the respondents who participated in this survey and formed the basis of this research.

Vita

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Chapter 1 – Problem Statement

Introduction to the problem

Many college students do not place into a college-level math courses for collegiate math and therefore must prepare by taking developmental math courses or enrolling in corequisite support courses with college-level courses. In community colleges, traditional developmental math sequences typically involve at least three courses for students entering with the least academic preparation. However, in the 2000s and early 2010s some colleges began offering new single-term courses, called accelerated courses, that prepare students for a specific college-level course, often statistics. Subsequently, another model has grown in popularity since the late 2010s, in which students directly enroll into college-level courses while also getting additional help in a concurrently enrolled course, called a corequisite course. These accelerated and corequisite support courses are both new to higher education and also high stakes for developmental students because these single courses replace multiple – typically two or three and occasionally four – traditional math courses. Therefore, students are more likely to succeed in these high-stakes courses when instructors provide non-academic support in addition to math-specific content. This qualitative survey study explored forms of non-academic support in the new, high-stakes accelerated and corequisite support courses that California community college math instructors reported they provided, how often the instructors believed they provided these supports, and the reasons instructors believed students would be helped by these forms of non-academic support.

Approximately 60% of community college students require at least one developmental math course (Attewell et al., 2006) to prepare for college-level courses, and many students need more than one course (Bailey et al., 2010a). Students' likelihood of completing a college-level math course strongly correlated with enrolling in fewer prerequisite courses (Bailey et al., 2010a). Accelerated developmental math curricula have shown promise to move more students into and successfully through college-level courses, predominantly statistics (Edgecombe, Jaggars, et al., 2013; Hayward & Willett, 2014; Zachry Rutschow et al., 2015).

Perhaps even more promising than accelerated courses are corequisite support classes that a student would be required to take concurrently when enrolling in a college-level math class as their first college math course, an even newer reform to college-level math completion. In a randomized controlled trial of community college students who sought to enroll in college-level statistics, students success outcomes were significantly improved for students who enrolled directly in a college-level statistics course in New York along with a corequisite support course compared to students who were required to enroll in an algebra prerequisite class (Logue et al., 2016; Logue & Watanabe-Rose, 2014). After this study and follow-up research on corequisite support in Tennessee (Belfield et al., 2016), community colleges began implementing corequisite support in addition to or instead of accelerated courses. As with accelerated courses, corequisite support courses are high-stakes for students, suggesting non-academic support may be critical for students to successfully complete the courses.

In California, popular statewide professional development for instructors of these new, high-stakes accelerated and corequisite support courses are recommended by research and practitioners (Cuellar Mejia et al., 2020; Hern & Snell, 2013). Recommended training includes providing non-academic support to students, including social integration, nurturing, motivation, theories of intelligence (i.e., “fixed” vs. “growth” mindset,) and addressing stereotype threat through “sense of belonging” and self-affirmation exercises, (Booth et al., 2013; Cohen et al., 2009; Dweck, 2006; Walton & Cohen, 2011; Yeager & Walton, 2011).

Context of the problem

Investment in a community college education generates significant concerns for both society (Stiles, Jon et al., 2012) and the individual. Community college students can increase annual wages by 5-10% for each school year completed (Marcotte et al., 2005). Completing a college-level math course early, within the first two years of beginning higher education, doubles the chances of completing a bachelor's degree (Adelman, 2006). The benefits of completing college-level math skyrocket (quadruple) for students who begin higher education needing remediation (Roksa & Calcagno, 2008).

Nearly 60% of students entering higher education, and especially those entering through community colleges, need remediation in English, Reading, or Math (Bailey & Cho, 2010). The situation is amplified at community colleges, compared to four-year colleges, because remedial education is increasingly being shifted from four-year colleges to community colleges (Bettinger & Long, 2004; Kozeracki, 2002; Soliday, 2002 as cited by Attewell et al., 2006). Success and persistence rates in community college remedial course sequences have been low, both nationwide (Bailey & Cho, 2010) and in California (Bahr, 2010a). According to Bailey and Cho (2010), success rates in community college remedial courses average approximately 70%, while sequence completion is approximately 30%. In math, the situation is worse. According to the California Chancellor's Office Basic Skills Progress Tracker, of the cohort starting in Fall 2008 including all 16,733 California community college (CCC) students enrolling in their first math course four levels below transfer, only 1,019 students (6%) had successfully completed a college-level math course at the same college by the end of Spring 2013.

In 2013, California enrolled 2.3 million community college students; nearly 20% of community college students in the United States are in California (*About Community Colleges*, 2013; California Community Colleges Chancellor's Office, 2013). California course success rates are comparable to those across the nation. According to Bahr (2010), approximately half of first-time California community college students enrolled in a remedial course. Bahr also noted that only one-third of students who begin in remedial courses later completed a credential, a degree, or transferred to a four-year college. In a related study, Bahr (2010a) found that only one-fifth of students who need remediation in both English and math become eligible for college-level English and math.

These low completion rates for community college students beginning math at the lowest level have resulted in increased attention to remedial education, and, eventually in 2017, to the adoption by the state legislature of a significant reform, AB 705. Prior to 2017, research focused on: how students transition from high school to community college; attrition rates associated with long course sequences; and creating school environments that help students become socially integrated, feel nurtured, improve motivation, develop a "growth mindset" theory of intelligence, and address stereotype threat by developing a sense of belonging or through self-affirmation exercises. I explore each of these topics below and include further statistics related to remedial math at the national level.

Student transition from high school to community college

In traditional college math curricula, high school graduates enrolling in a community college must start their math education either by enrolling in a math course that has no prerequisite or by demonstrating math skills at a level that satisfies prerequisites for more advanced courses. Students take a placement test to assess their skills. Results of placement tests indicate that most (91%) incoming students are not ready for college-level math. A majority (72%) of California community college students place into remedial courses (Brown & Niemi, 2007).

Until a better system of initial math placement is found, community colleges that rely on math placement tests will continue to see many students placing into pre-collegiate, often remedial, math courses. An important issue for these students is how the colleges can create curriculum and structures that allow the students to successfully complete the required math courses sequences that serve as a prerequisite for college-level math. At both the state and the national level, completion rates in these sequences have room for improvement.

Based on improvable outcomes of initial math placement processes and the successes of corequisite support courses, Florida passed legislation in 2013 (Park-Gaghan et al., 2020) that exempted students from college placement tests. Similarly, California passed AB 705 in October 2017. This bill required community college to use students' high school grades as the primary placement component instead of a placement exam.

National statistics for remedial education success

In Fall 2009, 17.6 million high school graduates began their pursuit of higher education. Of these, 7.1 million (40%) enrolled at a two-year college. Most (94%) of these two-year college students enrolled at one of the 1070 public two-year college (henceforth called a "community college") (National Center for Education Statistics, 2012), 97% of which are open admissions and have no entry requirement. Therefore, to enroll in a community college students do not need to demonstrate math proficiency (Aud et al., 2013). In fact, over 99% of the nation's community colleges offer remedial coursework (National Center for Education Statistics, 2012).

A study performed by the Community College Research Center (CCRC) (Bailey et al., 2010a) examined remedial student enrollment and completion in 57 Achieving the Dream community colleges throughout the United States. The researchers found that only one third of students who began math in remedial courses successfully completed a college-level math course. The most common non-success occurred when students did not pass a course in which they enrolled (29%). The researchers also found that 11% of the remedial students did not succeed in the sequence because they never enrolled in their next needed math course. Overall, the researchers found that the math course completion rate decreased as the number of remedial courses required increased – needing to take more math courses resulted in less success. Some researchers note that there are several places in a multi-course sequence where students may become unsuccessful in the sequence. For each course, a student may not pass or may not enroll. This phenomenon is sometimes called the "leaky pipeline" in remedial education (Hern, 2010, p. 1), with leaks occurring at multiple "exit points." Low course success rates, often seen in math courses, increase the leakage rate as students progress through the pipeline.

Cost of remedial higher education

Remedial course sequences, in addition to showing low successful completion rates, also cost educational institutions billions of dollars annually. One report (*Paying Double: Inadequate High Schools and Community College Remediation*, 2006) estimated the national yearly economic losses associated with college remediation is $3.7 billion. This included $1.4 billion to provide the remediation and an additional $2.3 billion in economic losses due to students not completing the remediation. This estimate is similar to another remedial cost estimate, $1.9-2.4 billion (*Diploma to Nowhere*, 2008).

Remedial education reform efforts

The high cost and low success rates for remedial education have led many researchers and practitioners to examine alternate course structures to improve student outcomes. In addition to improving the placement methods, research focused on accelerated remedial courses (Edgecombe, Jaggars, et al., 2013), contextualizing remediation (Research and Planning Group, 2009; Zachry Rutschow & Schneider, 2011), mainstreaming remedial students into college-level classes with embedded (or, comparably, corequisite) supplemental support (Bailey & Cho, 2010; Bettinger & Long, 2005), and providing non-academic support to help students persist in specific courses and college (Bailey et al., 2011; Booth et al., 2013).

Forms of non-academic support include social integration (Tinto, 1993), nurturing (Booth et al., 2013), improving motivation (Cox, 2009a, 2009b; Grubb & Cox, 2005; Karp, 2011), developing an incremental theory of intelligence or "growth mindset" (Dweck, 2006), and addressing stereotype threat (Steele & Aronson, 1995) such as by creating a sense of belonging (Walton & Cohen, 2011). Some researchers and practitioners believe that combining the recently created accelerated courses with non-academic support will lead to significant improvement in the rate of students progressing through college-level math; they also believe that the best option is to allow students to be able to directly enroll in college-level courses when supplemented with corequisite support (Hern & Snell, 2013), a relatively new idea to higher education math.

Accelerated remedial curricular models and corequisite support

According to my analysis of California community college math offerings in Fall 2017, several dozen California community colleges had already begun offering shorter remedial math course sequences in addition to or instead of the more traditional sequence of courses. For example, in Fall 2009, Los Medanos College implemented a remedial accelerated math course. An accelerated course offered redesigned curriculum in which some of the content taught in a multiple-course-sequence was taught in the accelerated course. However, an accelerated course was typically designed to prepare students for a specific subsequent college-level course and therefore used fewer instructional hours and offers more directed preparation than the total time required to complete multiple courses combined. In math, the most common acceleration example was to prepare students for a statistics course through a “pre-stats” course versus requiring students to pass arithmetic, pre-algebra, elementary algebra, and intermediate algebra. In order to ensure that an accelerated course would prepare students for the subsequent courses, some accelerated courses included “backward design from college-level courses” (Hern & Snell, 2013, p. 6), whereby skills needed in future courses formed the core of the accelerated course. More specifically, in a backward design model, accelerated courses cover some of the content in the arithmetic, pre-algebra, and algebra courses, but not all of it. Accelerated courses only cover the relevant skills that are needed for later application in the students’ next course (often statistics,) as well as also including core fundamental math understanding. The four-class traditional sequence could span 12-18 units for students, while a pre-statistics accelerated class might be 4-6 units.

Student success rates seen in these accelerated courses, such as the one at Los Medanos, showed significant improvement compared to students enrolling in traditional course sequences (Hayward & Willett, 2014; Hern, 2010). These high success rates indicate that the stakes were high for students: if students passed the accelerated course, they could skip several traditional math courses. Figure 1 illustrates this and compares a traditional math course sequence with accelerated and corequisite support models.

In the mid 2010s, the growing desire to offer accelerated courses, as noted by Edgecombe (2011), led to the formation of a California statewide consortium dedicated to accelerated courses. The California Acceleration Project (CAP) provided training for all 114 California community colleges in Math, English as a second language, and English accelerated courses (The California Acceleration Project, 2016).

In the late 2010s, reform initiatives had transitioned from promoting accelerated courses to promoting new placement processes to allow students to start their college math courses in a college-level courses while being provided additional support. After Florida's changes to the placement process and subsequent successful adoption of corequisite support (Park-Gaghan et al., 2020). other states followed suit and adopted successful corequisite support courses, including in Tennessee (Belfield et al., 2016; Ran & Lin, 2019) and Indiana (Royer & Baker, 2018) and West Virginia (Palmer, 2016). Similarly, in California, AB 705 was passed in 2017 after years of reviewing evidence such as the studies referenced above. In addition to changing the math placement practices to being based primarily on high school grades, AB 705 also prevented colleges from requiring students to enroll in prerequisite courses except in rare circumstances. As a result, corequisite support courses became more popular in California. Furthermore, interest in developing accelerated developmental courses waned because students could not be required to enroll in remedial courses. This transition from the relatively recently-developed accelerated courses in favor of new corequisite courses was evident in this study as early respondents privately informed me about their colleges' curricular shifts.

Non-academic support

Research documents the importance of incorporating non-academic affective domain support into teaching generally (Bailey et al., 2010a) and specifically into the new and high-stakes accelerated courses (Edgecombe, Jaggars, et al., 2013) and corequisite support courses (Cuellar Mejia et al., 2020). In an analysis of 887 students from 13 California community colleges throughout the state (Booth et al., 2013), six factors were identified as supporting students' completion: helping students focus on their goals, nurturing students, helping students engage with the college, connecting students with the college, valuing students, and directing students to courses and services that support their goals. Three of these success factors (nurturing, valuing, and connecting) are non-academic methods of supporting students that focus on the affective domain.

Similarly, in a position paper describing the next steps in accelerated remedial education, Hern and Snell (2013) suggested they have success incorporating activities related to “growth mindset” (Dweck, 2008b), reducing academic fear, increasing students’ willingness to work on challenging tasks, and increasing motivation in the course. Other studies also highlighted the importance of addressing these aspects of learning (Dweck, 2006; Gurin & Gurin, 1970; Leese, 2010; Ogbu, 1992; Oyserman, Bybee, & Terry, 2006; Portes, 1999; Rendón, 1994; Sanders and Sanders, 2006; Tinto, 1987; all as cited by Bickerstaff et al., 2012; Grubb & Cox, 2005; Roueche, 1981).

Later results (such as Cuellar Mejia et al., 2020; Hayward & Willett, 2014; Illowsky et al., 2013; Mery, 2011) highlighted the need for further research on non-academic support in redesigned accelerated developmental and corequisite math courses. While research has highlighted the benefits of accelerated and corequisite support courses and providing non-academic support in such courses, the educational research has not yet determined the prevalence of such support. Also unknown, and specifically questioned in Cuellar Mejia et al. (2020), is what forms of research-suggested non-academic support are provided in accelerated and corequisite math courses. This study helped address these gaps.

Project summary

For this qualitative study, I surveyed California community college math instructors of developmental accelerated courses and corequisite support courses. I chose these courses because they were both new to higher education and because they are high stakes for students. I sought to learn which of the five forms of non-academic the instructors said they provided. I inquired how often each form of non-academic support was provided and for what reasons the faculty believed these forms of support would help students. This allowed me to deduce some best practices and recommendations about faculty professional development to share with community college math faculty.

Research questions

1. Which forms of non-academic support do community college instructors of accelerated developmental and corequisite support math courses say they provide to students?
2. How often do instructors say they provide these supports?
3. For what reasons do faculty believe these forms of support are likely to help students?

Design and methods

My study was qualitative survey design. The survey encompassed of a sample of California community college accelerated developmental and corequisite support math instructors. A survey was appropriate because the prevalence of the implementation of forms of non-academic support and instructors' understanding of the reasons to provide such support are not yet well-understood.

I distributed surveys to a complete list of all California community college departments teaching accelerated developmental and/or corequisite support math courses. Previously, I conducted a thorough analysis of all 114 California community college math courses during the 2014-15 academic year and again in the 2017-2018 academic years. Based on my findings and data available through the state's Chancellor's Datamart, I determined which colleges were offering acceleration and how many sections they offered. At that time, many colleges were transitioning from acceleration to corequisite support during this research study.

For the departments offering accelerated and corequisite support courses, the surveys were sent directly to the math department chairs, faculty peers in the California Mathematics Council of Community Colleges, and math deans; these proxies were asked to forward the survey to the instructors of the designated courses. The survey was distributed twice, once in May 2018 and again in November 2018.

I explored the following five forms of non-academic support: connecting students with peers and the college (social integration); helping students feel they are in a nurturing environment; improving student motivation in the math class and college overall; helping students develop a “growth mindset” useful for overcoming challenging tasks; and combating stereotype threats such as through exercises to develop a sense of belonging and/or a sense of self-affirmation.

Significance and public engagement

I plan to share my findings through the Research and Planning group (RP group), the American Mathematical Association of Two-Year Colleges, the California Mathematics Council of Community Colleges, the California Community Colleges’ Success Network, and other relevant conferences across the state and nation. My ultimate goal is for community college math instructors to use my findings to adapt their courses and organizational structures to improve student success in developmental accelerated math.

Chapter 2 – Literature Review

Problem restatement

Completion of a community college education generates significant economic improvement for both society by increasing tax revenue and reducing the need for prisons and social welfare programs (Stiles, Jon et al., 2012) and the individual student by increasing annual wages by 5-10% for each school year completed (Marcotte et al., 2005). Completing a college-level math course during the first two years of higher education doubles the chances, from 37% to 70%, of completing a bachelor's degree, whether starting at a community college or a four-year university; completing a college-level math course within the first year increases bachelor's degree attainment even more (Adelman, 2006; Offenstein et al., 2010). The benefits of completing college-level math quadruple for students who begin higher education needing remediation (Roksa & Calcagno, 2008). While the stakes are high because college-level math completion is so important, unfortunately completing such a math course is unlikely for students placing two or more levels below college-level in a traditional math sequence. As a result, only one-third of developmental students earn a degree or transfer to a four-year college (Perry et al., 2010).

