The Equity Cost of Inter-Sector Math Misalignment: _Racial and Ethnic Disparities in Community College Student Outcomes_

By Federick Ngo and Tatiana Melguizo

INTRODUCTION. About 40 percent of students begin their college careers at a community college.[1] As open-access, affordable institutions, community colleges are especially important entry points to higher education for low-income, first-generation and/or racially minoritized students.[2] For example, Black students and Latina/o/x students are more likely to enroll in a two-year college than a four-year college.[3] Many students attend their local community college, with the median distance from home to campus for community college students being just eight miles.[4]

Despite this proximity, community colleges typically do not receive information from sending high schools about students' prior high school achievement and instead have historically relied on placement tests in deciding student course placement. As a result, prior to major state policy changes, approximately 70 percent of high school graduates across the nation,[5] and 80 percent in California,[6] were placed into developmental math or English courses when entering community college.

Yet many of these students who are deemed not "college-ready" by placement tests might not actually need to take developmental courses. Research has documented significant placement error[7] and substantial redundancy and repetition in course-taking in the transition from high school to community college.[8] As such, there has been greater policy interest across the nation to improve and reform assessment and placement practices, with states like Florida and California largely moving away from placement testing altogether.

This brief summarizes results from a study on the experience of inter-sector math misalignment (ISMM), when students who were deemed "college-ready" by high school standards were placed in developmental courses upon enrolling in a local community college. Given that racially minoritized students are more likely to be placed into developmental education courses[9] and report being questioned about their abilities in those courses,[10] they may experience more negative effects of being placed into developmental courses when they are actually college-ready.[11] This study explores the equity cost of math misalignment by examining whether it is especially detrimental for these college-ready students to begin college in developmental math courses.

Overall, results show that even for students considered "college-ready" by their high school achievements, many were placed into developmental math courses once they enrolled in community college. And while results show that math misalignment is high overall, it is especially high for Black and Latina/o/x students.

Subsequent analysis shows negative effects on student outcomes, with students that experienced math misalignment much less likely to complete transfer-level math and earn college credits compared to similar students who were placed into transfer-level

math.   Furthermore, Black students who experienced misalignment were particularly harmed and earned fewer total units compared to their similar White peers.

Background and Context

Prior research has documented significant misalignment between high schools and local community colleges.[12] For example, the vast majority of students in one district who completed high school having met various college-readiness benchmarks were placed into developmental math courses in college.[13] This study considers equity implications of math misalignment by exploring the following research questions:

1. Are there inequities in the experience of misalignment in the transition from high school to community college? Are racially minoritized students more likely to experience math misalignment?
2. What is the relationship between math misalignment and college outcomes, and do these relationships differ by race/ethnicity?

It is important to note that these results were from a time period in which the community college district heavily relied on placement tests in deciding which math courses students were placed into. Supplemental measures including high school GPA and prior course-taking were also considered but not as heavily weighted into the decision as the placement test results.[14] But since then, the California Legislature has passed Assembly Bill (AB) 705, which requires community colleges to use students' high school GPA, courses taken and course grades in deciding placement into college courses in order to increase the completion of transfer-level courses within one year.[15] While the data for this study are from before AB 705 was enacted, the results show the importance of colleges increasing standards alignment and considering disproportionate impacts on racially minoritized students as they implement their policies.

Data and Methods

This study uses administrative data from a large urban K-12 school district linked to records from a large urban community college district. The sample is limited to nine cohorts of students who graduated high school between 2005 and 2014, and enrolled in community college within three years. The data include a rich set of student demographics, standardized test results, high school and community college student transcripts, community college math placement test results, and course placements. The analysis estimates a series of models that compare the outcomes of students who did and did not experience misalignment, adjusting for student demographics and other characteristics using inverse treatment probability weighting.[16]

