COLLEGE OF THE CANYONS

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Math Disjunctive-Mixed Placements

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As part of the placement validation process, the Math department initiated a proposal to revamp Accuplacer placements in conjunction with the Institutional Research, Planning and Institutional Effectiveness office and student services. This process consisted of 8 separate meetings involving representatives from different areas on campus. Namely, three full-time and four adjunct Math faculty, the Senior research analyst and the Dean from Institutional Research, Planning and Institutional Effectiveness Office, the Director of Student Success and Support Programs, the Assessment coordinator, two General Counselors, the Curriculum Committee Chair and Chair in-training, the Dean of Instruction and Support Programs, & Academic Affairs, the Vice-president of Academic Affairs, the Vice-president of Instruction and the Deputy Chancellor.

This brief provides information on placement changes for students testing in spring/summer 2016 and presents data on placement rates after these changes were implemented in spring 2016. Implementing the changes required programming directly in Accuplacer by the Assessment Center Coordinator.

Placement Data Traditional vs. Disjunctive

Placement data were closely monitored through monthly reports that were extracted from Accuplacer. For a period of approximately 5 months, between March 7th and August 16th, 2016, **4,363** students took the Math assessment and received placement(s) that were reflective of the changes. These changes have an impact on the tracking of "transfer-level" placement rates in comparison to the traditional models prior to 2016 (Accuplacer and lower multiple measure weights). In 2016, transfer-level placements included a Statistics transfer placement and/or a transfer-level non-statistics (i.e. Calculus) placement.

Math placement trends across 4 years indicate that transfer-level placements made up the largest proportion of all placements in 2016 whereas it had been the smallest in prior years (Figure 1 and 2). For the Statistics pathway transfer-level placements increased more than 4-fold (15% vs. 71%) and for the Calculus pathway, transfer-level placements increased 2-fold (15% vs. 30%).