Nationwide in the 2000s, approximately 60% of community college students placed into developmental math but only 30% of these students successfully completed the developmental sequence and became eligible to enroll in college-level mathematics courses (Bailey & Cho, 2010). Similar statistics were seen in California's community colleges (Bahr, 2010b). The structure of the math curriculum typically involved long sequences of up to four or five remedial courses and contributed significantly to the low completion rate of the sequence (Bailey et al., 2010a). Therefore, some community colleges looked to other and newer curriculum models to increase sequence completion. One successful new model offers remediation in the form of accelerated courses (Edgecombe, Jaggars, et al., 2013). Accelerated courses offer students content-specific just-in-time remediation commensurate with skills that they will need in successive college-level math courses. A second successful new model is corequisite support, in which a student enrolls in a support course concurrently with a college-level math course (Belfield et al., 2016; Cuellar Mejia et al., 2020; Logue et al., 2016; Palmer, 2016; Park-Gaghan et al., 2020; Royer & Baker, 2018). Figure 1 compares the traditional math sequence with both of these newer forms of math education designed to help students complete college-level math more quickly and more successfully.

Because of the high-stakes (e.g., higher-unit and pre-requisition for college-level coursework) and the associated intensity of accelerated courses and because of the focus on support in corequisite courses, developmental education researchers continue to advocate providing non-academic support as part of math instruction. Recommendations include: socially integrating students into the college, providing a nurturing environment, improving student motivation, developing students' theories of intelligence ("mindset,") combating stereotype threat, and helping students develop a sense of belonging and self-affirmation (Anderman et al., 2011; Aronson et al., 2002; Bean & Metzner, 1985; Blackwell et al., 2007; Booth et al., 2013; Dweck, 2008b; Good et al., 2003; Halpin, 1990; Inzlicht et al., 2006; Karp & Hughes, 2008; Schmeichel & Demaree, 2010; Silva & White, 2013; Steele & Aronson, 1995; Tinto, 1993; Walton et al., 2012; Walton & Cohen, 2011; Yeager et al., 2013; Yeager & Walton, 2011).

In California, accelerated developmental education took a foothold in the early-mid 2010s. According to my analysis of California community college catalogs and to the co-leaders of the California Acceleration Project, (CAP) accelerated developmental math course offerings began in the late 2000s/early 2010s and expanded until the late 2010s, when accelerated courses yielded to corequisite courses. There were early indications (Mery, 2011) that non-academic support plays a critical role in students' successful completion of the new and high-stakes accelerated and corequisite mathematics courses.

Chapter outline

This chapter begins by reviewing the existing literature about initial developmental education placement processes and outcomes. Next I discuss the remediation needs of high school graduates both in the United States and throughout California, particularly in the community colleges. I follow by reviewing characteristics and frequency of developmental math students, including disaggregation by ethnic minorities, and the cost for providing developmental education in the traditional curriculum structure. The research shows that existing developmental courses result in low sequence completion rates which suggests a need to reform developmental education, both by accelerating the developmental sequence or skipping it altogether via corequisite support and also by integrating non-academic support into math courses. I conclude with descriptions of five forms of non-academic support that can be integrated into developmental math classes in community colleges.

High school students remediate too often; college placement plays a large role

Often, students who begin higher education complete their initial placement in math and English via one single modality: a placement test (Brown & Niemi, 2007). According to a study by the National Center for Education Statistics (Parsad et al., 2003) on postsecondary remedial education, 92-93% of public two-year colleges used placement tests to determine college-readiness in reading, writing, and math.

Several studies indicate that the relying on tests is a poor predictor of future student success. In a review of the research, Hughes and Scott-Clayton (2011) claimed that while the most common tests, ACCUPLACER and COMPASS, are valid predictors of success in college-level courses generally, these tests have not been predictors of student readiness for college-level math and English. Several studies reviewed by Hughes & Scott-Clayton (2011) found that 20-30% of students are initially placed incorrectly in English and/or math. Data from the National Center of Education Statistics (NCES) (Provasnik & Planty, 2008) show that 62% of high school graduates who immediately enrolled in community colleges completed Algebra II or higher, yet fewer than 40% of students initially placed into the next course immediately following intermediate algebra or algebra II. Results like this and by others (see, for example Hughes & Scott-Clayton, 2011; Packman & Mattern, 2009; Smith Jaggars, Shanna et al., 2013) showed students were being placed into more developmental courses than they may be necessary

Scott-Clayton (2012) studied an urban community college and found that placement tests are better able to predict getting a "B" or higher grade rather than a passing ("C" or higher) grade. Thus, placement tests are better at predicting who will perform well rather than who is likely to fail. In part, Hughes and Scott-Clayton attribute the non-predictability of readiness for college-level work to not including affective and non-cognitive measures in assessments, as suggested by Sedlacek (2004). Sedlacek believed tests are not good predictors of students' grades, especially "for people of color, women, or anyone else who has not had a White, middle-class, Euro-centric, heterosexual, male experience in the United States" (Sedlacek, 2004, p. 6) because they do not include measures of non-cognitive skills.

Another reason assessment may not accurately predict readiness for college-level work is how students approach the assessment process. While the placement test has high-stakes for students, students rarely understand the significance and inadequately prepare. Magee's dissertation (2010) explored initial math placement at a Los Angeles area community college.

She found that 25% of students who took a math placement test learned about it one week prior and that 56% of students did nothing to prepare. These results are consistent with past and subsequent studies (Bueschel, 2003; Fay et al., 2013). Fay et al found that 64% did not prepare due to lack of knowledge about available preparation materials. The evidence clearly indicates that initial placement in math and English can be improved.

Belfield and Crosta (2012) found that using high school GPA instead of placement tests would have reduced the error rate by half in both English and math. They suggest that incorporating high school grades along with placement tests would result in fewer placement errors and less need for students to enroll in developmental courses. Meuschke and Gribbons (2003) found that at College of the Canyons, a California community college, course success rates were highest (83-86%) when students were placed using multiple measures, including offering exceptions to placement in math and English. Based on these results and similar studies from the Community College Research Center, Long Beach City College (LBCC) began using students' high school transcripts as an integral part of the assessment and initial placement process. Based on this pilot project at LBCC, 22 California community colleges participated in the Student Transcript-Enhanced Placement Study (STEPS) (Illowsky et al., 2013). In 2016, STEPS evolved into the larger Multiple Measures Assessment Project (MMAP) with at least 28 California community colleges participating, and some faculty leaders say more than 60 are participating (Research and Planning Group, 2016).

Bailey (2009) hypothesized that under-placement discourages enrollment in college level courses and found (Bailey et al., 2010a) that one third of students who were referred to developmental courses never enrolled. Clearly, there were opportunities to improve initial math placement for entering students, with the likely result of reducing the need for remediation.

For these reasons, Florida passed legislation in 2013 (Park-Gaghan et al., 2020) that exempted students from college placement tests. Similarly, California passed AB 705 in 2017. This bill required community college to use students' high school grades as the primary placement component instead of a placement exam. Subsequent analyses suggest both placement reforms improved student successes (California Acceleration Project, 2019; Cuellar Mejia et al., 2020; Henson, 2020; Park-Gaghan et al., 2020).

Unfortunately, while placement reform was widely adopted in 2017 in California, practice still results in far too many students placing into lower levels of mathematics. What we do to help community college students who enroll in developmental math is critical to their success in college.

Remediation in math is common in the U.S. and mostly in community colleges

A significant portion of the provision of remediation in the U.S. has shifted to the community colleges. Several states have removed developmental courses from public four-year universities and directed students to community college for remediation (Attewell et al., 2006). At least ten states either prevent or discourage remediation at four-year institutions, including the California State University system (D. Jenkins & Boswell, 2002). Two key reasons for this shift of remediation to community colleges are a philosophical disagreement about teaching pre-collegiate courses at four-year institutions and that it is more costly to remediate at a four-year college than two-year institution (Bettinger & Long, 2005). The national need for remediation continues to grow, therefore the impact will be mostly felt at community colleges.

Assessments of first-time community college students indicate that between half and three-fourths need math remediation. Studies, such as the National Education Longitudinal Study of the 1988 cohort of entering high school students, find the initial remedial placement and enrollment percentage at 55-60% (Attewell et al., 2006; Bailey et al., 2010a; Bettinger & Long, 2005). Attewell and colleagues measured the 58% participation rate through (NELS:88); Bailey, Cho, and Jeong measured a 59% enrollment rate from 257,000 students attending Achieve the Dream community colleges; and Bettinger and Long measured a 55% rate by examining all Ohio first-time community college students who graduated from high school no more than two years prior to enrolling in community college.

<u>Remediation is common in California community colleges</u>

California educates 20% of all U.S. community college students (*About Community Colleges*, 2013; California Community Colleges Chancellor's Office, 2013) and, when compared to the national community college rates, shows more need for and participation in developmental education. California provided such remediation until AB 705 placement and remediation reforms were passed in 2017 and became mandatory in Fall 2019. Prior to AB705, an analysis by the Research and Planning Group for California community colleges (2005) measured that approximately one-third of California's community college students enrolled into "basic skills," the lowest levels of remediation, and 70% placed below college-level in math. In a study of the entire cohort of 122,427 California community college students who began in Fall 2002, 50% enrolled in one or more developmental classes, including 41% enrolling in at least one developmental math class (Perry et al., 2010). Other students who placed into developmental classes did not enroll.

Characteristics of developmental students

Community colleges serve predominantly students with lower socioeconomic status (SES), and those students needed more remediation than their higher SES counterparts (Attewell et al., 2006; Bailey et al., 2005a, 2005b). A study of all developmental students in the California community college system who began in fall 2002 (Perry et al., 2010) revealed other characteristics of developmental students. Developmental students were more likely (79% vs. 55%) than the general community college student population to be traditional college age (20 or fewer years old.) More than half of the developmental students enrolled in developmental classes in two or more developmental subject areas (i.e., math, reading, and writing).

Similarities in math curriculum across the state allowed the researchers to determine the first developmental math course taken by students, shown in Table 1.

<u>Overrepresentation of Black and Hispanic students</u>

The data in Table 1 show that the two lowest levels of developmental math courses (arithmetic and pre-algebra) at California community colleges disproportionately served Black and Hispanic students. The NELS:88 results (Bailey et al., 2005a, 2005b) showed that approximately 75% of Black and Hispanic students nationwide enrolled in a remedial course in two-year colleges, compared to 60% of the national sample overall and to, 55% of whites and 50% of Asians. The need for remediation hindered minority student completion.

Brown and Niemi (2007) found that, for courses one or two levels below college-level, California community college students' Basic Skills (math and English) course success rates varied by ethnicity. African Americans and Hispanics passed 40% of their classes, compared to 58% for white students. The achievement gap was even wider for the most remedial courses, where African Americans passed 41%, Hispanic students pass 54%, compared to 62% for white students, and 68% for Asian students (Complete College America, 2013). Of the Black and Hispanic students who enrolled in a remedial class, only approximately 20% completed a community college credential or transferred, compared to approximately 40% completion for those who did not need remediation. This was not true for Whites: white students were nearly equally likely to transfer or complete a credential, whether or not they enrolled in a remedial course. Overall, the data clearly show that remediation disproportionately impacts Black and Hispanic students with higher enrollment in developmental classes, lower success rates, and lower college completion rates.

Costs of developmental education in (California) community colleges

In 2006-2007, of the 2.6 million students enrolled in a California community college (CCC), over 600,000 (23%) were enrolled in developmental courses (Hill, 2008). Hill noted these developmental enrollments combined are equivalent to 115,000 full-time equivalent students (FTES) or 10% of all CCC enrollments. That year, California allocated approximately $4367 per credit FTES (*California Community Colleges 2006-07 Recalculation Apportionment, Exhibit E*, 2008), meaning that California taxpayers paid nearly half a billion dollars to support developmental education. In addition to these funds, in 2006-2007, California began allocating approximately $30 million annually to community colleges in support of developmental education through the Basic Skills Initiative, increasing the total spent on developmental education to $524 million. Given that California comprises 20% of the nation's community college enrollment (*About Community Colleges*, 2013; California Community Colleges Chancellor's Office, 2013), the extrapolated national spending on developmental education is $2.6 billion. These figures are consistent with other estimates calculated or culled from research at the national level, ranging from the broad $1-4 billion (Noble et al., 2003) to a more limited $2-3 billion (*Diploma to Nowhere*, 2008).

A detailed cost analysis of funding per successful student (defined as earning a degree or certificate) at one community college (Belfield, Crosta, & Jenkins, 2013), found that costs to the institution rose significantly as students place into lower courses. Successful students who placed into college-level courses cost $74,000 to complete their community college education, while students who placed one-level, two-levels, and three-levels below college-level, cost 36%, 76%, and 134% more, respectively. The cost increases associated with lower initial placement are caused by much lower completion rates as the remedial sequence lengthens. Researchers conclude that increasing sequence completion rates, particularly by shortening the remedial sequence, would dramatically lower the cost per successful student.

Math remediation isn't working for most students

The many-courses approach to developmental math education has been used and studied for several years. An NCES statistical analysis showed that public two-year colleges institutions offered an average of 3.4 remedial math courses (Parsad et al., 2003, p. 11) to help students meet their remediation needs and that these courses take the average student a year or more to complete. Based on my catalog analysis as part of this study, I found the 114 California community colleges shortest non-accelerated sequence averages 3.30 courses in 2014-2015. Studies across several years show 50-60% course completion rates (California Community Colleges Chancellor's Office, 2014; Hill, 2008). However, despite these course success rates, sequence completion rates are lower because each additional math course reduces sequence completion by approximately 50%.

In the seminal study that highlighted the nationwide problem with the long sequence structure of developmental education, the Community College Research Center (Bailey et al., 2010b) found the developmental education completion rates in math and reading developmental course sequences decreased as the number of courses students needed increased. The study analyzed data from 57 colleges in seven states that participated in the Achieving the Dream (ATD) program in either fall 2003 or fall 2004. Schools in the ATD program are more urban, low-income, minority serving schools compared to community colleges in the United States overall. The study included data for 256,672 first-time credential or transfer seeking students of which 141,590 placed into a developmental math course. Researchers followed all students for three years. Of the 53 ATD colleges reporting, 35 offered three or more levels of developmental math, nine offered two levels, and nine offered one level.

Overall, 59% of the math students were referred to developmental math, specifically into these levels: 24% to one-level below college level, 16% two-levels below, and 19% 3+ levels below. Of these students, only 33% completed the developmental sequence within three years. The completion rates declined as students were referred to lower-level classes, as shown in Table 2. Thus, the more remediation students are required to take, the lower their chances of completing a college-level course.

Three significant "exit points" were found in this study: failing or withdrawing from the math sequence, not enrolling in a subsequent course, and never enrolling in any math course. The researchers found a mild effect of course placement on never enrolling, but found that students who placed into lower classes were more likely not to enroll in the second or third class even after previously passing the first or second (e.g., 2% if placing only one level below vs. 23% when placing three levels below.) The need to take more classes also increased the chances of failing a course and thus becoming non-eligible to continue in the math sequence, ranging from 17% one-level below, 32% if placed two-levels below, and 44% if three-levels below. Thus, in two of the three possible "exit points," an increase in the number of required courses in the sequence strongly reduces students' likelihoods of completing the math sequence. Combining all factors, students who place one-level below college level eventually completed a college-level math course 27% of the time, compared to 20% if placed two-levels below and 10% if placed three-levels below. Overall, the length of the developmental math course sequence strongly impacted a students' ability to pass a college-level math course. Thus, the researchers recommended that colleges offer sequences with fewer courses, encourage students to continue in developmental sequences, and improve the initial placement process.

Two related studies (Bahr, 2012; Perry et al., 2010) performed similar analyses for all first first-time freshmen at all 105 semester-based California community colleges who began in Fall 2001, Fall 2002, or Fall 2003, (Bahr) or in just Fall 2002 (Perry et al) and enrolled in at least one remedial math course. Bahr showed that passing the first math course was a strong predictor of attempting the next course and a predictor of passing all subsequent math courses. Overall, he found that each successive level of required math saw some students exit either by failing the course (approximately 50% per course) or not registering for the subsequent course (approximately 30%.) Bahr's course completion rates did not vary much by course level. Extending the work to sequence completion, Perry et al 2010 found that 8% of students who first take arithmetic eventually complete college-level math. The college-level math completion rates improved for students starting at higher levels: 16% if starting in pre-algebra, 28% if starting in basic algebra, and 51% if starting in intermediate algebra or geometry (i.e., only one level below a college-level course). Overall, only 26% of all developmental math students completed a college-level course during the seven-year period studied. While few students completed college-level math, many students persisted for at least 2.5 semesters.

The long developmental sequence, even with extended time to complete it, was clearly not working for many students in California community colleges and was especially challenging for those who begin in the lowest levels (i.e., arithmetic and pre-algebra.) The results of not completing the math sequence are catastrophic for students, even though many continue to enroll in non-math courses. Bahr (2013) found that more than 80% of the students who do not complete the remedial math sequences depart from the community college system without earning a credential and without transferring to a four year institution.

Bailey et al (2013) offered an important conclusion about their findings about long course sequences resulting in lower student completion: "The remedial sequence is likely to screen out less determined students, students who face more non-academic problems, and perhaps those who lack support networks outside of college." (p. 8.) This suggests that math courses that address non-academic problems and/or courses that strengthen support networks may improve math completion rates.

Remedial education is reforming

Evidence has been building for decades that reform in community college developmental education is needed, and that it is important to incorporate non-academic support. The "drill-and-skill" technique commonly used is often the same teaching approach used in high school (Hodara, 2011; Levin & Calcagno, 2008) and is not adequate.