College-Ready Subsamples
Without consistent federal or California college readiness standards to draw upon, we identified a number of college-readiness indicators aligned with the current move towards multiple measures under AB 705. The analysis focuses on different non-mutually exclusive subsamples of students who met one of the following four college readiness criteria:
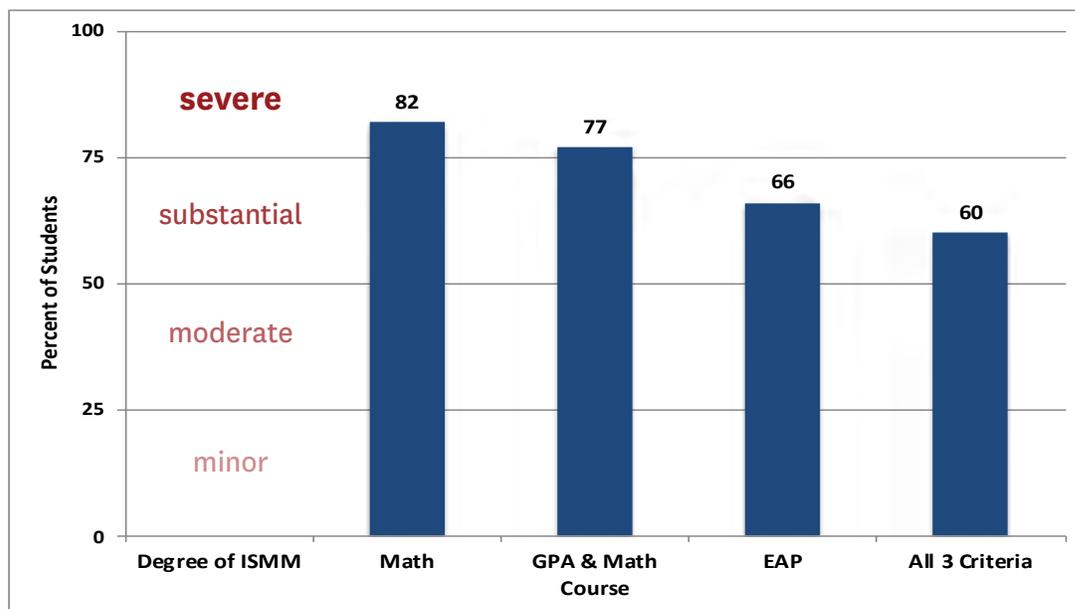
1. Math Course: Students who earned a B or better in Algebra 2 or higher in high school (11,489 students)
2. Math Course & GPA: Students who earned a high school GPA of 2.7 or higher and took at least algebra 2 (7,781 students)
3. Math Test: Students who passed the Early Assessment Program (EAP) math test (2,330 students)
4. All 3 Criteria: Students who met all three of these criteria (1,548 students)

RESULTS

The Severity of Math Misalignment
Figure 1 shows the percentage of students placed into developmental math courses by each of the four college-readiness indicators described above. Overall, there is evidence of math misalignment across all categories of college readiness. Among all students who earned a B in high school algebra 2 or higher, 82 percent were placed into Algebra 2 or lower in community college. This is similar for students who earned a 2.7 GPA or higher (77 percent) and students who passed the EAP math exam that would have exempted them from remediation at the CSU (66 percent). Finally, even 60 percent of students who met all 3 criteria of high school course-taking, high school GPA and passing the EAP test were not placed into transfer-level math.

**Figure 1. Math Course Placement of College-Ready Students by ISMM Criterion**

Figure 2 shows math misalignment by race and each subsample of misalignment definition. While the previous results show that math misalignment is high overall, it is especially high for Black and Latina/o/x students compared to their White and Asian Pacific Islander peers. The left set of columns shows that among students who earned a B in Algebra 2, 94 percent of Black students and 87 percent of Latina/o/x students experienced math misalignment compared to 64 percent of White and 60 percent of Asian Pacific Islander students. This pattern holds across all different subsamples. Ninety-one percent of Black students and 85 percent of Latina/o/x students who earned a 2.7 GPA and passed high school math experienced math misalignment, while this only was true for 59 percent of Asian Pacific Islander and 56 percent of White students.

Even among students who achieved the strictest definition of college readiness -- earning a B or higher in Algebra 2, a 2.7 high school GPA, and passing the EAP test that would have exempted them from remediation at CSU -- 74 percent of Black students and 68 percent of Latina/o/x students were not placed into transfer-level math, compared to only 50 percent of Asian Pacific Islander and 49 percent of White students. The result for Latino/a/x students is of particular concern, given that these students represent 46 percent of the overall CCC population.