Figure 1. Math Placements for the Statistics Pathway across 3 years

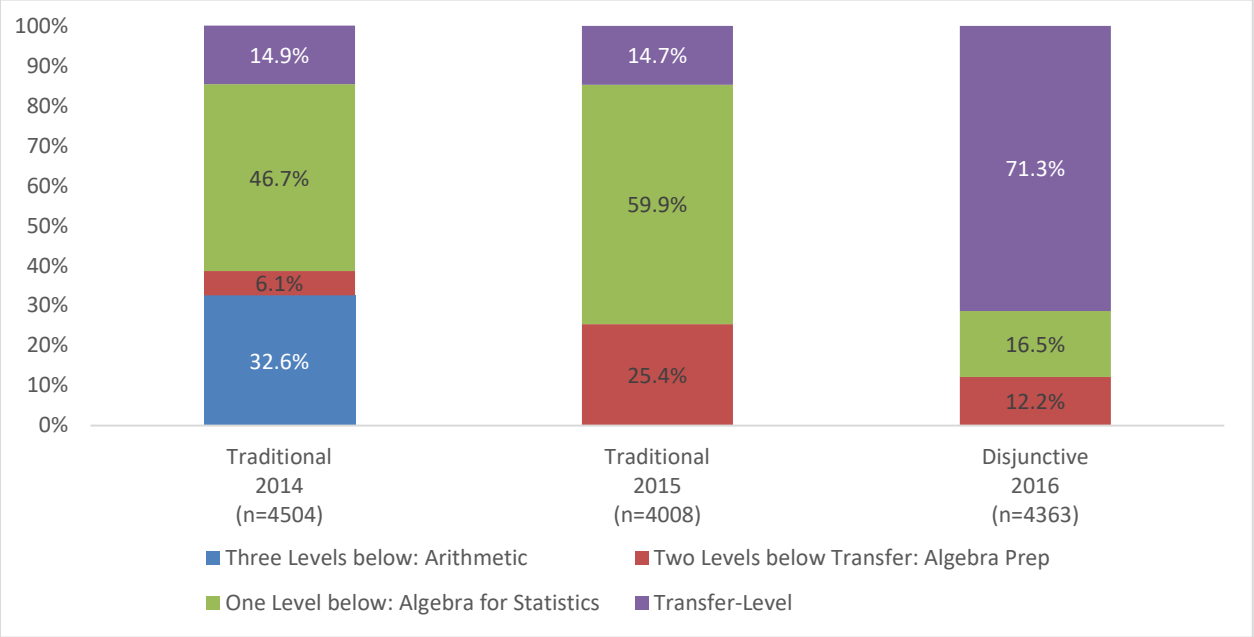
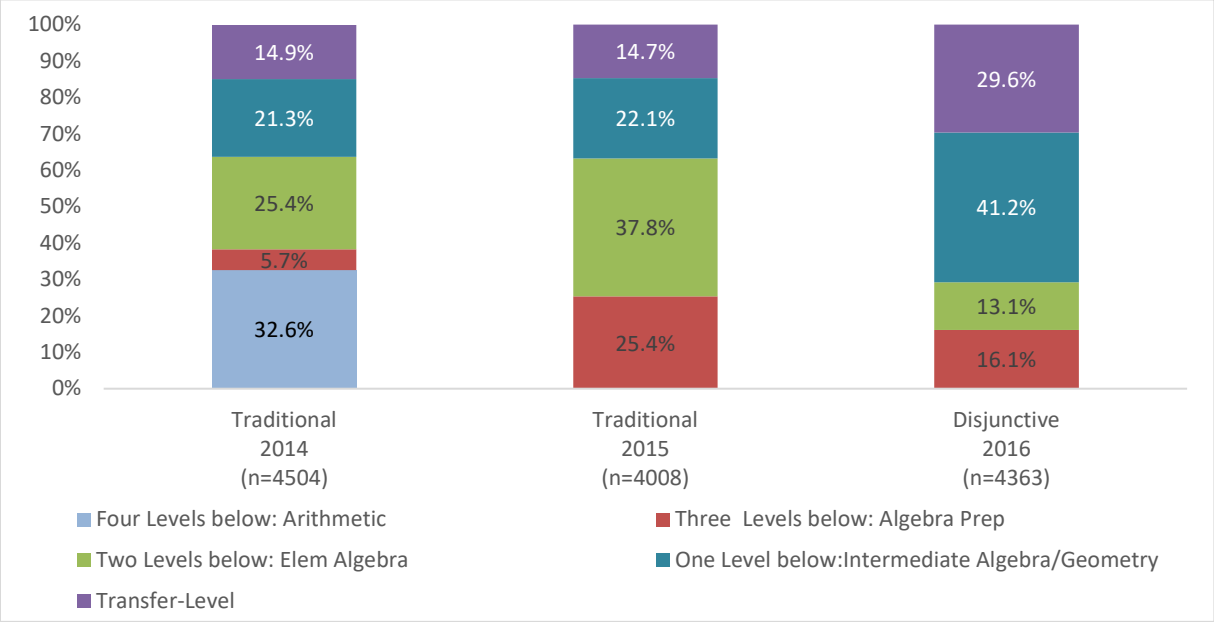


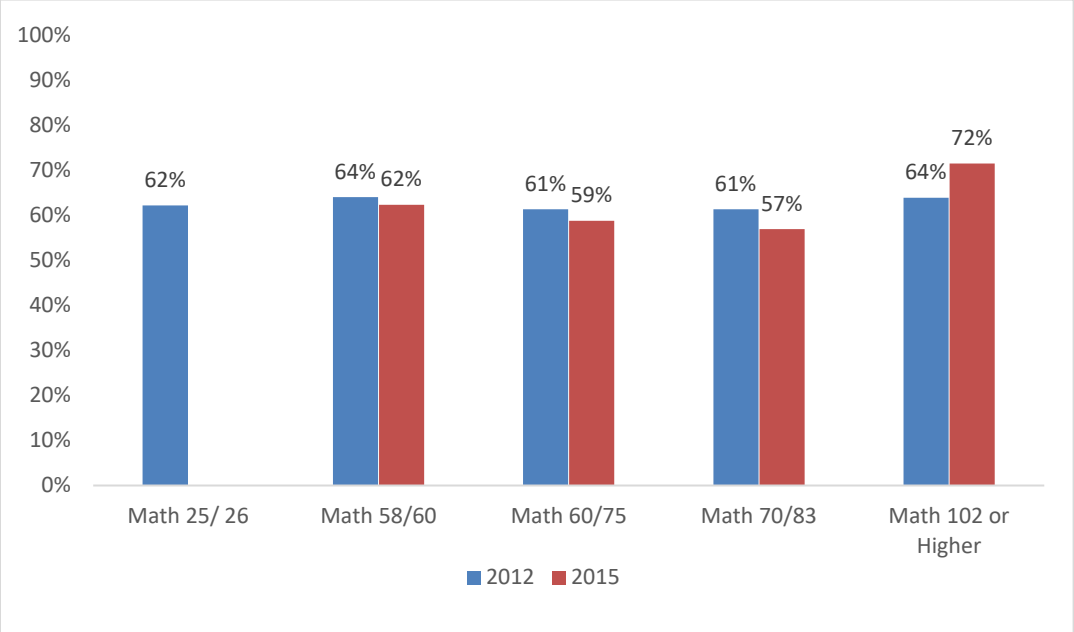
Figure 2.Math Placements for the Calculus Pathway across 3 years