Research conducted by the Government Accountability Office (2013) and by the CCRC Scaling Innovation project (Edgecombe, Cormier, et al., 2013) found that many developmental education reform initiatives are becoming widespread. The most common reform efforts fell into one of three categories: improving initial placement (e.g., "boot camps"), targeting materials to students' individual needs (e.g., contextualization,) or shortening sequences in developmental education. Until the late 2010s, most research focused on shortening sequences using one of two methods: mainstreaming (now called "corequisite support") and acceleration (Nodine et al., 2013).

Corequisite support (formerly Mainstreaming)

The most researched mainstreaming model of accelerated curriculum redesign is the English Accelerated Learning Program (ALP) at the Community College of Baltimore County (Adams et al., 2009; P. D. Jenkins et al., 2010). Students who placed into the highest levels of developmental English were allowed to enroll either in the traditional course, one level below college-level, or "mainstream" directly in the college-level course with concurrent enrollment in a companion course taught by the same instructor; this latter model is now commonly implemented as "corequisite support." This method of accelerating the English curriculum removes one "exit point" from the remedial sequence: all students one-level below college-level also enroll in the college-level class. Other than attaching a corequisite course, no other changes were made to the college-level ALP course. Jenkins et al (2010) found that college-level English course completion nearly doubled (74% vs. 38%) and at a cheaper cost per successful student ($2680 vs $3122). But they also noted that the ALP program increased costs per student enrolled. A follow-up study (Cho et al., 2012), found ALP students were more likely to persist one year after completing the college-level English course and to complete other college-level courses. Overall, the ALP mainstreaming model in English has been successful at Community College of Baltimore County.

A promising study showed similar results for math, calling into question the need for developmental education for math students who place just below college-level math. Logue and Watanabe-Rose (2014) and later with Douglas (Logue et al., 2016) conducted a randomized and controlled trial of 717 students attending one of three community colleges in the City University of New York system. Students were randomly assigned to one of three groups: a traditional elementary algebra course, an elementary algebra course supplemented with weekly required workshops, or a statistics course supplemented with a required weekly workshop. The four insturctors in this study each taught one section of all three courses, mitigating instructor-specific effects. The researchers found that the students who enrolled directly into statistics without first taking elementary algebra had the highest course success rates (56%), statistically significantly higher than the success rates of the other two groups taking the pre-requisite class. This study suggests that offering less remediation can lead to increased student success and sequence completion if support is provided, at least for those students who place just below college-level.

Soon after this study, several states started implementing and finding significant success in corequisite course models, including in Florida (Park-Gaghan et al., 2020), Tennessee (Belfield et al., 2016; Ran & Lin, 2019) and Indiana (Royer & Baker, 2018) and West Virginia (Palmer, 2016). Similarly, in California, when AB 705 was passed in 2017, there were two key impacts. AB 705 required community colleges to change the math placement practices to being based primarily on high school grades. AB 705 also prevented colleges from requiring students to enroll in prerequisite courses except in rare circumstances. As a result of these high-stakes successes, corequisite support courses, which typically require 1-3 units of student enrollment, became more popular in California.

Unfortunately, corequisite support is not the norm everywhere. What can be done for students who are still required to enroll in remedial developmental courses?

Accelerating

Students who start with more developmental needs may benefit from accelerated math courses. There are two methods of accelerating: compressing courses (also called intensive, condensed, or time-shortened) and redesigning curriculum. Researchers have developed a consensus definition for acceleration through curriculum redesign: the reorganization of multiple developmental courses into fewer courses that focus on skills and abilities needed for college-level courses, allowing students to reduce the time spent remediating and complete college-level courses more quickly (Edgecombe, 2011; Hayward & Willett, 2014; Nodine et al., 2013). Through curriculum redesign, American community colleges are moving to prioritize preparation for statistics and quantitative reasoning skills, compared to the traditional one-size-fits-all STEM-centered traditional sequences of developmental courses (Burdman, 2013) starting with arithmetic and progressing through pre-algebra, elementary algebra (or algebra I), and intermediate algebra (or algebra II). A comparison between a traditional math sequence, a compressed algebra sequence, an accelerated sequence, and a corequisite support model are shown in Figure 1.

Acceleration through curricular redesign occurs when a new set of remedial courses are offered in place of the traditional remediation sequence. Such redesigned courses often eliminate redundant content and are created with a focus on the needs of (typically non-STEM major) students in the subsequent course (e.g., statistics or college-level writing) (Cullinane & Treisman, 2010). As a result, accelerated courses include some of the content in the arithmetic, pre-algebra, and algebra courses, but not all of it. Accelerated courses only cover the relevant skills that are needed for later application in the students' next course as well as also including core fundamental math understanding. The elimination of redundant content allows the four-class traditional sequence, which typically spans 12-18 units for students, to be replaced with a single a pre-statistics accelerated class that may only require students to enroll in 4-6 units prior to a college-level course. Accelerated courses are at a disadvantage to corequisite support courses because accelerated courses require more units than what is required in the corequisite support model (typically 1-3 units) and are sequential courses rather than concurrent.

Curricular redesign was a relatively new area for developmental math in the early-mid 2010s. In a doctoral dissertation that explored such a developmental education math reform, Mery (2011) wrote, “to date there are no published studies of developmental mathematics sequence acceleration utilizing statistics contextualization at community colleges” (p. 5.) Since that study, several community colleges have implemented forms of acceleration through curriculum redesign. Some of the most well-known are the StatWay/Quantway sequences and the curricula developed in California community colleges.

StatWay and Quantway

One of the most widely adopted redesigned curriculum models was the Carnegie Institute’s Statway and Quantway programs (Cullinane & Treisman, 2010; Silva & White, 2013), used in 28 community colleges across the U.S. as of 2013 and, according to my analysis of college catalogs and schedules of courses, in 10 California community colleges. Statway and Quantway are both accelerated two-course sequences for non-STEM majors with no pre-requisite courses. Both programs have students complete developmental math integrated with either statistics (Statway) or quantitative reasoning (Quantway) in a two-semester sequence. When creating these sequences, the curriculum authors (M. Snell, personal communication, 2015) recognized the need for students to integrate with peers, instructors, and college support resources. The curriculum authors also designed courses that focused on non-academic support related to motivation and included “growth mindset,” self-affirmation, and sense of belonging. Silva and White (2013) report that the Statway and Quantway classes result in 51% and 56% of students completing the sequence in one year, respectively, compared to 15% and 21% of students completing college-level math sequence within two years, tripling the success rates in half the time.

California accelerated math colleges

In the early 2010s, several community colleges began using similarly accelerated developmental education, in English, ESL, and/or math. As a result, two community of practice groups developed: the California Acceleration Project (CAP) and Acceleration in Context (AIC). Based on my analyses of college catalogs and schedules of courses in 2014-2015, 32 colleges implemented at least one accelerated developmental math course, 23 of them through CAP (Hern, 2014). AIC leaders worked with more than 20 community colleges on curricular redesign. Based on another analysis I conducted of course offerings in California community colleges, by the start of the 2017-2018 academic year the number of colleges offering accelerated courses approximately doubled from 32 to 65, as shown in Appendix B.

In 2009, Los Medanos College began offering "Path2Stats," a one-semester math course with no prerequisite which prepares students for college-level statistics class. Students completed statistics at triple the rate compared to students enrolling in a traditional pathway, 60% vs 19% (Hern, 2012). Data from additional cohorts also show that Path2Stats students passed statistics at the same rates as other statistics students (Snell et al., 2012). Overall, the increasing prevalence of math acceleration in 65 of the 114 California community colleges makes for a fertile field to research on this new, important, high-stakes curriculum.

Success analysis of redesigned accelerated courses

The first thorough analysis of multiple accelerated redesigned courses was completed by the Research and Planning Group of California Community Colleges (Hayward & Willett, 2014). Hayward and Willett conducted a quantitative multi-college study that examined the efficacy of accelerated developmental math and English; this summary only includes the math components. They studied 16 California community colleges that implemented accelerated curriculum by

2011-2012, including eight colleges using accelerated math. The colleges were diverse in enrollment sizes (4,000 – 25,000 FTES), location (urban/suburban/rural), student ethnicities (50% minorities on average), and were split evenly between single-college and multi-college districts. Using multivariate statistical analyses on data from the state chancellor's office, they examined outcomes of 653 math students in accelerated courses offered through the California Acceleration Project (CAP). They noted that CAP provided training, advice, and support to faculty interested in implementing accelerated courses. Researchers compared students in the accelerated cohorts with cohorts who enrolled in traditional math sequences and followed all students for 2 or 2.5 years. As part of the statistical analysis, the researchers examined 13 confounding variables related to academic, socioeconomic, and demographic categories including GPA in other courses, ethnicity, gender, Pell grant status, previous English and math course outcomes, and participation in the Early Opportunity Programs and Services (EOPS) program.

The benefits conferred by acceleration were convincing. Students in accelerated math courses were 4.5 times more likely to complete a gateway (college-level) math course than the comparison cohort. After controlling for demographics, 38% of accelerated math students completed a gateway course compared to 12% in the control group.

Some particularly interesting results included that acceleration resulted in improvements for students at all levels of initial placement, adhering to a "do no harm" principle. Acceleration was especially helpful for Hispanics in math, where 40% completed the gateway math course compared to 15% in traditional developmental courses. Also encouraging was that African American students who took accelerated courses completed math gateway courses as often as the "average" accelerated math student. Thus accelerated courses closed the ethnicity-based achievement gap for African Americans and conferred educational advantage for Hispanics. Six of eight colleges that offered accelerated math also provided non-academic support. Researchers suspected such support was an important aspect of the high student success rates.

<u>Importance of non-academic support in accelerated math</u>

In Mery's (2011) doctoral dissertation, a mixed-methods case study and statistical analysis of an accelerated "path to stats" redesign curriculum, students were very successful and the success was importantly attributed to non-academic support. The sequence success rates in the redesigned curriculum were strong: 86% of students in the "path to stats" and subsequent statistics course passed both courses in the two-course sequence and performed comparably to national peers on a national statistics exam (CAOS). Many students entered the "path to stats" course with overwhelmingly negative math experiences, a fixed mindset (i.e., an entity theory of intelligence), and limited encouragement. Yet after the "path to stats" course, students reported that their development of a "growth mindset" (i.e., an incremental theory of intelligence) and having nurturing and caring instructors were critically important to their success. This finding emerged despite the fact that "growth mindset" was unfamiliar to the researcher prior to this study. Mery also noted that the "path to stats" instructor involved each student and created a sense of belonging. These findings resulted in Mery's claim that "an attentive instructor who fosters growth mindset … is more important for students who have been marginalized by prior mathematics experiences" (p. 224).

Integrating non-academic support improves student success and retention

In an extensive literature review about non-academic support, Karp (2011) explored which non-academic support processes helped students and how they help. She noted that students in open-access community colleges and four-year commuter colleges are most susceptible to pressures of transitions from high school to higher education, because these colleges are more likely to enroll “academically vulnerable students” (p. 1). These students struggle in the transition to college because they must navigate bureaucratic systems and form new interpersonal relationships. As a result, community college students are likely to benefit from non-academic support that helps students acclimate to and be successful in college.

Researchers generally have found that successful non-academic support primarily focuses on non-cognitive, affective, social, and psychological domains. In a literature review on teaching adolescents, Farrington et al., used this definition of non-cognitive skills: “the way students interact with the educational context, effects of interactions on students' attitudes, motivation, and performance” and “includes beliefs about own intelligence, self-control and persistence, quality of relationships with peers and adults…” (2012, pp. 4, 6). Ramirez, in study describing the cognitive mechanism underlying how non-academic factors can influence academic performance, notes that “affective factors are not simply an inevitable product of one’s insecurities or lack of competence but rather play a direct role in *shaping* the efficiency of students’ cognitive processing and competence” [emphasis in original] (2013, p. 57).

Five categories of non-academic support

Reviewing the literature, five category themes emerge from the literature: 1) social integration, 2) nurturing, 3) motivation, 4) having an incremental theory of intelligence (often called a “growth mindset,”) and 5) addressing stereotype threat either by building sense of belonging and/or through self-affirmation. Levin and Calcagno (2008) specifically cite addressing motivation and providing a supportive social learning environment as two research-demonstrated successful interventions for developmental students.

In a seminal publication by Sedlacek (2004) about non-cognitive variables that cannot be easily measured by typical tests, he found eight non-cognitive variables that assess students' abilities to adjust to college and be motivated. I show these eight variables and their association with the five non-academic support categories in Table 3. Similarly, in a study by the Research and Planning Group for California Community Colleges (i.e., the RP group) six themes that students reported that most contributed to their success fit into four categories from Table 3 (Booth et al., 2013). Karp and other researchers at the Community College Research Center found four non-academic support mechanisms that encourage student success, also shown in Table 3. Psychological interventions that have been explored and researched in educational environments also fit into two of these five categories shown in Table 3. All of these psychological studies are intertwined, yet addressing any one or more of these interventions can result in deep, recursive processes that transform students' thoughts about themselves, which then initiate processes, behaviors, and thoughts that reinforce positive outcomes (Yeager & Walton, 2011).

The above studies suggest interventions for math students, particularly developmental math students and students taking their first math class. Researchers and practitioners have explicitly recommended that faculty implement such support in classes (Cuellar Mejia et al., 2020; Hern & Snell, 2013).

Helping students attribute negative outcomes to temporary causes, a key idea underlying an incremental theory of intelligence ("growth mindset") and sense of belonging, can offset harmful impacts associated with stereotype threat. Other students may need to be taught these skills.

More details about each of the five non-academic support categories follow.

Social integration

Social integration was first recognized as an integral aspect of higher education by Tinto (Tinto, 1975, 1993), although Tinto suspected these ideas may not apply to community colleges. He extended ideas about social connectedness, engagement, and integration as a means of suicide prevention to higher education. He found that students who are more connected are more likely to persist enrollment in higher education institutions because these connections help overcome challenges from other, non-academic communities that may not support a student's education or may place competing time demands (e.g., work or family). However, researchers have known for decades (see Bean & Metzner, 1985 and references cited within) that the typical community college nontraditional students, including older or returning students, are more affected by external circumstances such as personal or family finances or responsibilities, employment, and encouragement and discouragement of others. Tinto's predictions and model of persistence were validated for community college's quantitatively by Halpin (1990) and qualitatively by Karp, Hughes, and O'Gara (2010).

Nurturing

According to a study performed by the RP group (Booth et al., 2013) students strongly value caring and nurturing they receive from others as they transition into college and deal with everyday life challenges. This is particularly true for African American students (Shears, 2010). In the RP group's study, 94% of students said "student support" was very or somewhat important to them, such as knowing that their instructors cared about them. The researchers generally found that "when someone cares about a student and his/her achievement, that student is also likely to experience the other factors for success" (p. 19). In the study, students reported that faculty engaged in several means that achieved this nurturing feeling, including: ensuring students understand course material, providing students with opportunities to participate in class, directing students to helpful resources, and helping students make connections between class and personal goals and experiences. Based on her studies of student fear and motivation, Cox (2009b) specifically recommends that developmental faculty should both pay attention to students' perception of the class and be approachable to students.

Motivation

Maintaining students' motivation is another key ingredient in student persistence, particularly among developmental students. When developmental students enroll in a course without having clear aspirations, purpose, or an understanding of both, they are more likely to be derailed from their goals (Karp, 2011). Several studies (Cox, 2009a, 2009b; Grubb & Cox, 2005) recommend clearly articulating how specific courses and course topics further students' educational and employment goals, as well as aligning curriculum in developmental courses with subsequent courses to make the benefits of the courses transparent to students and to increase the likelihood students will stay motivated to complete the course. If value is lacking or unclear, some students will drop courses or will not submit assignments and may fail (Cox, 2009b). These latter recommendations have been implemented recently in some accelerated developmental math courses.

In addition to revising course structure and activities to motivate students, instructors can take additional approaches to increase student motivation. Many studies, (see, for example, Pink, 2011 and references within) have shown that students respond and perform better when intrinsically motivated (e.g., by desiring to achieve) rather than extrinsically motivated (e.g., by points awarded for an assignment). This suggests that fostering a desire to achieve and succeed may be more important than, for instance, assigning points to key assignments. However, some students struggle with such a desire. Cox (2009a, 2009b), through in-depth interviews of community college developmental students and their instructors, found that students fear failure and fear being assessed as failing. Through classroom visits and interviews of instructors, she discovered several non-academic support strategies that ameliorate these fears, including convincing students they have the ability to accomplish the work (i.e., "growth mindset,) paying special attention to students' perception of the class and the work, and being approachable.

Another motivation strategy that shows promise is to appeal to students' self-discipline, self-control, and self-determination. In multiple studies of high school students, Duckworth and Seligman (2005) found that self-discipline explains variation in many educational outcomes twice as well as measured IQ, including: attendance, hours spent on homework, and final course grades, even after controlling for achievement-test scores and measured IQ. "Grit," defined as perseverance and passion for long-term goals (Duckworth et al., 2007), was the best predictor of student success in a variety of fields including science, art, sports, and communications. "Grit may be as essential as talent to high accomplishment." In her TED talk (Duckworth, 2013), Duckworth suggested that the best way to help people strengthen their "grit" was to help students develop a "growth mindset" or incremental theory of intelligence, as described by Dweck (2006).