Figure 2. Math Misalignment by Subsample and Race
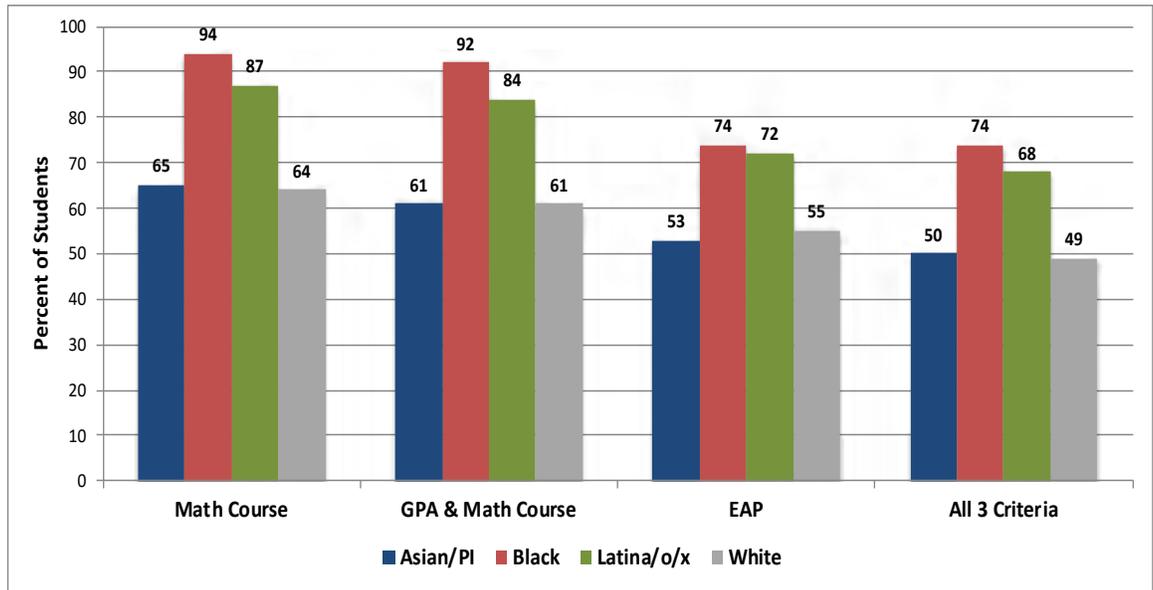
KEY TAKEAWAY #2

Black and Latina/o/x students who met college-readiness benchmarks in high school were more likely to experience math misalignment in college than Asian/Pacific Islander and White students.
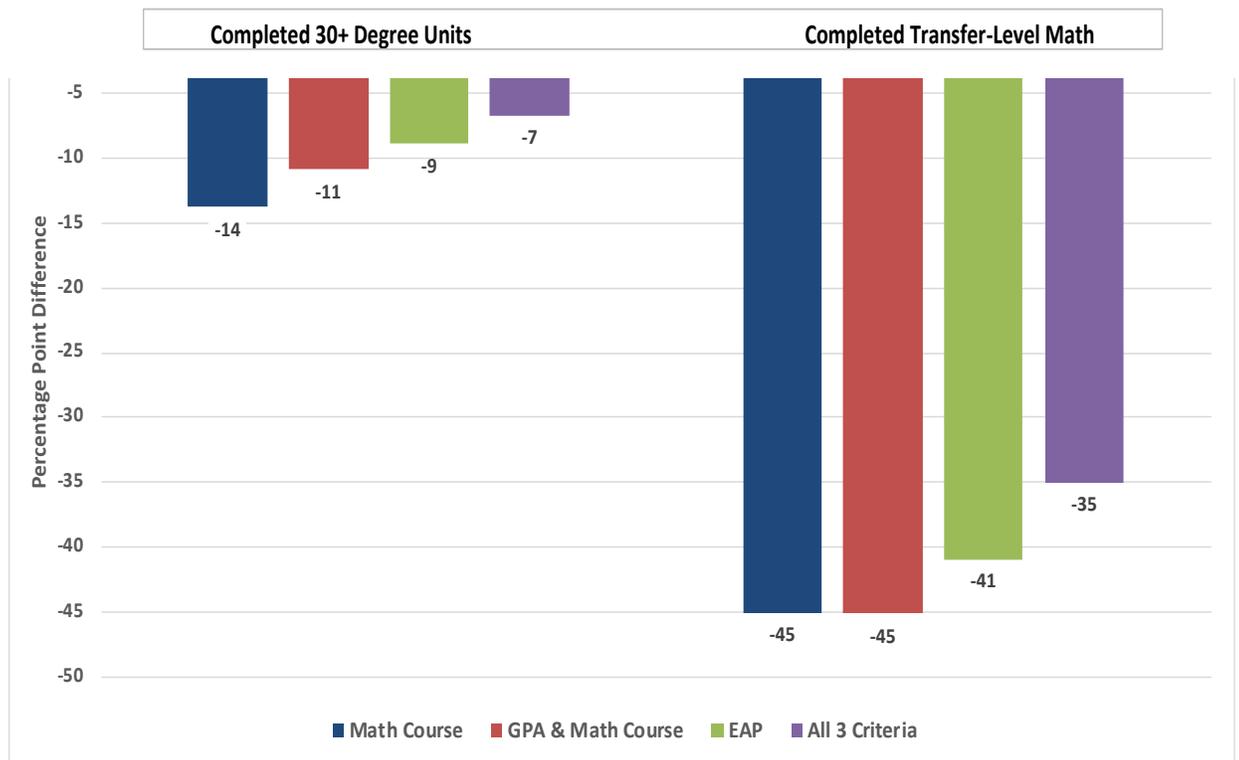
The Relationship Between Math Misalignment and Student Outcomes