Background

Fall 2015 changes in Math placement consisted of a) the elimination of the lowest arithmetic level (Math-025), b) lowering the cut scores for the new lowest level (Math-058) and the next level (Math-060/075), c) an advisory message for noncredit arithmetic courses, d) removing negative weights from multiple measure questions, and, e) adding a question on overall high school GPA. These changes went into effect in fall 2015 and outcome data showed slight decreases in success rates for all but transfer-level Math courses (Figure 3). Moreover, placement level for certain disadvantaged racial/ethnic groups increased slightly due to the elimination of the lowest level Math course (025). The largest change across all groups was seen in the substantive increase in elementary algebra/intermediate algebra for statistics (Math 060/075) placements, 2-levels below transfer.

Figure 3. Success Rates for Math Courses 2012 vs. 2015



Placement Changes & Data Analysis Results

In response to data showing little-to-no change in transfer-level placements, and in light of research indicating high success rates in courses at COC for students receiving As or Bs in their senior year Math courses (Gribbons & Meuschke, 2013) and, reliability of self-reported grades and courses (Gribbons & Meuschke, 2015), Math faculty examined and proposed a disjunctive model for placing students into Math courses. These discussions were also well-aligned with recent models used by the RP group, the Multiple Measures Assessment Project (MMAP) (Willett et al., 2015) and the California Accelerated Project (CAP) (Huntsman, Hern, & Snell, 2016).

Disjunctive placement includes models of placement that use either students' High School data *or* a traditional placement test (e.g. Accuplacer). After robust discussion, a collaborative effort resulted in changing the placement model to use high school information on GPA, last Math course and grade in last Math course in three ways:

I. Implementing "floors" for placement
II. Enabling direct placement into a Statistics courses (i.e. Math140, Soci137, Psych104)
III. Applying increased positive weights for Multiple Measure Questions

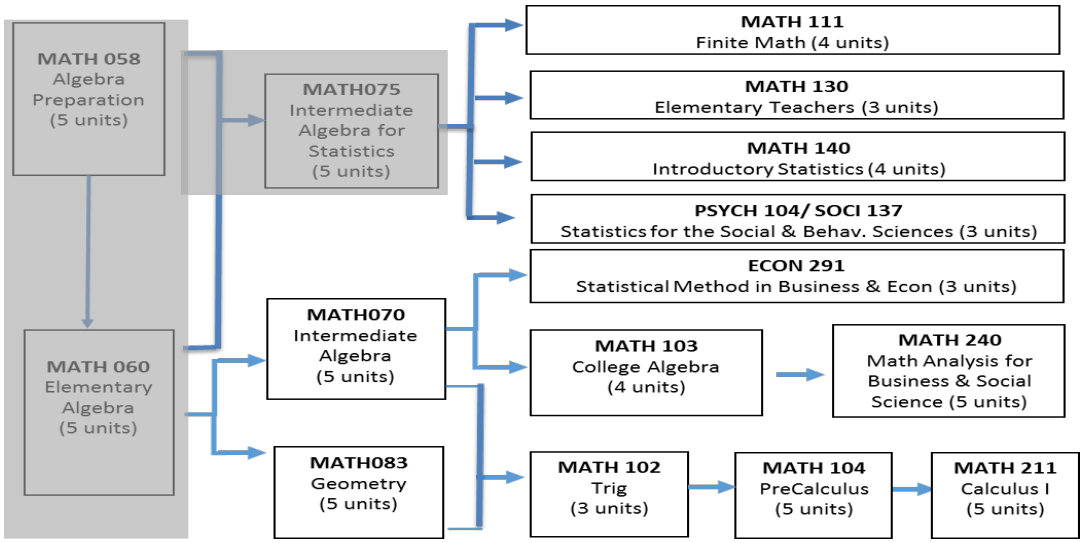
I. "Floors" Model

The floors model consists of creating *minimum placement* levels for students who meet certain criteria. The idea is to prevent students from placing into a lower level than the last high school course they passed (C or better).