Theories of intelligence (mindset)

Psychologists (see Dweck, 2006 and references therein) categorized people as having either an incremental or an entity theory of intelligence, which Dweck colloquially called "growth" and "fixed" mindsets respectively. An incremental theory of intelligence is based on the idea that people can develop intelligence and personality traits with effort, guided practice, and help from others. An entity theory of intelligence is based on the idea that people have only a fixed amount of intelligence (or personality or ethical inclination) throughout their lives. The incremental theory of intelligence continues to gain traction as neuroscience validates the findings, including that the brain grows with practice and effort (Driemeyer et al., 2008).

While teachers may initially be inclined towards thinking students have a "fixed mindset," (Good et al., 2003) students and teachers can learn "growth mindsets" (Blackwell et al., 2007; Good et al., 2003) resulting in increased academic performance. However, as is the case with students facing stereotype threat (Steele & Aronson, 1995), the research consensus is that different theories of intelligence may not result in different academic outcomes until students are faced with challenging and difficult situations (Blackwell et al., 2007; Grant & Dweck, 2003). Thus, a challenging math curriculum is an opportune setting to reap benefits from coaching students towards a "growth mindset."

Stereotype threat; Addressing through sense of belonging and self-affirmation

Because developmental courses serve a disproportionate number of African American and Hispanic students, stereotype threat affects many developmental students. In the seminal paper about stereotype threat, Steele and Aronson (1995) defined it as "being at risk of confirming, as self-characteristic, a negative stereotype about one's group" (p. 797). They found that when people experience stereotype threat, they tend to perform worse on the task at hand than when the threat is absent from the same task. African Americans students commonly experience a stereotype threat of having inferior academic ability (J. Aronson et al., 2002) and women experience a threat of having inferior math skills, particularly in developmental math courses (Inzlicht et al., 2006). Both threats have been shown to result in poorer academic outcomes. Combatting stereotype threat requires a person to devote finite mental resources, such as working memory (Beilock & Carr, 2005; Beilock, 2008) and self-control (Inzlicht et al., 2006) to mentally battle the stereotype. As a result, negative outcomes are most likely to result when someone is mentally highly engaged in a frustrating activity with unlikely success (Steele & Aronson, 1995), similar to what happens to students who have a "fixed mindset" (Blackwell et al., 2007; Grant & Dweck, 2003). Thus, helping students develop a "growth mindset" reduces negative impacts of stereotype threat (Aronson et al., 2002; Good et al., 2003).

Walton and Cohen (2011) found that creating sense of belonging by attributing social adversity to common and fleeting phenomena can result in closing the ethnicity achievement gap by half, increasing African Americans' grade-point averages 0.4 grade points. Results like this indicate that when students develop a sense of belonging, the harmful impact of stereotype threat can be reduced. Developing a sense of belonging also results in students working longer with higher motivation (Walton et al., 2012). Walton et al. also found that helping students develop a sense of belonging need not be involved nor difficult. Small shared experiences, including a shared birthday or favorite musician, suffice. Achieving a sense of belonging, even through a brief (one hour) intervention, has been shown to improve grades and health, and reduces the ethnicity achievement gap, at least for African Americans (Walton & Cohen, 2011).

Sense of belonging can also be attained through self-affirmation exercises, when a student writes or speaks positively about his/her own achievements, values, relationships, or worth (Cohen et al., 2006; Schimel et al., 2004). Working for two years with seventh and eighth grade students Cohen and his colleagues performed an initial (2006) and a follow-up (2009) experiment where students periodically wrote self-affirmative statements. GPAs increased, particularly for African Americans, and students reported they fit in and would succeed over time. The researchers believed that the initial self-affirming exercise was sufficient to stop a "recursive" threat process that lowered students' performance.

Self-affirmation may extend to college topics. Research (Miyake et al., 2010) in college physics-for-STEM-majors classes demonstrated that values-based self-affirmation exercises implemented using double-blind methods, similar to the two studies by Cohen et al (2006), found the affirmation eliminated gender-differences in physics. However, another study, a near replica of the study by Miyake et al, showed no gender-based achievement gap and no endorsement by students of gender-based stereotype threat in life science classes (Lauer et al., 2013). Thus, subject matter and context may be relevant to the impact of self-affirmation writing.

Chapter summary

Recent results (Hayward & Willett, 2014; Illowsky et al., 2013; Mery, 2011) highlight the need for further research on non-academic support in the new and high-stakes redesigned accelerated developmental math courses. While research has highlighted the benefits of accelerated courses, corequisite support courses, and providing non-academic support in both traditional and accelerated or support courses, the educational research has not yet determined the prevalence of such support. Also unknown is what forms of research-suggested non-academic support – social integration, nurturing, improving motivation, developing a “growth mindset” theory of intelligence, and combatting stereotype threat either by creating a sense of belonging or through self-affirmation exercises – are provided in the new accelerated or corequisite support math courses. This study helps address these gaps.

Chapter 3 – Research Design

Problem restatement

Prior to some states recently restricting developmental math courses, approximately 60% of community college students required at least one developmental math course (Attewell et al., 2006) to prepare for college-level courses, and many students needed more than one course (Bailey et al., 2010a). Students' likelihood of completing a college-level math course has strongly correlated with enrolling in fewer prerequisite courses (Bailey et al., 2010a). Accelerated developmental and co-requisite support courses, two new curriculum models, both have shown promise to move more students into and successfully through college-level courses, predominantly statistics (Edgecombe, Jaggars, et al., 2013; Hayward & Willett, 2014; Logue & Watanabe-Rose, 2014; Zachry Rutschow et al., 2015) and have formed the basis of recent developmental course restrictions, resulting in high stakes for students who take these new courses.

In California, much of the statewide professional development for faculty members of these new accelerated and support courses includes training instructors about providing non-academic support to students, including social integration, nurturing, motivation, "growth mindset," and addressing stereotype threat through "sense of belonging" and self-affirmation exercises (Booth et al., 2013; Cohen et al., 2009; Dweck, 2006; Walton & Cohen, 2011; Yeager & Walton, 2011). Little is known about what forms of non-academic support accelerated developmental math instructors implement in the courses. This study seeks to understand the forms, frequency, and faculty understanding of the reasons behind implementation of non-academic support.

Research questions

1. Which forms of non-academic support do community college instructors of accelerated developmental and corequisite support math courses say they provide to students?
2. How often do instructors say they provide these supports?
3. For what reasons do faculty believe these forms of support are likely to help students?

Research design and methods

I conducted this survey study by distributing it to two populations: a sample of math instructors in California community college system teaching accelerated developmental courses and a sample of the early adopters of corequisite support classes. A survey of the population was appropriate because the prevalence and forms of implementation of non-academic support are not yet well known or understood and a survey with open-ended questions can both reach a large population and provide significant insight to existing practices and underlying reasons for practices. This survey explored was designed to reach a large sample of instructors in the population and explored a wide variety of forms of non-academic support.

The survey instrument appears in Appendix A. The survey instrument comprised three sections: free-response questions that asked about how faculty would respond to student scenarios related to forms of non-academic support to address the first and third research questions; fixed responses questions that asked about the frequency of implementing forms of non-academic support to address the second research question; and demographic questions about the respondents.

The free-response questions all began with a short description of a scenario (e.g., "A student submits incomplete assignments"). For three question groups, respondents were allowed to choose from a set of closely-related scenarios. Multiple scenarios were offered to increase the likelihood the respondent had recently encountered one of the scenarios in their teaching. The specific scenarios were chosen to be clearly related to the five forms of non-academic support. Four of the scenario descriptions were followed with the same three questions:

1. What are the first few comments you would say to the student?
2. How would you continue to help this student, both initially and during the term?
3. Why would the student find this to be helpful?

Other free-response questions related to a specific form of non-academic support (e.g., "In your support or accelerated class, what kind of activities occur that result in students getting to know other students?")

Table 4 provides a crosswalk between the open-ended survey questions and the form of non-academic support explored in each question.

The fixed-response questions were in a matrix format and all began with the same question stem, "During the term, how many times have you ____." Each row in the matrix offered the following choices: 4 or more, 3, 2, 1, or none.

Table 5 provides a crosswalk between the fixed-response survey questions and the form of non-academic support explored in each question.

Each survey question was designed to explore one or, in two instances, two forms of non-academic support. For example, the first scenario offered respondents two choices for a "sense of belonging" situation, either about "A student tells you that they feel that they do not belong in college" or about "A student informs you that a close family member or close friend thinks they are not going to succeed in college."

Population and sample

The population I examined for my survey was current California community college faculty members of developmental accelerated math and early adopters of corequisite support classes. These faculty respondents were provided the survey by their department chairs, faculty peers in the California Mathematics Council of Community Colleges, or deans, who in turn received the survey directly from me. My research questions concerned instructors' self-reported rates of, forms of, and reasons for implementation of non-academic support. Instructors are best positioned to describe their implementation, the frequency of the implementation, and the underlying reasons.

Observation Site Selection

The state of California educates 20% of all U.S. community college students. Prior to the implementation of AB 705, at least 70% of those students placed below college-level math (*About Community Colleges*, 2013; California Community Colleges Chancellor's Office, 2013; Research and Planning Group, 2005). This research focused on California community colleges, as opposed to community colleges elsewhere for two reasons: similar (semester-long) course structure throughout the state and enforced prerequisites and corequisites based on students' initial placement and course successes. California's community college system has strictly enforced rules about course prerequisites and the implementation of these prerequisites, in accordance with state Title 5 regulations. These regulations standardize practices about which students may enroll in college-level or developmental courses. Even after fall 2019, when changes associated Assembly Bill 705 were enforced by the Chancellor's office and significantly reduced prerequisite developmental courses, the state's regulations were expected to be uniformly implemented by all community colleges.

Population access

I contacted all faculty respondents via proxy through multiple emails sent to deans, department chairs, and contacts listed for the California Mathematics Council of Community Colleges at the colleges offering accelerated math courses. These proxies then forwarded the survey to faculty members who have taught the accelerated courses. I administered the survey using the web-based software, *Qualtrics* with the questions shown in Appendix A. The survey was available in two installations, first from May 23 – July 8, 2018 and then from November 19 – December 2, 2018.

To ensure representation for the survey, in 2015 and again in 2018 I analyzed the college catalogs (i.e., course offerings and math curricula) of all 114 community colleges for academic years 2014-2015 and 2017-2018. I also analyzed the 2014 CB21 codes (i.e., level developmental skills taught in classes) to determine which colleges offer accelerated courses. I began with CB 21 codes as a means to determine if a math course was developmental, and if so, how many levels below college-level the college faculty believe the course was, based on existing California community college studies (Perry et al., 2010). If there had been widespread agreement, consistency, and accuracy by colleges when coding their classes using the CB21 rubric developed in 2010, this analysis would have resulted in an accurate listing of all colleges that offer accelerated developmental math. To guard against incomplete or inaccurate CB21 coding, I conducted a second analysis, a manual examination of all 114 California community college 2014-2015 and 2017-18 catalogs. I then retrieved data available from Datamart at the California Community Colleges Chancellor's Office (http://datamart.cccco.edu/datamart.aspx) to learn how many sections of each accelerated course each college offered during the 2014-15 academic year and again in the fall 2017 semester. The catalog analysis was significantly more revealing and complete in locating accelerated courses than was the CB 21 analysis alone.

Of the 114 California community colleges, 65 colleges, listed in Appendix B, had adopted accelerated courses into the 2017-18 curriculum (not counting the eleven that adopted a "combined algebra" courses.) In fall 2017, 50 colleges offered at least one section of accelerated math. Of those, 34 colleges offered fewer than five distinct sections of their accelerated courses in fall 2017, although a five colleges offered at least a dozen sections. Early during the first distribution of the survey, respondents revealed that a small number of colleges had begun pilot-testing corequisite support curriculum. Therefore, the survey scope was expanded from its initial focus of accelerated courses and finally included both accelerated and corequisite support courses.

Survey incentives and second survey distribution

To help increase the response rates, during both survey distributions, respondents were offered a $10 gift card upon completion. The initial survey distribution was sent in May 2018 to 83 proxy recipients and garnered 75 responses but only 34 surveys with useful information (i.e., complete or nearly complete). The low number of complete and authentic responses necessitated a second distribution of the survey. Overall response statistics are summarized in Table 6.

The second distribution was sent to 79 deans and department chairs, serving as proxies, in November 2018, and again I asked them to distribute to faculty teaching accelerated or corequisite support courses. For the second survey distribution I implemented two additional measures to garner more responses: I announced the survey in a Facebook post in the public California Acceleration Project group (founded in July 2015) and I announced the survey in a Facebook post in the public California Acceleration Project's Math-specific group (named "CAP MATH," founded in July 2018 and which was later renamed AB 705 MATH Forum.) Both public posts mentioned the $10 gift card for completing the survey. The second distribution generated 281 responses and included 225 completed surveys. The second distribution's much larger response set was unexpectedly large.

Inauthentic survey responses

I determined that the large number of responses to the second distribution of the survey included many responses that were either not complete or not authentic (lacking credibility) for this study based on a number of factors. First, the number of responses was approximately equal to the number of sections of accelerated math offered in Fall 2017 and represented nearly a 100% survey response rate. Such a high response rate was unexpected and suspicious and suggested the responses likely were authored by people outside of the target population (i.e., California community college math faculty). Upon a cursory review of the responses provided, I suspected many of the respondents were not math instructors in any higher education institution based on the noticeably wider diversity of response types to the free-response questions than what was seen in the first survey distribution. For these reasons, a careful inspection of the second survey distribution led me to categorize most responses as "spam" and authored by respondents seeking the $10 gift card that I offered as an incentive. A response was deemed to be a "spam" response if several free-response answers satisfied at least 3 criteria listed Appendix C.

Additional indications of a "spam" responses were that a response indicates the student is a male (even though all references to students were non-gendered) and/or that the response included the word "university" which is not a common descriptor of a California community college (especially compared to the more common "college".)

Upon careful analysis and excluding "spam" responses, only 24 survey responses in the second distribution contained authentic, credible information. Of the original 281 survey responses, 56 survey responses were not complete, 257 survey responses were categorized as spam as described above or not usefully complete. The most common “spam” survey response (143 surveys) included all blank answers in the free response questions. I further classified 114 other survey responses as spam based on the criteria above.

Overall, there were 34 credible surveys from the first distribution and an additional 24 credible surveys from the second distribution, 58 total useful responses. The results of this study were based on those 58 responses.

Demographics of respondents

There were 58 survey respondents between the two survey distributions (34 in the first distribution and 24 in the second.). Of these 58, only 29 of the 34 in the first distribution replied to demographic questions while all of the 24 respondents to the second distribution replied, yielding 53 total responses. Demographic results are summarized in Table 7 through Table 17.

Data reduction of free-response scenario responses

To reduce and analyze data for free-response questions, I used an emerging trends analysis based on grounded theory, using an open coding scheme (Merriam, 2009, p. 178). Prior to reviewing any survey responses, I developed categories of non-academic support strategies based on expectations from prior research that were highlighted during the pilot stages of the survey. I then refined the list of categories after multiple iterations of coding the survey responses. The final category list included themes or ideas that were either present in multiple responses to one question or were present across multiple questions. Overall, 75 descriptive survey categories were assigned plus tags for frequency. These categories are listed Appendix D.

Results reported in most data tables show results combined between both survey distributions unless results were noticeably different between the two survey distributions.

Ethical considerations

I explored three forms of ethical consideration as part of this study:

1. Participants potential for risk
2. Confidentiality and anonymity of participants
3. Managing my role

Participants' potential for risk was assessed and guarded through UCLA's Institutional Review Board (IRB) and, for two colleges, the respondents' college IRB. The survey asked about instructors' implementation of teaching practices. I believe there were no risks to the instructors or students.

I provided confidentiality, but not anonymity, for instructors. While the survey was permitted to be anonymous, because a $10 gift card incentive was offered, respondents who wished to receive the incentive needed to provide an email address. Some faculty members also provided email addresses if they were willing to be contacted for follow-up clarification to their responses. However, no identifying information was considered in any part of this study.

To manage my role and personal influence on respondents, I did not survey faculty members at the colleges where I had worked as an administrator prior to either survey distribution. Nearly all of the survey respondents were unknown to me. While I have been a part of the acceleration training groups in California, I was not a practitioner of teaching mathematics and thus was an outsider from this study's observed population.

Reliability and validity

One potential source of unreliability or invalidity would be the spurious spam responses that were present in the second survey distribution and discussed above. However, nearly all comparisons between the two different survey distributions show strong similarities, suggesting the spam filtering processes were successful in eliminating fake responses. Because both survey distributions yielded similar results, the survey appears to be reliable.

Objectively, the validity of this study's survey questions cannot easily be assessed because the bulk of the survey asks open-ended questions about the forms of support provided in specific contexts encountered by students. Verification of respondents' survey answers through observation would be impractical because students may not wish to reveal the circumstances explored in the scenarios posed in the survey. Similarly, in terms of reliability, it would be difficult to detect such situations repeatedly. One participant retaking a survey multiple times would likely result in a different set of responses based on the respondents evolving instructional methods. However, the two different distributions of the survey helps provide confidence in the reliability of the results.

I have also addressed the following issues by the study design: bias in the sample selection and analysis, generalizability, and social desirability/reactivity when responding to survey questions.

Bias in sample and analysis

To reduce sample bias, I distributed my initial survey to a complete sample of all California community colleges teaching accelerated math courses in spring 2018 (first distribution) and fall 2018 (second distribution.) Because the survey was offered with an anonymous option, I cannot accurately and completely determine which specific colleges were represented by the respondents. However, the survey was distributed to all colleges in the desired population as determined by the multiple catalog and course analyses described above; the survey was sent to the complete population, not to a sample of the target population. Thus there is no known bias in the set of responses to this study.