The results above show that math misalignment is prevalent across achievement levels in high school, and especially prevalent for Black and Latina/o/x students. But this placement into below-transfer level math can potentially have a negative relationship with student outcomes. Figure 3 shows the relationship between math misalignment and the likelihood of completing transfer-level math and the likelihood of completing 30 or more degree-applicable units. Across all college-readiness indicators, students who experienced misalignment were 7-14 percentage points less likely to earn at least 30 degree-applicable units compared to students who were placed directly into transfer-level math.

This negative association is even larger for the likelihood of completing transfer-level math. Among students who earned a high school GPA of 2.7 or higher and took at least Algebra 2, students who experienced math misalignment were 45 percentage points less likely to complete transfer-level math, compared to students who were not misaligned. There are similarly negative relationships for students passing Algebra 2 (45 percentage points), students passing the EAP exam (41 percentage points), and those meeting all three criteria of high school math course-taking, high school GPA and EAP test (35 percentage points). These are all extremely large negative differences between students with essentially the same level of achievement in high school.

These negative relationships between math misalignment and college outcomes were significantly larger in magnitude for Black students. Figure 4 shows the difference in the size of the math misalignment penalty between White students and other racial groups using the math course indicator. Across all college-readiness indicators, the only significant differences (bolded) are between Black and White students. Though not shown, this pattern was also consistent when using the math course and GPA indicator. Compared to White students who experienced math misalignment, Black students who experienced math misalignment were 12 percentage points less likely to enroll, 25 percentage points less likely to complete transfer-level math, and 30 percentage points less likely to earn 30 degree-applicable credits. These results indicate that math misalignment was particularly harmful to Black students, evidence of a severe equity cost to inter-sector math misalignment.
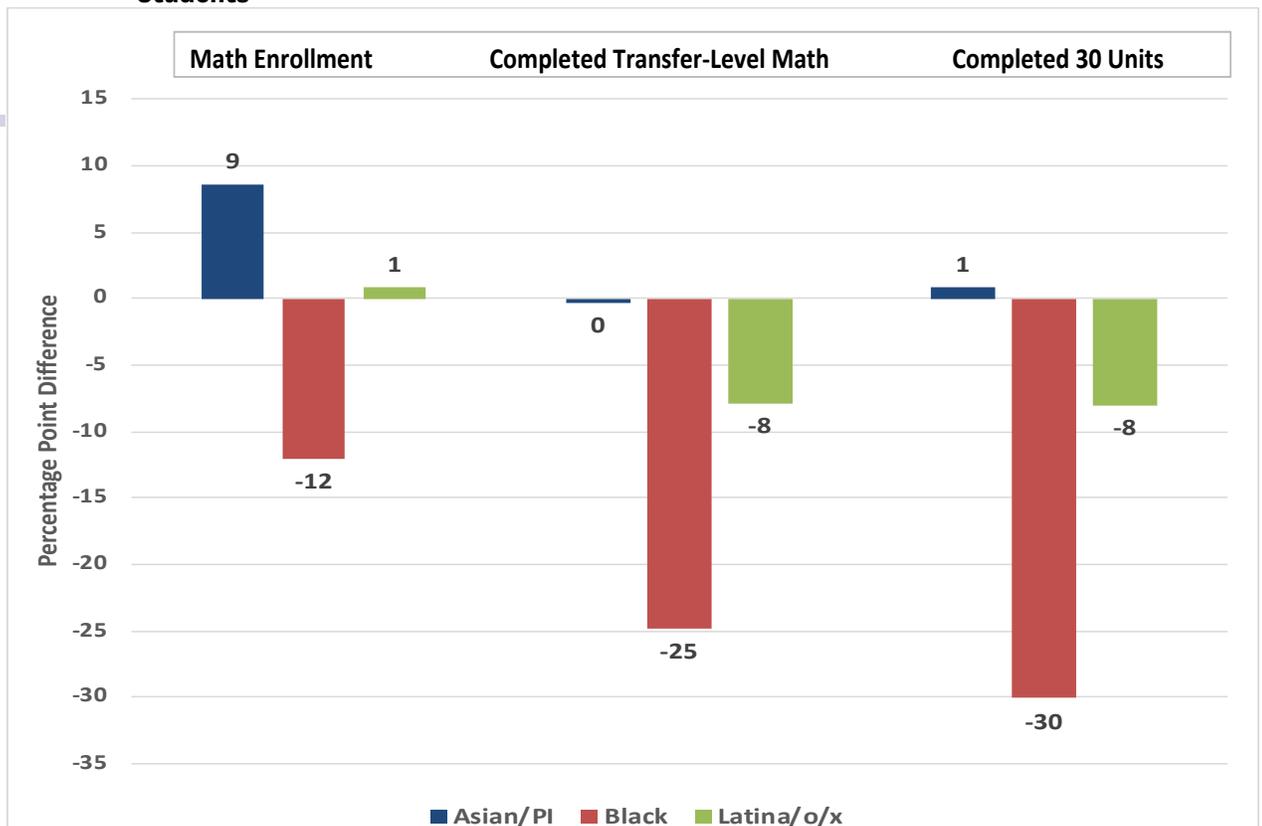
Figure 3. Change in Probability of Completing Transfer-Level Math and 30+ Degree Applicable Units after Math Misalignment (Percentage Points)

Completed 30+ Degree Units				Completed Transfer-Level Math			
-14	-11	-9	-7	-45	-45	-41	-35

■ Math Course ■ GPA & Math Course ■ EAP ■ All 3 Criteria

Y-axis: Percentage Point Difference

Figure 4. Difference in Math Misalignment Penalty Between Racially Minoritized Students and White Students

Math Enrollment			Completed Transfer-Level Math			Completed 30 Units		
9	-12	1	0	-25	-8	1	-30	-8

■ Asian/PI ■ Black ■ Latina/o/x

Y-axis: Percentage Point Difference

Discussion

Overall, results from this study show that math misalignment is substantial, with the majority of students being placed into below transfer-level math despite taking Algebra 2 or higher in high school, achieving a 2.7 high school GPA or higher, and/or passing a college placement test. Even though these students were considered "college-ready" by their high school achievements, many were placed into developmental math courses once they enrolled in community college.

There are also significant disparities in math misalignment and its effects by race. Not only were these students more likely to experience math misalignment, but this relationship held after controlling for high school achievement and preparation and for community college attended. Most notably, 72 percent of Latina/o/x and Black students who passed the math portion of the Early Assessment Program exam in high school (which would have exempted them from developmental education at the CSU) were placed into below-transfer level math at the community college, including 25 percent placed into Algebra 1 or below.

The study also provides evidence that inter-sector math misalignment is an early math experience in college that can influence students' academic progress. Students who experienced math misalignment had lower rates of completing transfer-level math courses, lower rates of completing 30 credits, and lower overall credit accumulation. Importantly, the disaggregated evidence revealed an equity cost to math misalignment, particularly for Black community college students. Given that the math misalignment penalty for Black students was significantly larger than the penalty for White students, the findings suggest that something about the experience of misalignment may have influenced Black students' academic decisions and trajectories in a different manner than white students. This implies that the lack of math standards alignment between educational sectors systematically disadvantages and harms Black students.

We believe that more attention to inter-sector math misalignment can ultimately bolster the continuum of care in the transition from high schools to local community colleges and mend the breaches that presently exist. High school and community colleges, particularly those serving large portions of racially minoritized students, ought to expand care beyond their individual sectors and consider care between sectors. A continuum of care—measured by standards alignment, fostered by inter-sector agreements, and reinforced by student supports in the transition to college—can mitigate misalignment and set students on a for-ward, upward path through college.