Generalizability

Because I conducted my survey with a complete sample of the accelerated developmental math population in California community colleges and early adopters of corequisite support courses, the results of this study should be widely generalizable. The following exceptions may apply.

The findings in this study may be limited to curricula similar to those implemented in California and may not be as applicable in other states.

The findings may also only apply to faculty members who have a propensity to quickly adopt new curriculum models. Accelerated developmental curriculum, including in math, was still fairly new to the community college sectors when this study was completed. Corequisite support courses were even earlier in the growth process; such support classes in math had just been written by fall 2017 in a handful of colleges. In California, most colleges adopted accelerated curriculum during or after Fall 2011, according to the California Acceleration Project. Therefore the participants in this study were early adopters (i.e., implemented within seven years of curricular design) and/or change agents. It is possible that subsequent adopters of the accelerated or corequisite curriculum may have different rates or mechanisms to implement non-academic support. These differences may limit the generalizability of this study.

Social desirability / reactivity

In any survey, it is possible that the respondents may have responded in a way that they believe the researcher wishes them to respond; this phenomenon is called “social desirability” (Fowler, 1995, p. 28) or “reactivity” (Maxwell, 2013). My survey could have been impacted by this phenomenon. Many of the survey questions ask about practices that instructors who are research-informed or research-aware may believe would be beneficial. The population of accelerated instructors is likely informed about the examined research practices, based on the 53% prevalence of statewide training reported by respondents in the survey. Therefore, some participants may be inclined to over-report their true implementation rates. However, to minimize the potential impact of social desirability, the survey questions typically asked respondents to report what they do, would do, or have done rather than what they believe is important or what they believe they should do. By focusing on current and past practices, rather than intended practices or beliefs, I reduced the desire to over-report socially desirable responses.

Chapter summary

This study was a survey of instructor implementation of non-academic support distributed. The population surveyed was all California community colleges offering accelerated developmental math and/or corequisite math support courses during the spring and fall 2018 terms. The survey was distributed once in each of those terms; while the second survey distribution received several inauthentic responses, analysis suggests all 58 of the considered respondents were genuine and in the desired population target. The results of the survey are discussed in the following chapter.

Chapter 4 – Results

Summary of overarching results

In this study, I surveyed California community college math faculty who teach accelerated and corequisite support courses about the forms of non-academic support they provided (RQ1), how frequently they provided the support (RQ2), and why they thought those forms of support would be helpful to students (RQ3). This study focused on five forms of non-academic support: nurturing, growth mindset, social integration, motivation, and sense of belonging.

Of the five forms of non-academic support, math instructors reported in the survey using nurturing support most often, but social integration and sense of belonging supports least often. There were similar results for the open-ended scenario questions, with use of growth mindset and nurturing strategies reported most and sense of belonging reported least often. In contradiction, however, for the open-ended questions overall, when examining forms of support for all questions surveyed, math instructors foregrounded helping students to get or remain connected to and to work with others, so as not to feel alone, responses which point to sense of belonging.

When asked, in the survey, to explain why they thought students would find their supports strategies useful, math instructors again came back to answers indicating students need to know they are not alone (and to develop a sense of belonging) and nurturing students by helping them sense their instructor cares. However, in response to the survey questions about number of times using a support, math instructors again listed “nurturing support” most frequently during the term but sense of belonging least frequently during the term. This strong and repeated contradiction will be addressed in the Discussion chapter 5.

Training and available support

To get a sense of how much help and training faculty had already received in areas of non-academic support, to clarify the circumstances surrounding their support, faculty were asked in the survey how many peers were in their department, how many of those peers currently helped or supported them, and about two specific professional development training opportunities they may have had. Respondents had significant peer availability but were afforded little support from these peers. Similarly, while professional development training opportunities were available, most had not undertaken such opportunities in the affective domain. As seen in Table 14, respondents reported an average of 5.6 peers teaching accelerated/support courses. The number of peers who were currently helping or supporting the respondent was lower, as seen in Table 15, averaging 3.2 peers.

In terms of training, a slight majority 28 (53%) reported being trained by the California Acceleration Project, while 23 (43%) said they had not and 2 (4%) were unsure, as seen in Table 16. Fewer had receiving training in the affective domain or sense of belonging, as seen in Table 17 with 23 (44%) receiving training, 27 (52%) not, and 2 (4%) unsure.

Answering research question 1 – What forms of support do faculty say they provide?

To answer this research questions, I examined the responses to all open-ended questions. Responses were coded using a grounded theory approach that developed categories of non-academic support strategies based on expectations from prior research, highlighted during the pilot stages of the survey, and refined after multiple iterations of coding the survey responses.

Using the strategy categories, there are two methods to answer this research question. The first method is to examine all strategies reported by the respondents for all open-ended questions combined, without regard to the type of support being examined in the survey's scenarios. For example, in this method, I treated responses to "A student submits incomplete assignments" (a motivation-related scenario) equally with responses to "What kind of opportunities, if any, do you provide for students to get to and demonstrate improved understanding and mastery later in the term?" (a growth mindset related scenario.)

The second method is to examine the same data set after grouping the strategies by form of non-academic support explored in the scenario. Using the same examples from the preceding paragraph, the second method examines strategy responses for motivation and growth mindset support separately.

Results from combining responses to all scenarios (first analysis method)

The data for the first analysis method, where results for all scenarios are combined together, are shown in Table 18. The five most popular strategies given in all of the open-ended questions combined were "*stay connected*" (67 times stated, 3.53 times per 19 questions,) [help students to] "*find a group*" (59 times stated, 3.11 times per 19 questions,) "*refer [students] to a [college] service*" (55, 2.89,) directing students to "*work in groups [for] cooperative learning*" (54, 2.84,) and to help students understand they are "*not alone*" (53, 2.79.) All five of these most common strategies suggest respondents would help students strengthen their sense of belonging and connection to the college. The two remaining strategies that garnered more the 2.50 times stated per question were to "*stay strict*" about their class rules and regulations (53, 2.79) which is not a support strategy, and to *ask students if they were ok* (51, 2.68), which is a form of inquiry and demonstrates nurturing behavior. There is a large gap between asking students if they are ok and the next most common response, "*senses caring*" (42, 2.21.)

Results separated by each form of support (second analysis method)

All results in Table 19 through Table 23 show the strategies reported by the respondents to open-ended scenario questions and grouped by the form of non-academic support. The scenarios were representative of different non-academic challenges students face, as listed in the crosswalk Table 4. All five of these results tables show the total number of times each strategy was mentioned throughout the relevant open-ended questions ("Times stated total") as well as the number of times per question associated with that form of support ("Times stated per question.")

Examining each of the five forms of non-academic support separately shows a clear distinction between respondents' support preferences. Nurturing-related scenarios, shown in Table 19, yielded 9 responses with at least 2.50 times stated per 3 questions and all 9 responses combined (i.e., summed) yielded 52.67 times stated per question. The top three strategy choices were *asking if students were ok* (38 total times stated, 12.67 times stated per question), *referring students to college services* (29, 9.67,) and helping students to *stay connected* with peers (22, 7.33). Each of these three strategies were selected by more than 10% of respondents, corresponding to 5.80 times per question.

Social integration related scenarios (see Table 20) also yielded 8 strategies with more than 2.50 times stated per question, with a lower combined total for these responses of 35.60. For this form of academic support, only 2 strategies garnered more than 5.80 times stated per question: helping students to "*find a group"* (53 total times stated, 10.60 times stated per question), the similar response of asking students to "*work in groups"* (39, 7.80.) Note that the third most popular strategy in this table, "Daily," and the less popular "Weekly," are responses to an open-ended question about how often respondents reported using strategies for one specific scenario and were not included in the 35.60 total.

Growth mindset scenarios (see Table 21) resulted in 7 strategies with more than 2.50 times stated per question, but with a high combined total times stated per question of 50.00, second only to nurturing support above. Like with nurturing, there were 3 strategies that garnered more than 5.80 times stated per question, including the two most popular strategies in this study. The most common strategy, in terms of times stated per question, was telling students to "*learn from mistakes*," which yielded 30 total responses in the two scenarios (30, 15.00). The second most common strategy was to indicate that mistakes and struggles are "*common*" (27 total times stated, 13.50 times stated per question). The third strategy respondents suggested to students, ironically, was to do "*nothing*" (e.g., "I would not make adjustments" or in response to asking "What kind of opportunities, if any, do you provide for students to get to and demonstrate improved understanding and mastery later in the term" the respondent wrote, "I don't have anything like that.")

Motivation related scenarios (see Table 22) also yielded 6 strategies with more than 2.50 times stated per question and, like nurturing, only 2 strategies above 5.80 time stated per question. The combined total was the lowest of the 5 forms of non-academic support, 31.67. The two most popular motivation strategies were to help students "*stay connected*" (29, 9.67) and to "*refer students to the instructor*" (i.e., themselves) or the instructor's office hours (28, 9.33). Overall respondents did not report many motivation support strategies.

The form of non-academic support that generated the weakest support for all strategies was clearly for sense of belonging (see Table 23). While there were 11 sense of belonging strategies with at least 2.50 times stated per question (yielding a total of 46.25 times stated per question), only one strategy generated more than 5.80 times stated per question, helping students to "*stay connected*" which resulted in only 7.00 times stated per question (28, 7.00.) The many, varied strategies to this form of non-academic support were diffusely spread, unlike the other forms of non-academic support that saw concentrated popularity limited to a small number of strategies.

In summary, when considering the type of support examined in the scenarios, respondents had a clear preference for providing nurturing support most and sense of belonging least, with support for social integration, growth mindset, and motivation in between nurturing and sense of belonging. However, when considering the strategies to support students overall, without regard to type of support suggested in the scenario, the strategies listed most commonly across all open-ended questions point towards both nurturing and sense of belonging. This contradiction about how respondents provide sense of belonging support and lack of congruence between the two analysis methods is explored in the Discussion section of Chapter 5.

Answering research question 2 – How often do instructors say they provide these supports?

For the second research question, there were a total of 36 closed-ended survey items that explored all five forms of non-academic support, including two questions that could be placed into multiple forms of support and which are not discussed further. All of these closed-ended questions asked how many times the respondent had implemented a specific strategy. Results for these questions were grouped by form of non-academic support explored and then averaged to yield the values in Table 24. (See also Table 5 for the crosswalk between the survey questions and the associated form of non-academic support.)

Respondents reported the highest level of (i.e., most frequent) support for nurturing-related situations, averaging 3.11 times during the term. Unlike in the open-ended scenarios reports, motivation was the second highest form of support, implemented on average 2.96 times during the term. Growth mindset support was in the middle of five forms, averaging an implementation of 2.48 times during the term. The second lowest form of support was social integration, implemented 2.27 times during the term. The least implemented form of support was helping students to develop a sense of belonging and combatting stereotype threat (2.07 times during the term.)

Answering research question 3 – For what reasons do faculty believe these forms of support are likely to help students?

To answer RQ3, I examined the responses to the open-ended question, “Why would the student find this to be helpful and effective?” This question was asked for four of the specific open-ended scenarios. As with RQ1, responses to this question were coded using a grounded theory approach that was based on categories of strategies developed as described above. Results reported below in Table 25 through Table 29 show the responses for each scenario.

When responding to a scenario related to sense of belonging (Table 25,) respondents reported most, 18 times, that students would find the proposed strategies helpful because students would feel *not alone*, including not feeling unwanted or becoming part of or connecting to a community. For example, two respondents wrote, “My efforts would go a long way toward making them feel they belong because I’m showing by my actions and words” and “if the student feels like a faculty member has taken an interest in them, they may start to feel that they belong in the college setting.” The second most common response was that students would *sense caring*, concern, or sympathy (17 times). Example responses include, “Most students seem to feel more welcome when … the teacher shows they care about success for the student” and “Students need to know that faculty cares.” No other responses garnered more than six responses, equivalent to 10% of respondents.

For nurturing-related scenarios, results are reported in Table 26. Respondents gave similar responses for why students would be helped by the respondents’ reported strategies, with

15 respondents noting that students would *sense caring*, and an additional 9 noting students would then *access resources* that may help them. Examples of accessing resources include, "they would hopefully get connected to the services that they need," "working with them to have access and knowledge of resources will help them to make the next step" and "we need to refer the student to the right place for help. Homeless shelters/Child Abuse/DSPS." Similarly, for motivation scenarios, only one response was mentioned at least six times and thus appearing in at least 10% of surveys: students feeling *not alone* based on motivational strategies provided by respondents, which appeared seven times in the surveys. See Table 27 for more details. Finally, when respondents replied to why students would be helped by their strategies for a social integration scenario in Table 28, only two responses were stated at least six times: students feeling *not alone* (14 times stated) and helping students to *overcome shyness* to work with their peers (9 times stated). Example responses for overcoming shyness included "some students are not as social as others and by talking to them and finding a group they fit in with, they would be more comfortable and be able to get the assignment done," "Hopefully this would help him/her open up when I am not there," and "if the students are just shy, they need to overcome this hurdle to interact with others."

Interestingly, as shown in the summary table, Table 29, two reasons dominated the responses across all four scenarios, even though the scenarios targeted different forms of non-academic support. The most popular reason was that students would feel *not alone*, an idea associated with developing a sense of belonging – the least popular form of support across this study. However, the second most popular reason students would find the respondents' support helpful is that the students would *sense caring*, an idea associated with the most popular form of support, nurturing.

The next chapter presents discussions of the findings, as well as implications for practice, professional development, and possible future research efforts.

Chapter 5 – Findings and Implications for Practice and Research

Restatement of motivation for this study

Developmental math in California community colleges has long struggled to move students through the long sequence of courses. Research in the early 2010s found that the sequence of courses itself was a likely culprit for low student throughput (Bahr, 2010a; Bailey et al., 2010a; Bailey & Cho, 2010). Researchers and early adopters (for example Edgecombe, Jaggars, et al., 2013) began exploring a new form of developmental math courses: accelerated courses that would significantly reduce the time and number of courses students would need to take prior to attempting college-level math courses. By the late 2000s and early 2010s such courses started becoming more widespread. My catalog analysis showed that by 2014, 32 of the 114 California community colleges had implemented such courses and by 2017, 65 such colleges had.

The rapid increase in such offerings is likely due to prevalence of statewide training from the California Acceleration Project and similar groups as well as the vision they espoused (Hern & Snell, 2013). As mentioned, initially state math reform efforts began with accelerated courses. However, based on results on studies like those from Logue and Watanabe-Rose (Logue et al., 2016; Logue & Watanabe-Rose, 2014), researchers strongly believed that a more effective pathway to completing college-level math courses was for students to enroll in transfer-level math classes concurrently with associated corequisite support classes. This method became codified in California Education Code with AB 705, approved in October 2017 and with full implementation expected in Fall 2019.

Both the initial accelerated courses and the corequisite support courses include extra time in class – both to provide math content support and also to provide for non-academic (i.e., non-math content) support. As summarized in chapter 2, researchers have recommended that faculty provide five forms of non-content area support (Booth et al., 2013; Karp & Hughes, 2008): social integration (Halpin, 1990), nurturing, motivating students (Anderman et al., 2011), a growth mindset approach to theories of intelligence (Blackwell et al., 2007; Dweck, 2008a), and providing a sense of belonging in part to combat stereotype threat (Aronson et al., 2002; Good et al., 2003). However, no studies indicate which of these forms of non-academic support math faculty actually provide in their courses. Therefore, this study sought to discover the forms of non-academic support faculty were providing, how frequently they were providing the support, and what reasons the faculty believed these forms of support would be helpful to students.

Summary of key findings

When examining what forms of non-academic support community college math faculty provided to students that were designed around a specific non-academic challenge (e.g., "a student tells you that they feel that they do not belong in college," "a student is attending and participating in class, but is not submitting work") and which are based on one of the five forms of non-academic support, faculty state a strong preference for nurturing support and a weak disposition towards sense of belonging support, as seen in Table 19 and Table 23. Faculty reported providing nurturing support strongly by using several strategies, including the top three nurturing strategies that totaled 29.67 times reported per question. Faculty also strongly provided support for growth mindset-oriented scenarios, with the top three strategies totaling 36.50 times reported. Faculty only reported two strategies strongly for both social integration and motivation, with the top-two strategy totals 18.40 and 19.00 respectively. Faculty reported the weakest support for sense of belonging based scenario, with only one strategy strongly reported at 7.00 times reported per question asked.

When examining what forms of support faculty provided overall in accelerated or corequisite support, a few key findings are evident from Table 18. First, faculty had strong dispositions to help students connect with others. Specifically, when exploring a variety of scenarios, faculty most often would help students "stay connected," would help students to "find a group," would refer students to a college service, or would direct students to "work in groups" for cooperative learning. The fifth most commonly reported support was to help students understand they are "not alone." All five of these most common responses suggest respondents helped students strengthen their sense of belonging and connection to the college. Faculty also reported they would help provide a nurturing environment for their students by inquiring if they "are ok" and would help students "sense caring" from their instructors. These two forms of support formed seven of the top eight most common responses and were reported in a variety of scenarios, including scenarios that were not intended to address a student's possibly weak sense of belonging. Nevertheless, the faculty gravitated towards these two forms of support.

When faculty reported on how frequently they implemented various forms of support, a similar pattern of preferred forms of non-academic support emerged, as seen in Table 24. While faculty reported all forms of support at least twice during the term, they reported providing nurturing support most often, 3.11 times, again showing the most implementation. In the middle tiers were motivation (2.96 times), growth mindset (2.48,) and social integration (2.27,) with sense of belonging again being the weakest, least frequent form of support provided (2.07 times).

These results suggest an ability to provide a diverse form of support. The results also suggest faculty have developed a preferences for implementing nurturing support when encountering scenarios corresponding to specific student challenges. Faculty also reported the weakest support for strategies to strengthen students' sense of belonging in specific scenarios.

Other findings

There are other patterns that emerge when examining the standard deviations of the frequency that faculty reported providing the different forms of support (see Table 24.) First, nurturing support had both highest average (3.11 times support was implemented during the term) and also the smallest standard deviation (1.15). These two results combined indicate respondents implemented this form of support both the most and the most consistently, because there was less variation among the respondents. This consistency suggests math faculty from across California have developed similar approaches to how often they provide support in nurturing-focused situations. This consistency could be explained in several possible ways: widespread nurturing training that was not queried in this survey, choosing to hire faculty who provide nurturing support, or choosing nurturing faculty to assign to teach accelerated or co-requisite support courses.

In contrast, the three least frequent forms of support (sense of belonging, social integration, and growth mindset) all had comparable, higher standard deviations (1.42, 1.57, and 1.60 respectively), indicating wider disparity in implementing these other forms of support. Growth mindset and social integration support had the largest standard deviations, shown by the facts that the most frequent rate of reporting support during the term was “4 or more” times, while the second most frequent response was “zero” times. Many of the respondents were all or nothing for these two forms of support. Again, as noted above, these results suggest that professional development training opportunities have potential for noticeable changes in faculty support behavior.

When exploring possible explanations for the variability and contradictory results, one possible explanation is that the respondents were newer to teaching accelerated or corequisite support courses. However, that is not the case: only 19% were in their first year of teaching accelerated courses (see Table 11); the remaining 80% of respondents taught at least 1 year and averaged 3.45 years of teaching accelerated courses. Similarly, the faculty were not particularly new to the craft of math instruction. As seen in Table 12, the respondents' overall teaching experience was 8.82 years, with nobody in their first year teaching. Thus, lack of experience is not a cause for the unexpected and surprising findings.

Similarly, the findings do not seem to be explained by the lack of access to peers. As seen in Table 14, only one of 48 respondents indicated they have no peers teaching acceleration or corequisite support courses. However, 10 of 52 said no peers currently help or support respondent. More broadly, comparing the averages in Table 14 and Table 15, there were 40% fewer peers (3.22 vs 5.58) helping the respondents compared to the number of peers teaching similar courses. This suggests more intradepartmental cooperation or intradepartmental training activities could be helpful.

Contradictory responses: reported rates and forms of support

Of the five forms of non-academic support, community college math faculty reported providing nurturing support most frequently, and two closely related forms of support, social integration and sense of belonging, least frequently (see Table 24). Similarly, when faculty described how they would respond to open-ended student scenarios focused on the forms of support, they responded most strongly with growth mindset and nurturing strategies and the least strongly when support provided students with a sense of belonging (see Table 19 though Table 23).

In contradiction, however, when examining the strategies faculty reported, without separating strategies by the type of scenario posed (see Table 18), math faculty foregrounded helping students to remain connected to and to work with others, so as not to feel alone. These responses point to sense of belonging without explicitly using this term. When asked why the faculty thought students would find these forms of support useful, math faculty again came back to answers indicating the need for students to know they are not alone, therefore helping to develop a sense of belonging, as well as to provide a nurturing environment for students by helping them sense their instructor cares.

In the discussion section below, I offer a few possible explanations for why math faculty report not implementing sense of belonging strategies while still expecting students to be receptive to their help which provides both a sense of belonging and nurturing for students.

Possible explanation for contradictions

Based on the results of this survey, a couple of key points are evident. First, all evidence points towards low frequency and low implementation rates of providing support directed towards strengthening students' sense of belonging. The scenarios suggest that when situations develop for students in which their sense of belonging is threatened, faculty do not respond as strongly or as often as for other non-academic challenges (e.g., needing motivation). However, secondly, based on the forms of support faculty provide in a variety of scenarios, faculty are clearly aware of the need to help build for a strong sense of belonging. Faculty do not lack information about the importance of increasing students' sense of belonging.

How can we reconcile the idea that faculty know the importance of students' sense of belonging, yet they do not provide much support in this area? A few ideas are consistent with the data and present opportunities for future research. One idea is that the respondents may believe that providing support for sense of belonging is not something that should be provided during class time with all students present, as explored in RQ2, but rather should be handled on an individual case-by-case basis. However, several studies (such as Yeager & Walton, 2011) suggest interventions during class help students strengthen their sense of belonging, such as assigning brief readings (Walton & Cohen, 2011), as is common in classes to develop students' sense of growth mindset (Dweck, 2008a) or sharing something they have in common with other students (Walton et al., 2012). This study did not examine the hypothesis that faculty would respond more strongly to providing sense of belonging support in a smaller group or one-on-one setting.

Three other related ideas also seem plausible. First, while faculty seem to be aware of the value of strengthening students' sense of belonging, they may not be personally comfortable providing such support themselves to students. This is consistent with the prevalence of respondents referring students to counselors or academic services (see Table 19, Table 22, and Table 23). Secondly, it is possible that faculty believe that strengthening a students' sense of belonging does not require prolonged or frequent interaction from faculty. This is consistent with findings in other research about sense of belonging or "social belonging" (for example, Walton et al., 2012; Walton & Cohen, 2011). However, many of the interventions suggested or implemented by these researchers are quite brief (e.g., reading an article about overcoming adversity and reflecting on how it applies, helping students find simple common traits with peers such as a common birthday or favorite musician). The brief and simple nature of these interventions may help overcome faculty discomfort providing such support in class. Third, it is possible that a significant number of respondents do not know how to effectively strengthen students' sense of belonging. All three of these ideas suggest that faculty may benefit from professional development training in this area to raise their level of comfort and familiarize faculty with specific suggestions for brief interventions based on psychology research, as discussed in more detail in the implications for faculty development section. Again, none of these hypotheses were explored in this study.

Limitations of this study

This study is based solely on survey responses. Self-reported survey respondents only report what instructors believe they provide regarding non-academic support, what they wish to believe about their own practices, or what they wish the researcher to believe. Self-reported survey responses may not accurately depict actual implementation of non-academic support – theories-in-use can vary from theories-in-action (Anderson, 1997). The results reported here could be an overestimate of actual implementation. Such possible variation suggests that classroom implementation should also be explored and triangulated through other methods. A qualitative approach is needed to examine to what extent implementation of non-academic support occurs. Grubb (2001) states that if a goal is to learn about how to improve developmental education techniques, “classroom practices in remedial courses must be observed and described. Otherwise it is difficult to know what might have generated a particular set of outcomes - and therefore what might be changed” (p. 6). Such observations could form the basis for a future research study.

Additionally, this study only included the results from 58 respondents. It is possible that these respondents may not be representative of the full population, which now must be several hundred, possibly more than one thousand, faculty members. While attempts were made to ensure this study is generalizable, the large expansion of corequisite support may limit generalizability; this study queried the early adopters but after AB 705, a much larger portion of all math faculty became instructors of corequisite support courses. The post-AB 705 mainstream adopters may differ from the early adopters in how and how often they provide non-academic support.

Implications for faculty professional development and practice

The forms of non-academic support explored in this study have been known to researchers and practitioners for years. These forms of support have formed the underpinning of widely available training offered by the California Acceleration Project (CAP) dating back at least to 2013 (Hern & Snell, 2013). Furthermore, the demographic analysis of the respondents to this study tell us that approximately 53% (28 of 53) of respondents had participated in CAP training (see Table 16), and that 44% (23 of 53) had training in affective domain or sense of belonging non-content area support (see Table 17) at the time of this study. While training was widely available, approximately half of respondents had not undertaken such training. The lack of such professional development by half of the faculty surveyed suggests that there is further opportunity to integrate the research-indicated supports into math curriculum more broadly.

Additionally, in exploring possible explanations for the contradiction about supporting students' sense of belonging, several ideas suggested professional development training may help raise faculty's provision of sense of belonging support to levels seen for nurturing. While faculty reported awareness of the importance of providing sense of belonging support, their reported implementation was noticeably less than other forms of support. One explanation was that faculty may not be comfortable providing such support. Focused training, such as through role-playing examples of interactions with students or through suggesting equity or inclusion-oriented readings about how to incorporate students' cultures into math curriculum could strengthen faculty members' level of comfort providing such support to students. Training could help faculty to develop activities that are similar to those that resulted from small, brief interventions that strengthened students sense of (“social”) belonging (Walton et al., 2012; Walton & Cohen, 2011; Yeager et al., 2013; Yeager & Walton, 2011). Such interventions included: assigning brief readings about successfully adjusting to college or how setbacks are common and temporary, assigning students to speak aloud or write about how they can be (more) resilient when facing setbacks or adjustments to college, writing about their fears and concerns (e.g., prior to exams) as a way to reduce the stereotype threat they feel during exams possibly coupled with writing about the values they hold important and why in a self-affirmation assignment (Cohen et al., 2006; Miyake et al., 2010), and helping students to find characteristics (including academic characteristics) they share with other college students perhaps in ice-breaker early-term activities.

Implications for possible future research efforts

With only 58 respondents to the survey in this study, this study does not yield a sufficiently large enough data set that would permit disaggregation of results into two populations worth studying further: community college math faculty who *have* and who *have not* been trained about how to provide different forms of non-academic support. This study revealed that only approximately half of math faculty had participated in training at the time this study was conducted. Furthermore, as such training has become even more widely available, the impact of such professional development may result in different outcomes were this study or a similar study to be repeated again. Exploring these issues in more detail may yield insights beyond what this study can provide.

Another opportunity for future research is to simply repeat a similar study again, four years later. Faculty self-reported provision of non-academic support now, in the four years since this study was conducted, have likely changed significantly if for no other reason than the population of instructors teaching corequisite courses has grown significantly. The implementers of today have evolved from the early-adopting instructors that I was examined to mainstream instructors today. Corequisite courses are now the norm in 114 California community colleges. In comparison, accelerated courses were offered in 32 colleges in 2014-15 when this study was conceived and in 65 colleges in 2017-2018 when this study was conducted. Even more pronounced: at the time of this study, corequisite courses were in the development stages and taught at a couple of colleges at most. With such a large expansion of the target population, results are likely to be different and include pronounced differences between early adopters (who I suspect are strong implementers) and late-stage adopters who may be more resistant to implementing non-academic support. How are today's instructors in corequisite support courses implementing non-academic support?

Two related topics for future research are also ready for examination. One topic is to explore the characteristics that differentiate instructors who provide strong and frequent non-academic support from other instructors who provide weak or infrequent non-academic support. The second topic is to examine the provision of non-academic support from the perspective of the students. How do students perceive the non-academic support instructors provide? Which forms of non-academic support do students perceive and which forms resonate best with students? How often do students believe faculty are providing that support? Do students find the non-academic support helpful or not and why? Do these answers about student perception vary across the different forms of non-academic support? Are students exploring information they learn about instructors' approaches to non-academic support prior to enrolling in a course? Are students using such information to help them decide which course or which instructor to take when selecting college-level math courses?

With corequisite support becoming the norm in California after the passage of AB 705 and becoming more widespread based on early research findings, it is important that researchers continue to explore how to best help students be successful in courses in ways that extend beyond the math content. Provision of non-academic support will remain an important topic for the foreseeable future in college-level math classes taught in community colleges.

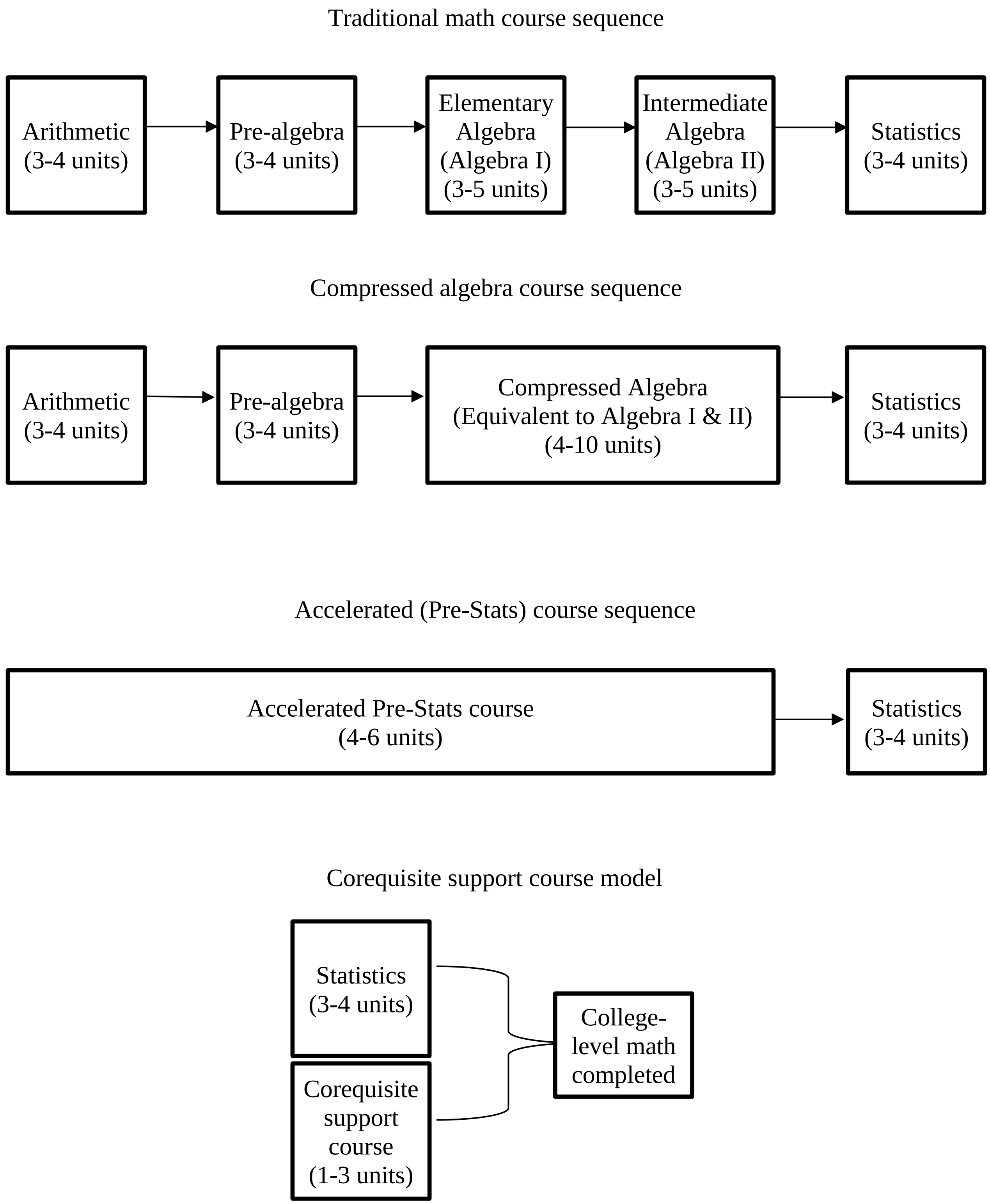
Dissemination of findings

I plan to propose conference presentations at conferences held by the American Mathematical Association of Two-Year Colleges, the California Mathematics Council of Community Colleges, the California Community Colleges' Success Network, and the Research and Planning group (RP group).

With the growth of equity-oriented inclusive teaching across the curriculum, I also have opportunities to share these results in the region where I work and especially at the college where I currently serve as the dean of the mathematics department. In this role, I will continue to work with math faculty leaders to develop or assist with professional development trainings like those I recommended earlier in this chapter. Additionally, I will continue to work with local champions of non-academic support by helping them explore topics, by providing access to research findings and contacts in the community, and by continuing to increase their ability to broadcast their ideas to their peers. In other words, I will continue to strengthen the sense of belonging for faculty members who integrate non-academic support into their teaching.