******

The full version of this paper can be found in **The Journal of Higher Education**.

Key Implication

The lack of math standards alignment between educational sectors systematically disadvantages and harms Black students. More attention to inter-sector math misalignment can bolster the continuum of care in the transition from high schools to local community colleges.

Authors

Federick Ngo is an assistant professor at the University of Nevada, Las Vegas. His primary research is on higher education policy and inequality in higher education, with a focus on college access and community college students. This includes research projects on developmental education, math course-taking in two- and four-year colleges, and undocumented community college students.

Tatiana Melguizo is an associate professor in the USC Rossier School of Education. She works in the field of economics of higher education. She uses quantitative methods of analysis to study the association of different factors, educational programs, as well as public policies on the persistence and educational outcomes of minority and low-income students.

Suggested Citation

Ngo, F. & Melguizo, T. (2020). *The equity cost of inter-sector math misalignment: Racial and ethnic disparities in community college student outcomes* (Issue Brief 3). USC Pullias Center for Higher Education.

Endnotes

1 Dalton, B., Ingels, S. J., & Fritch, L. (2016). High School Longitudinal Study of 2009 (HSLS: 09) 2013 update and high school transcript study: A first look at fall 2009 ninth-graders in 2013. NCES 2015-037rev. *National Center for Education Statistics*.

2 Carnevale, A. P., Smith, N., & Strohl, J. (2010). *Help wanted: Projections of job and education requirements through 2018*. Georgetown University Center on Education and the Workforce. https://market.android.com/details?id=book-GKKV5ff3NsoC

3 Campaign for College Opportunity (2015). While Southeast Asian and Pacific Islander students are also more likely to enroll in two-year colleges than four-year colleges, we are unable to disaggregate the data to analyze math misalignment among these subgroups.

4 Hillman, N., & Weichman, T. (2016). Education deserts: The continued significance of "place" in the twenty-first century. *Viewpoints: Voices from the Field*. American Council on Education.

5 Chen, X. (2016). Remedial coursetaking at U.S. public 2-and 4-year institutions: Scope, experiences, and outcomes. Statistical analysis report. NCES 2016-405. *National Center for Education Statistics*. https://eric.ed.gov/?id=ED568682

6 Rodriguez, O., Jackson, J. & Cuellar Mejia, M. (2017). Just the facts: Remedial education in California's colleges and universities. San Francisco: Public Policy Institute of California. https://www.ppic.org/wp-content/uploads/jtf-remedial-education-jft.pdf

7 Scott-Clayton, J., Crosta, P. M., & Belfield, C. R. (2014). Improving the targeting of treatment: Evidence from college remediation. *Educational Evaluation and Policy Analysis, 36*(3), 371–393.

8 Ngo, F. (2020). High school all over again: The problem of redundant college mathematics. *The Journal of Higher Education, 91*(2), 222-248; Ngo, F. J. & Velasquez, D. (2020). Inside the math trap: Chronic math tracking from high school to community college. *Urban Education*, 1-29.

9 Attewell, P., Lavin, D., Domina, T., & Levey, T. (2006). New evidence on college remediation. *The Journal of Higher Education, 77*(5), 886-924; Bailey, T., Jeong, D. W., & Cho, S. W. (2010). Referral, enrollment, and completion in developmental education sequences in community colleges. *Economics of Education Review, 29*(2), 255-270.

10 Roberts, M. T. (2019). Racism in remediation: How Black students navigate stereotypes to achieve success in developmental mathematics. *Community College Journal of Research and Practice,* 1-21.

11 Xu, D. (2016). Assistance or obstacle? The impact of different levels of English developmental education on underprepared students in community colleges. *Educational Researcher, 45*(9), 496-507.

12 Melguizo, T., & Ngo, F. (2020). Mis/alignment between high school and community college standards. *Educational Researcher, 49*(2), 130-133.

13 Ibid.

14 Melguizo, T., Kosiewicz, H., Prather, G., & Bos, J. (2014). How are community college students assessed and placed in developmental math? Grounding our understanding in reality. *The Journal of Higher Education, 85*(5), 691-722.

15 CCCCO https://www.asccc.org/content/year-later-where-we-are-ab-705-mathematics-and-english

16 More information on inverse probability weighting can be found in Woolridge, J. M. (2010). *Econometric analysis of cross section and panel data*. 2nd ed. Cambridge, MA: MIT Press.