Figure 1

Figure 1 - Comparing traditional, compressed, accelerated, and corequisite support math course sequences



Tables

Table 1 - First math course

First developmental math course: California community college students entering in Fall 2002 (data source: Perry et al., 2010)					
	Arithmetic	Pre-algebra	Beginning Algebra	Intermediate Algebra	Total % by ethnicity
Total	23%	21%	34%	23%	
Black	39%	22%	26%	13%	100%
Hispanic	30%	23%	30%	16%	100%
White	15%	19%	37%	28%	100%
Asian	15%	17%	34%	33%	100%

Table 2 - Sequence completion rates and starting course

Number of courses below college-level	Sequence completion rate
Overall	33%
1 level below	45%
2 levels below	32%
3 or more levels below	17%

Table 3 - Research studies on categories of non-academic support

Categories of non-academic support	Sedlacek's 8 categories (Sedlacek, 2004)	RP group study's 6 themes [rank] (Booth et al., 2013)	Karp four support mechanisms (Karp, 2011)	Psychological Studies
Social integration	Availability of strong support people; leadership experience; community involvement	Being engaged in classes or extracurricular activities [3]; feeling connected to college community [4] (and some forms of feeling valued [5])	Creating social relationships	
Nurturing		Being nurtured [2]; feeling opinions are valued [5] (and some forms of focus on goals [1] and engagement [3])	Making life feasible* to manage daily tasks**	
Motivation	Preference for long-term goals	Being focused on goals [1]; being directed to completing goals [6] (and some forms of engagement [3])	Clarifying aspirations and enhancing commitment	
Theories of Intelligence				(Blackwell et al., 2007; Dweck, 2006, 2008b)
Stereotype threat and addressing it through sense of belong and self-affirmation exercises	Positive self-concept; realistic self-appraisal	(Some forms of focus on goals [1] and nurturing [2] and engagement [3] and feeling valued [5])		(Aronson et al., 2002; Good et al., 2003; Inzlicht et al., 2006; Steele & Aronson, 1995) (Cohen et al., 2009; Miyake et al., 2010; Schimel et al., 2004)
Other factors	Gaining knowledge in the field; handling the system successfully		Developing college know-how (cultural capital)*	
Notes			* less support in education research prior to this study ** later RP group study supports	

Table 4 - Crosswalk between open-ended survey questions and forms of support

Survey Question designation	Form of support	Survey question
Single – pt 2	Growth Mindset	Soon afterwards, you learn the student feels shy and uncomfortable making mistakes in front of others. What, if anything, would you adjust in your answers above?
Struggling- pt 1	Growth Mindset	Some students initially struggle with material and may initially perform poorly. What kind of opportunities, if any, do you provide for students to get to and demonstrate improved understanding and mastery later in the term?
3a	Motivation	A student is attending, but is not submitting work.
3b	Motivation	A student submits incomplete assignments.
3c	Motivation	A student is attending sporadically, and frequently is not in class for the entire session due to late arrival and/or early departure.
2a	Nurturing	A student is noticeably distracted during more than one class session
2b	Nurturing	A student arrives in class and compared to previous days, you sense they are less healthy (e.g., tired, sick, or hungry) or less hygienic (e.g., clothes appear more tattered or an increased body odor.)
1a	Sense of Belonging	A student tells you that they feel that they do not belong in college
1b	Sense of Belonging	A student informs you that a close family member or close friend thinks they are not going to succeed in college.
Struggling – pt 2	Sense of Belonging	How do you help students recognize that struggle is common and helpful for learning?
Single – pt 1	Social Integration	A student is sitting alone while working on the task during a time when you asked students to work together in small groups
Getting to know – pt 1	Social Integration	In your support or accelerated class, what kind of activities occur that result in students getting to know other students? How often and when do these activities occur?
Getting to know – pt 2	Social Integration	How often and when do these activities occur?

Survey Question designation	Form of support	Survey question
Final - pt 1	all	Is there anything else you do in situations similar to the questions you have answered so far?
Final - pt 2	all	Is there anything you do to help prevent some of the above situations from occurring? For example, do you have any all-class activities or discussions about these topics? Small group activities or discussions? Homework?

Table 5 - Crosswalk between fixed-response survey questions and forms of support

	For each of the following, please respond to this question: "During the term, how many times have you ____?"
Form of support	**Survey question**
Growth Mindset	Incorporated low-stakes assignments in which students assess previous learning?
Growth Mindset	Discussed "growth mindset"?
Growth Mindset	Incorporate assignments where students submit multiple drafts and learn from feedback from you and/or peers?
Motivation	Discussed how math relates to the real world during class
Motivation	Discussed the topic of students' educational goals with individual students?
Motivation	Discuss the topic of educational goals during class?
Motivation	Made connections between students' personal goals and class?
Motivation	Discussed how math relates to students' educational goals during class?
Motivation	Encouraged students to continue by taking the next math class?
Motivation	Discussed or conducted activities focused on students' dedication or perseverance towards completing long-term (>2 years) goals?
Nurturing	Mentioned you care about the students' success in math, either during or outside of class?
Nurturing	Mention you care about the students' success in college, either during or outside of class?
Nurturing	Had a conversation with an individual or small group of students about their academic experience and situation at your college? (Example topics could be how well students are accomplishing their goals, discussing challenges they have at the college, or asking about grades in other classes?)
Nurturing	Asked how students are doing personally?
Nurturing	Spoken about personal (non-academic) life responsibilities with students either individually or the class as a whole ?
Nurturing	Connected a student with a college or external resource to help the student address daily tasks or to improve feasibility of life challenges? Examples of resources include food banks, shelters or homeless resources, and physical or mental health resources.
Sense of Belonging	Provided students an opportunity to discuss their family culture, history, or traditions in class?
Sense of Belonging	Talked to an individual student about their attendance?

	For each of the following, please respond to this question: "<u>During the term,</u> how many times have you ____?"
Form of support	**Survey question**
Stereotype Threat (Sense of Belonging)	Assigned or allocated class time for students to write or speak about their achievements, values, or relationships?
Stereotype Threat (Sense of Belonging)	Asked your students write about values that are personal and important to them?
Social Integration	Mention gathering/studying locations on campus (e.g., library, lounges)?
Social Integration	Required students work with peers outside of class?
Social Integration	Discussed or made students aware of extra-curricular activities (e.g., clubs, serving on a college committee, and student government)
Social Integration	Discuss or make students aware of co-curricular activities (e.g., debate team, math competitions)
Social Integration	Used group projects where the work was contained during class time
Social Integration	Used group projects that required students to work together outside of class
Social Integration	Required students to interact with you outside of class time (such as mandatory visits to office hours?)
Social Integration	Helped ensure students know about <u>student services</u>, such as counseling, financial aid, disabled student support services?
Social Integration	Help ensure students know about <u>academic support services</u>, such as tutoring, the college library, academic support workshops, and academic support courses?
Social Integration	Helped ensure students know about <u>peer learning groups or programs</u>, such as EOPS (Extended Opportunities Programs and Services), learning communities, and first year/ freshman experience programs?
multiple	Told the class that you want them to attend class?
multiple	Complimented students' or groups' specific course-related accomplishments during class?

Table 6 - Survey Response Counts

	Distribution 1	Distribution 2
Useful	34	24
Completed	29	225
Incomplete	46	56
Spam but completed	0	197
Total responses	75	281

Table 7 - Gender of Respondents

Male	**30**	**57%**
Female	23	43%
Total	53	

Table 8 - Race of Respondents

RACE	N	%		MULTIRACIAL ENTRIES (1 ENTRY EACH)
AFRICAN AMERICAN / BLACK	1	2.0%	2.0%	Caucasian and Hispanic
ASIAN / PACIFIC ISLANDER	4	7.8%	2.0%	Chinese/White
CAUCASIAN / WHITE	33	64.7%	2.0%	White and Pacific Islander
LATINO / HISPANIC	6	11.8%	2.0%	African and Asian
NATIVE AMERICAN	0	0.0%	2.0%	Japanese/Caucasian
MULTIRACIAL (SPECIFY)	7	13.7%	2.0%	White and Native American
			2.0%	Hispanic, Belgium
TOTAL	51			

Table 9 - Respondent Age

RESPONDENT AGE			VALUE USED TO CALCULATE AVERAGE AGE	
UNDER 30 YEARS	4	7.7%	28	
30-39 YEARS	15	28.8%	34.5	
40-49 YEARS	15	28.8%	44.5	
50-59 YEARS	10	19.2%	54.5	
60 OR OLDER	8	15.4%	62	
TOTAL	52		44.96	Avg. age

Table 10 - Employment Status

EMPLOYMENT STATUS		
FULL-TIME	33	63%
PART-TIME	19	37%
TOTAL	52	

Table 11 - Years Teaching an Accelerated Course

RESPONSE	N	%	VALUE USED TO CALCULATE AVERAGE YEARS	
THIS IS MY FIRST YEAR	10	19.2%	0.5	
1-3	22	42.3%	2	
4-7	17	32.7%	5.5	
8-14	2	3.8%	11	
15 OR MORE	1	1.9%	15	
TOTAL	52		3.45	Average years

Table 12 - Years Teaching Math in Community Colleges

RESPONSE	N	%	VALUE USED TO CALCULATE AVERAGE YEARS	
THIS IS MY FIRST YEAR	0	0.0%	0.5	
1-3	10	18.9%	2	
4-7	17	32.1%	5.5	
8-14	9	17.0%	11	
15 OR MORE	17	32.1%	15	
TOTAL	53	reported 6	8.82	Average

Table 13 - Is Respondent's Math Course Part of a Learning Community or Other College Program

RESPONSE	N	%	
YES [WHICH?]	6	11.3%	
SOMETIMES	11	20.8%	
NO	26	49.1%	
I DON'T KNOW	10	18.9%	
TOTAL	53		
	Which?		
	1	1.9%	learning community
	1	1.9%	Embedded Tutoring
	1	1.9%	UMOJA
	3	5.8%	Community of Practice

Table 14 - Number of Math Faculty Peers Also Teaching Accelerated Course

RESPONSE	N	%	VALUE USED TO CALCULATE AVERAGE NUMBER OF PEERS	
NONE	1	2.1%	0	
1	0	0.0%	1	
2-3	11	22.9%	2.5	
4-7	19	39.6%	5.5	
8 OR MORE	17	35.4%	8	
TOTAL	48		5.58	Average

Table 15 - Number of Math Faculty Who Currently Help or Support Respondent

RESPONSE	N	%	VALUE USED TO CALCULATE AVERAGE NUMBER OF PEERS	
NONE	10	19.2%	0	
1	4	7.7%	1	
2-3	21	40.4%	2.5	
4-7	10	19.2%	5.5	
8 OR MORE	7	13.5%	8	
TOTAL	52		3.22	Average

Table 16 - Participated in Training from California Acceleration Project

RESPONSE	N	%
YES	28	52.8%
NO	23	43.4%
I DON'T KNOW	2	3.8%
TOTAL	53	

Table 17 - Participated in Training in affective domain or sense of belonging

RESPONSE	N	%
YES [WHICH?]	23	44.2%
NO	27	51.9%
I DON'T KNOW	2	3.8%
TOTAL	52	

Table 18 – All Non-Academic Support Strategies (First Analysis Method)

Strategy – sorted from most to least (truncated below 1.00 times stated per question, 19 question scenarios)	Times stated total	Times stated per question
stay connected - follow-up/monitor;	67	3.53
find group - assign or coach students to group (when working alone)	59	3.11
refer to service -- or person; services are available	55	2.89
work in groups - cooperative learning	54	2.84
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	53	2.79
stay strict - reminders of class rules (group work)/expectations/grading scheme	53	2.79
are you ok -- or similar question (how are you; is working in a group ok?)	51	2.68
senses caring -- senses concern; sympathy	42	2.21
refer to instructor - or office hours	40	2.11
common -- normal	39	2.05
explain value - teacher describes value of activity	39	2.05
learn from mistakes - we learn from mistakes	37	1.95
why happening - ask why this is happening	34	1.79
Daily [a frequency question]	[32]	[1.68]
academic support - refer to tutoring	31	1.63
nothing - do nothing or make no changes	31	1.63
you belong - or will succeed;	25	1.32
refer to counselor - counselor help; talk to college counselor (NOT psychologist)	25	1.32
refer to peer - or mentor; or classmate/group	24	1.26
encourage - reassures;	24	1.26
multiple submissions - test corrections or HW	22	1.16
listen -- sounding board	21	1.11
TOTAL	826	43.48

[The entry for "daily" above, was not tabulated in the sums.]

Table 19 - Non-Academic Support Strategies - Nurturing Scenarios

Nurturing scenarios include questions 2a, 2b

Strategy – sorted from most to least (truncated below 2.50 times stated per question, 3 questions asked)	Times stated total	Times stated per question
are you ok -- or similar question (how are you; is working in a group ok?)	38	12.67
refer to service -- or person; services are available	29	9.67
stay connected - follow-up/monitor;	22	7.33
senses caring -- senses concern; sympathy	15	5.00
seem distracted -- inattentive/different/less healthy	13	4.33
refer to counselor - counselor help; talk to college counselor (NOT psychologist)	11	3.67
can I help	11	3.67
listen -- sounding board	10	3.33
accesses resources	9	3.00
TOTAL of 9 rows above	158	52.67

Table 20 - Non-Academic Support Strategies – Social Integration Scenarios

Social integration scenarios include Single part 1 and
Students Getting to Know Each Other parts 1 and 2.

Strategy – sorted from most to least (truncated below 2.50 times stated per question, 5 questions asked)	Times stated total	Times stated per question
find group - assign or coach students to group (when working alone)	53	10.60
work in groups - cooperative learning	39	7.80
Daily [a frequency question]	[32]	[6.40]
explain value - teacher describes value of activity	25	5.00
stay strict - reminders of class rules (group work)/expectations/grading scheme	18	3.60
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	17	3.40
nothing - do nothing or make no changes	13	2.60
Weekly [a frequency question]	[13]	[2.60]
icebreaker - 2 truths/lie	13	2.60
TOTAL of 9 rows above	178	35.60

[The entries for “daily” and “weekly” above, were not tabulated in the totals.]

Table 21 - Non-Academic Support Strategies – Growth Mindset Scenarios

Growth Mindset scenario questions include Single part 2 and Struggling part 1

Strategy – sorted from most to least (truncated below 2.50 times stated per question, 2 questions asked)	Times stated total	Times stated per question
learn from mistakes - we learn from mistakes	30	15.00
common -- normal	27	13.50
nothing - do nothing or make no changes	16	8.00
productive struggle	9	4.50
growth mindset	7	3.50
multiple submissions - test corrections or HW	6	3.00
explain value - teacher describes value of activity	5	2.50
TOTAL of 7 rows above	100	50.0

Table 22 - Non-Academic Support Strategies – Motivation Scenarios

Motivation scenario questions include 3a, 3b, and 3c.

Strategy – sorted from most to least (truncated below 2.50 times stated per question, 3 questions asked)	Times stated total	Times stated per question
stay connected - follow-up/monitor;	29	9.67
refer to instructor - or office hours	28	9.33
encourage - reassures;	13	4.33
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	9	3.00
senses caring -- senses concern; sympathy	8	2.67
goal progress - setting goals / making progress towards goals	8	2.67
TOTAL of 6 rows above	95	31.67

Table 23 - Non-Academic Support Strategies – Sense of Belonging Scenarios

Sense of belonging scenario questions include 1a, 1b, Struggling part 2, and Getting to know - part 1.

Strategy – sorted from most to least (truncated below 2.50 times stated per question, 4 questions asked)	Times stated total	Times stated per question
stay connected - follow-up/monitor;	28	7.00
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	21	5.25
senses caring -- senses concern; sympathy	18	4.50
academic support - refer to tutoring	18	4.50
refer to instructor - or office hours	17	4.25
you belong - or will succeed;	17	4.25
refer to service -- or person; services are available	17	4.25
multiple submissions - test corrections or HW	14	3.50
why do you feel that?	13	3.25
teacher personal experience; share personal experience	12	3.00
common -- normal	10	2.50
TOTAL of 11 rows above	185	46.25

Table 24 - Frequency of Support for Each Form of Non-Academic Support

Form of Support	Nurturing	Motivation	Growth Mindset	Social Integration	Sense of Belonging or Stereotype Threat	Questions with Multiple Forms of Support	Sense of Belonging only	Stereotype Threat only
Number of Questions	6	7	3	10	4	2	2	2
N (responses)	316	369	158	523	210	105	104	106
Std. Dev.	1.15	1.26	1.60	1.57	1.42	1.05	1.42	1.38
Average	3.11	2.96	2.48	2.27	2.07	3.20	2.32	1.83
0	16	23	35	118	39	2	16	23
1	12	31	11	56	41	6	16	25
2	62	67	21	93	42	19	20	22
3	58	63	25	77	42	20	23	19
4 or more	168	185	66	179	46	58	29	17

Table 25 - Sense of Belonging - Why students would find helpful

Reason	Times stated total
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	18
senses caring -- senses concern; sympathy	17
improve confidence	4
academic support	3
accesses resources	3
believe in students	3
refer to service	3
you belong	3
common	2
encourage	2
establish wins	2
comfortable	1
effort pays	1
goal progress	1
growth mindset	1
praise success	1
refer to instructor	1
refer to peer	1
stay connected	1
teacher personal experience	1
you matter	1
study groups	1

Table 26 - Nurturing - Why students would find helpful

Reason	Times stated total
senses caring -- senses concern; sympathy	15
accesses resources	9
not alone	5
refer to service	4
listen	3
believe in students	2
comfortable	2
improve confidence	1
common	1
encourage	1
goal progress	1
growth mindset	1
refer to instructor	1
care personally	1
extrinsic motivation	1
I am here for you	1
stay strict	1

Table 27 - Motivation - Why students would find helpful

Reason	Times stated total
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	7
you belong	5
encourage	3
goal progress	3
academic support	3
content	3
refer to counselor	3
senses caring	2
refer to instructor	2
extrinsic motivation	2
I am here for you	2
establish wins	2
refer to peer	2
stay connected	2
explain value	2
forming habits	2
provide accommodations	2
receiving feedback	2
time management	2
accesses resources	1
care personally	1
praise success	1
you matter	1
can I help	1
environment	1
multiple submissions	1
nothing	1
productive struggle	1
reduce stress	1
value work	1
work in groups	1

Table 28 - Social Integration - Why students would find helpful - Combined Distributions

Reason	Times stated total
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	14
overcome shy - students are shy sometimes and need to work with others	9
comfortable	4
you belong	2
senses caring	2
explain value	2
value work	2
stay strict	2
encourage	1
I am here for you	1
accesses resources	1
respected	1
suck it up	1
icebreaker	1

Table 29 - Reasons Why Students Would Find Strategy Helpful - All Four Strategies Combined

Reasons – Top 20 listed	Times stated total
not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you	44
senses caring	36
accesses resources	14
you belong	10
overcome shy	9
comfortable	7
encourage	7
refer to service	7
academic support	6
goal progress	5
believe in students	5
improve confidence	5
explain value	4
I am here for you	4
refer to instructor	4
establish wins	4
value work	3
stay strict	3
content	3
refer to counselor	3

Appendix A: Survey questions

Disclosures
David Vakil, a graduate student and working under the supervision of faculty adviser Dr. Diane Durkin in the Educational Leadership Program at the University of California, Los Angeles (UCLA) is conducting a research study as part of Mr. Vakil's dissertation research.

You were selected as a possible participant in this study because you are currently or recently were a math faculty teaching a support course or an accelerated developmental course at a California Community College. Your participation in this survey is voluntary.

Why is this study being done?
This study is being conducted to assess the forms of non-academic support, such as in the affective domain, that faculty provide to their students, the context of the support, the frequency of the support, and why faculty believe these forms of support are likely to help students. Results will be used to improve support courses, accelerated math courses, and non-academic support provided in math courses, including classes that respond to Assembly Bill 705.

What will happen if I take part in this research study?
Your participation in this study consists of completion of this survey. If you wish and if you provide contact information, you may be contacted to follow up on some of your responses or you may receive a summary of the results.

Duration of the survey
This survey is estimated to take approximately 30 minutes.

Risks and benefits
There are no anticipated risks or discomforts to participating in this survey.

The results of this research may benefit faculty who teach math, who teach other accelerated courses, or who provide non-academic support to students in their classes.

Will I be paid for participating?
Current faculty members who teach or who have recently taught support courses or accelerated math courses and who complete the survey will receive a $10 e-gift card within a week of completing and submitting the online survey. The e-gift card will be from your choice of one of these vendors: Amazon.com, Barnes and Noble, Best Buy, Staples, or Starbucks.

Choosing not to participate or respond
You may refuse to answer any questions that you do not want to answer and you will remain in the study.

Information not shared and will be kept confidential
Any information that is obtained in connection with this study and that can identify you will remain confidential. It will be disclosed only with your permission or as required by law. Confidentiality will be maintained by means of coding contact information during analysis and destroying codes upon completion; survey results will be stored on researcher's private computers and will not be stored in the cloud after the survey has closed.

What are my rights if I take part in this study?

- You can choose whether or not you want to be in this study, and you may withdraw your consent and discontinue participation at any time.
- Whatever decision you make, there will be no penalty to you, and no loss of benefits to which you were otherwise entitled.
- You may refuse to answer any questions that you do not want to answer and still remain in the study.

Who can I contact if I have questions about this study?

- The research team:
  If you have any questions, comments or concerns about the research, you can talk to one of the researchers. The principal investigator is David Vakil and can be reached at david.j.vakil@gmail.com. The faculty sponsor is Diane Durkin and she may be reached at durkin@humnet.ucla.edu.
- UCLA Office of the Human Research Protection Program (OHRPP):
  If you have questions about your rights as a research subject, or you have concerns or suggestions and you want to talk to someone other than the researchers, you may contact the UCLA OHRPP by phone: (310) 206-2040; by email: participants@research.ucla.edu or by mail: Box 951406, Los Angeles, CA 90095-1406.

Which form of support or accelerated developmental math course do you currently teach or have you recently taught at a California community college? [Select all that apply]

☐pre-stats, Path to Stats, Statway
☐ Quantway
☐ Co-requisite math support course
☐ Combined algebra
☐ Other __________
☐ None; I have not taught accelerated courses

Thank you for taking time to participate in this research study about California Community College accelerated developmental math instruction.

This survey consists of three sections in the following order:

1. Open-ended questions, which will take the bulk of your time responding to this survey and approximately half of the survey pages;
2. Multiple-choice questions;
3. and finally Demographic questions about you and your college.

In the next pages, you will be given three sets of scenarios (2-3 scenarios per set.) First you are asked to choose one scenario and then to respond to questions about the scenario you choose. All of the questions are the same; only the scenarios change.

<u>Pick the one scenario below</u> with which you have the most experience or which has most impacted student success in your support or accelerated classes and respond to the questions below.

Scenario set 1:

☐A student tells you that they feel that they do not belong in college

☐A student informs you that a close family member or close friend thinks they are not going to succeed in college.

What are the first few comments you would say to the student?

____

____

How would you continue to help this student, both initially and during the term?

____

____

Why would the student find this to be helpful and effective?

____

____

<u>Pick the one scenario below</u> with which you have the most experience or which has most impacted student success in your support or accelerated classes and respond to the questions below.

Scenario set 2:

☐A student is noticeably distracted during more than one class session

☐A student arrives in class and compared to previous days, you sense they are less healthy (e.g., tired, sick, or hungry) or less hygienic (e.g., clothes appear more tattered or with increased body odor)

What are the first few comments you would say to the student?

____

____

How would you continue to help this student, both initially and during the term?

Why would the student find this to be helpful and effective?

Pick the one scenario below with which you have the most experience or which has most impacted student success in your support or accelerated classes and respond to the questions below.

Scenario set 3:

☐A student is attending and participating in class, but is not submitting work

☐A student submits incomplete assignments

☐A student is attending sporadically, and frequently is not in class for the entire session due to late arrival and/or early departure

What are the first few comments you would say to the student?

How would you continue to help this student, both initially and during the term?

Why would the student find this to be helpful and effective?

Next you are given a single scenario followed by some questions.

Single Scenario

A student is sitting alone while working on the task during a time when you asked students to work together in small groups.

What are the first few comments you would say to the student?

How would you continue to help this student, both initially and during the term?

Why would the student find this to be helpful and effective?

Soon afterwards, you learn the student feels shy and uncomfortable making mistakes in front of others. What, if anything, would you adjust in your answers above?

The next set of questions ask you about the feedback, activities, and support you provide in your support or accelerated classes.

Struggling Students
Some students initially struggle with material and may initially perform poorly.

What kind of opportunities, if any, do you provide for students to get to and demonstrate improved understanding and mastery later in the term?

____
____

How do you help these students to recognize that struggle is common and often helpful for learning?

____
____

Students getting to know each other
In your support or accelerated class, what kind of activities occur that result in students getting to know other students?

____
____

How often and when do these activities occur?

____
____

Is there anything else that you do in situations similar to the questions you have answered so far?

____
____

Is there anything you do to help prevent some of the above situations from occurring? For example, do you have any all-class activities or discussions about these topics? Small group activities or discussions? Homework?

____
____

Please continue to the multiple choice questions on the following pages.

Thank you for sticking with this. Your time and input are valuable and appreciated.

The rest of the survey should proceed quickly.

For each of the following, please respond to this question: "During the term, how many times have you ________?"					
	4 or more	3	2	1	None
Discussed how math relates to the real world during class					
Incorporated low-stakes group assignments in which students assess previous learning					
Mentioned that you care about the students' success in math, either during or outside of class					
Mentioned that you care about the students' success in college, either during or outside of class					
Assigned or allocated class time for students to write or speak about their achievements, values, or relationships					
Provided students an opportunity to discuss their family culture, family history, or traditions in class					
Discussed the topic of students' educational goals with individual students					
Discussed the topic of educational goals during class					
Mentioned gathering/studying locations on campus (e.g., library, lounges)					
Encouraged students to continue math by taking the next math class					
Talked to an individual student about their attendance					
Told the class that you want them to attend class					
Had a conversation with an individual or small group of students about their academic experience and situation at your college Example topics could be: how well students are accomplishing their goals, discussing challenges they have at the college, or asking about grades in other classes.					
Made connections between students' personal goals and your math class					
Discussed "growth mindset"					
Discussed how math relates to students' educational goals during class					
Asked how students are doing personally					
Discussed or conducted activities focused on students' dedication or perseverance towards completing long-term (>2 years) goals					
Complimented students' or groups' specific course-related accomplishments during class					
Spoken about personal (non-academic) life responsibilities with students either individually or the class as a whole					

For each of the following, please respond to this question: "During the term, how many times have you ________?"					
	4 or more	3	2	1	None
Required students to work with peers outside of class					
Discussed or made students aware of extra-curricular activities (e.g., clubs, serving on a college committee, and student government)					
Discussed or made students aware of co-curricular activities (e.g., debate team, math competitions)					
Used group projects where the work was contained during the class time					
Used group projects that required students to work together outside of class					
Required students to interact with you outside of class time (such as mandatory visits to office hours)					
Incorporated assignments where students submit multiple drafts and learn from feedback from you and/or peers					
Helped ensure students know about student services, such as counseling, financial aid, and disabled student support services.					
Helped ensure students know about academic support services, such as tutoring, the college library, academic support workshops, and academic support courses					
Helped ensure students know about peer learning groups or programs, such as EOPS (Extended Opportunity Programs and Services), learning communities, and first year / freshman experience program					
Connected a student with a college or external resource to help the student address daily tasks or to improve feasibility of life challenges. Examples of resources include food banks, shelters or homeless resources, and physical or mental health resources.					
Asked your students to write about values that are personal and important to them					

You have finished the content of the survey. The last few questions ask about you and your college working environment.

Questions about you and your working environment

Is your support or accelerated developmental math course part of a learning community, contextualized academy (e.g., linked directly with a CTE vocational program) or another college program?

☐Yes [Which?] ____

☐Sometimes

☐No

☐I don't know

Have you participated in math training provided by the California Acceleration Project (CAP)?

☐Yes ☐No ☐I don't know

Have you participated in training or professional development in the "affective domain," or students' social belonging or sense of belonging or creating a community of learners?

☐Yes [Which?] ____

☐No

☐I don't know

How many math faculty members at your college are also teaching a support or accelerated developmental math course?

☐None

☐1

☐2-3

☐4-7

☐8 or more

☐I don't know

How many math faculty members <u>currently</u> help or support you with your teaching methods?

☐None

☐1

☐2-3

☐4-7

☐8 or more

For how many years have you taught <u>a support or an accelerated developmental math</u> course at a community college?

☐This is my first year

☐1-3

☐4-7

☐8-14

☐15 or more

For how many years have you taught <u>math</u> at a community college?

☐This is my first year

☐1-3

☐4-7

☐8-14

☐15 or more

What is your employment status where you teach the support or accelerated developmental math course described in your responses?

☐Full-time ☐Part-time

What gender are you?

☐Male ☐Female ☐Other ______________________

What age range are you in?

☐Under 30 years
☐30-39 years
☐40-49 years
☐50-59 years
☐60 or older

What is your ethnicity?

☐African American / Black
☐Asian / Pacific Islander
☐Caucasian / White
☐Latino / Hispanic
☐Native American
☐Multiracial (specify) ______________________________________
☐Other (specify) ______________________________________

Email address for e-gift card and possible follow-up

In order to receive the e-gift card, please provide your email address. ______________________

Would you be willing to be contacted about your responses for possible follow-up?

☐Yes ☐No

Would you like information about the outcomes of this study to be shared with you?

☐Yes ☐No

Please select the vendor from which you wish to receive a $10 e-gift card:

☐Amazon.com ☐Barnes and Noble ☐Best Buy
☐Starbucks ☐Staples ☐I decline the $10 e-gift card

Thank you for participating in this survey and supporting my dissertation research. I am truly appreciative.

This concludes the survey. Have a nice day and thank you again.

Appendix B: California community colleges' accelerated math courses in 2017-2018

College	Course
Allan Hancock College	PS PA PR
*American River College	Statway
Bakersfield College	PS PA PR
*Berkeley City College	PS PA PR
Cabrillo College	PS PA PR
*Canada College	PS PA PR
Cerritos College	PS PA PR
*Chabot College	PS PA PR
Citrus College	PS PA PR
*City Coll. San Francisco	PS AR PR
Coastline Comm. Coll.	Statway
*College of Alameda	PS PA PR
College of Marin	Statway
College of San Mateo	PS AR PR
*College of the Canyons	PS PA PR
College of the Redwoods	PS no PR
Columbia College	PS no PR
*Compton College	PS no PR
*Contra Costa College	PS no PR
Copper Mountain College	PS PA PR
Crafton Hills College	PS no PR
*Cuesta College	PS PA PR
*Cuyamaca College	PS no PR
*Cypress College	PS AR PR
*De Anza College	Statway
*Diablo Valley College	Statway
*El Camino College	PS no PR
*Evergreen Valley College	PS AR PR
*Foothill College	Statway
Glendale Community Coll.	PS PA PR
Golden West	PS no PR
Hartnell College	Statway
Irvine Valley College	PS PA PR
LA City College	PS PA PR
*LA Harbor College	PS PA PR

College	Course
*LA Mission College	PS PA PR
*LA Pierce College	Statway
LA Valley College	PS PA PR
*Long Beach City College	PS PA PR
Long Beach City College	Statway
*Los Medanos College	PS no PR
*Mendocino College	PS AR PR
Merritt College	PS AR PR
MiraCosta College	Statway
Mission College	Statway
Monterey Peninsula Coll.	PS PA PR
Moorpark College	PS PA PR
*Moreno Valley College	PS no PR
*Mt. San Antonio College	Statway
Mt. San Jacinto College	PS no PR
Ohlone College	PS no PR
*Palomar College	PS PA PR
*Pasadena City College	Quantway
Reedley College	PS AR PR
Rio Hondo College	PS PA PR
*Riverside City College	PS no PR
*San Diego City College	Statway
*San Diego Miramar Coll.	Statway
*San Jose City College	Statway
Santa Monica College	PS PA PR
Shasta College	PS PA PR
Sierra College	PS PA PR
Sierra College	Quant.
*Skyline College	PS AR PR
Southwestern College	Statway
Ventura College	PS PA PR
Victor Valley College	PS PA PR

*Acceleration present in 2014-2015

Legend

PS AR PR	pre-statistics course with arithmetic prerequisite requirement
PS no PR	pre-statistics course with no prerequisite requirement
PS PA PR	pre-statistics course with pre-algebra prerequisite requirement
Quantway (Statway)	Quantway (Statway) two-course quantitative reasoning sequence
Quant.	quantitative reasoning course that serves as prerequisite for statistics

Appendix C: Spam survey response criteria

Criteria used in free-response questions for determining if a survey respondent was providing "spam" responses and who is unlikely to be in the target survey population.

1. Incomplete responses to essay questions or responses of "N/A"
2. Responses do not address the question prompt or the selected choice
3. Denigrating the hypothetical student or making a factual statement unsupported by the question prompt (e.g., "You have a learning disability")
4. Responses to free response question are inconsistent with responses to related questions
5. Responses indicate respondent would use a method of teaching or grading that deviates significantly from the norm in higher education (e.g., assessing students with a [monetary] fine or contacting the students' parents)
6. Answers to the courses taught are not consistent with existing math curriculum at any California community college
7. Answers to multiple questions are identical
8. Responses include universal statements ("all" or "never") that are clearly incorrect
9. Responses were platitudes
10. Responses were written in broken English that suggested not teaching math in English
11. Responses were very brief (1 sentence) and did not discuss the situation in any significant detail.

Appendix D: Non-academic support strategies for free-response questions

Descriptive survey tags:

1. academic support - refer to tutoring
2. accesses resources
3. affective domain - discuss or class activity
4. are you ok -- or similar question (how are you; is working in a group ok?)
5. available - instructor available extra time
6. believe in students;
7. can I help
8. care personally - about student's personal situation - ask about it
9. challenging material
10. comfortable -- increases student comfort
11. common -- normal
12. confrontational
13. content -- lesson questions
14. cumulative tests
15. do not engage
16. drop low score - possibly replace lowest score with another score
17. effort pays
18. encourage - reassures;
19. environment - ask about learning/studying environment
20. establish wins - short-term successes; low stakes early
21. explain value - teacher describes value of activity
22. explains situation - students disclose;
23. extended time - more time for assignment; take-home assignments; accept late work
24. extrinsic motivation - grades drive actions
25. find group - assign or coach students to group (when working alone)
26. forming habits
27. get focused -- stay focused
28. goal progress - setting goals / making progress towards goals
29. grit - perseverance
30. growth mindset
31. I am here for you
32. I'm concerned
33. importance of attention/health/hygiene;
34. improve confidence
35. incorporate student voice - integrate student experiences into lessons
36. learn from mistakes - we learn from mistakes
37. listen -- sounding board
38. math anxiety - discussion or activities
39. math games – competition
40. multiple submissions - test corrections or HW

41. not alone -- not unwanted ; sense of belonging/community ; student does not feel alone/isolated; connected to community/counselor/peers; someone paying attention to you
42. nothing - do nothing or make no changes
43. only your opinion matters - other people's opinions do not matter
44. overcome shy - students are shy sometimes and need to work with others
45. praise success
46. productive struggle
47. provide accommodations - help student individually overcome their challenges or behaviors (provide notes)
48. receiving feedback - students get useful feedback from instructor
49. reduce stress - teacher's actions will reduce student's stress
50. refer to instructor - or office hours
51. refer to peer - or mentor; or classmate/group
52. refer to club - or extra curricular activities
53. refer to service -- or person; services are available
54. refer to counselor - counselor help; talk to college counselor (NOT psychologist)
55. respected - students feel respected
56. safe learning environment
57. seem distracted -- inattentive/different/less healthy
58. senses caring -- senses concern; sympathy
59. stay connected - follow-up/monitor;
60. stay strict - reminders of class rules (group work)/expectations/grading scheme
61. stereotype threat - address explicitly
62. suck it up - persevere; work hard(er); persist
63. teacher personal experience; share personal experience
64. they are wrong - fear/others' statement is wrong
65. time management - set a schedule / regular study time
66. value work - student will increase value of the work/content/group-work
67. why do you feel that?
68. why happening - ask why this is happening
69. you belong - or will succeed;
70. you matter - or are important
71. work in groups - cooperative learning
72. icebreaker - 2 truths/lie
73. study groups - outside of class
74. think pair share
75. group test - or quiz

For open-ended questions that asked about frequency of activities, the tags were: daily (almost), early term, weekly, late term, half.

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