Based on the response to the question: "Which of the following was the highest Math class you passed with a C or better", students are blocked from placing into certain levels and still have the opportunity to place into higher levels based on their assessment score.

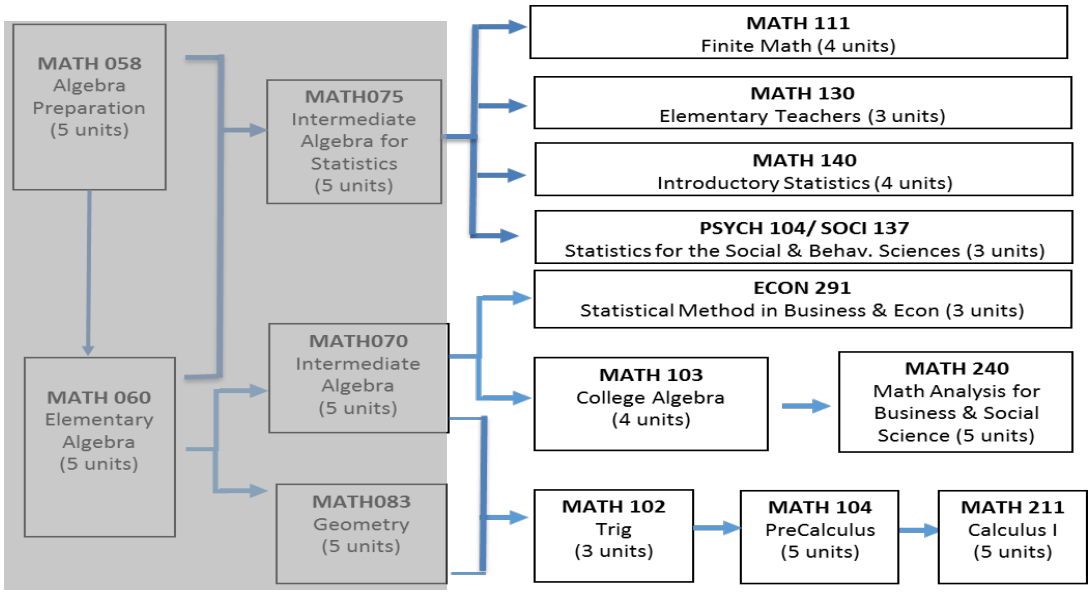
If a student indicated having passed (C or better) *Algebra II, Statistics* or *Trigonometry* as the last Math course, that student cannot be placed below intermediate algebra (Math 075/ Math 070/ Math 083). Figure 4 presents the Math placement chart and the blocks (in grey) for this scenario. For these students, placements into Algebra preparation and elementary Algebra/Intermediate Algebra for Statistics are disabled.

Figure 4. Blocked levels (in grey) for Algebra II, Statistics or Trigonometry



If a student indicated having passed *Pre-Calculus or Calculus* as the last Math course, that student could not be placed below transfer-level Math (i.e. Math 102, 103, 111,130,140, Soci137, Psych 104). Figure 5 presents the Math placement chart and the floors (in grey) for this scenario. For this student, placements into Algebra prep., elementary Algebra/Algebra for Statistics, and intermediate Algebra/Geometry are disabled.

Figure 5. Blocked levels (in grey) for Pre-Calculus or Calculus



Overall 2,356 students (54%) received a 'floor' or were blocked from placing into a lower level.

- 1,649 students (70%) were blocked from Algebra Prep and elementary Algebra/Algebra for Statistics
- 706 students (30%) were blocked from Algebra Prep, elementary Algebra/Algebra for Statistics and Intermediate Algebra/ Geometry.

II. Direct Placement

Another change to the placement process consisted of a direct placement option into transfer-level Statistics courses for students who met *any* of the following criteria:

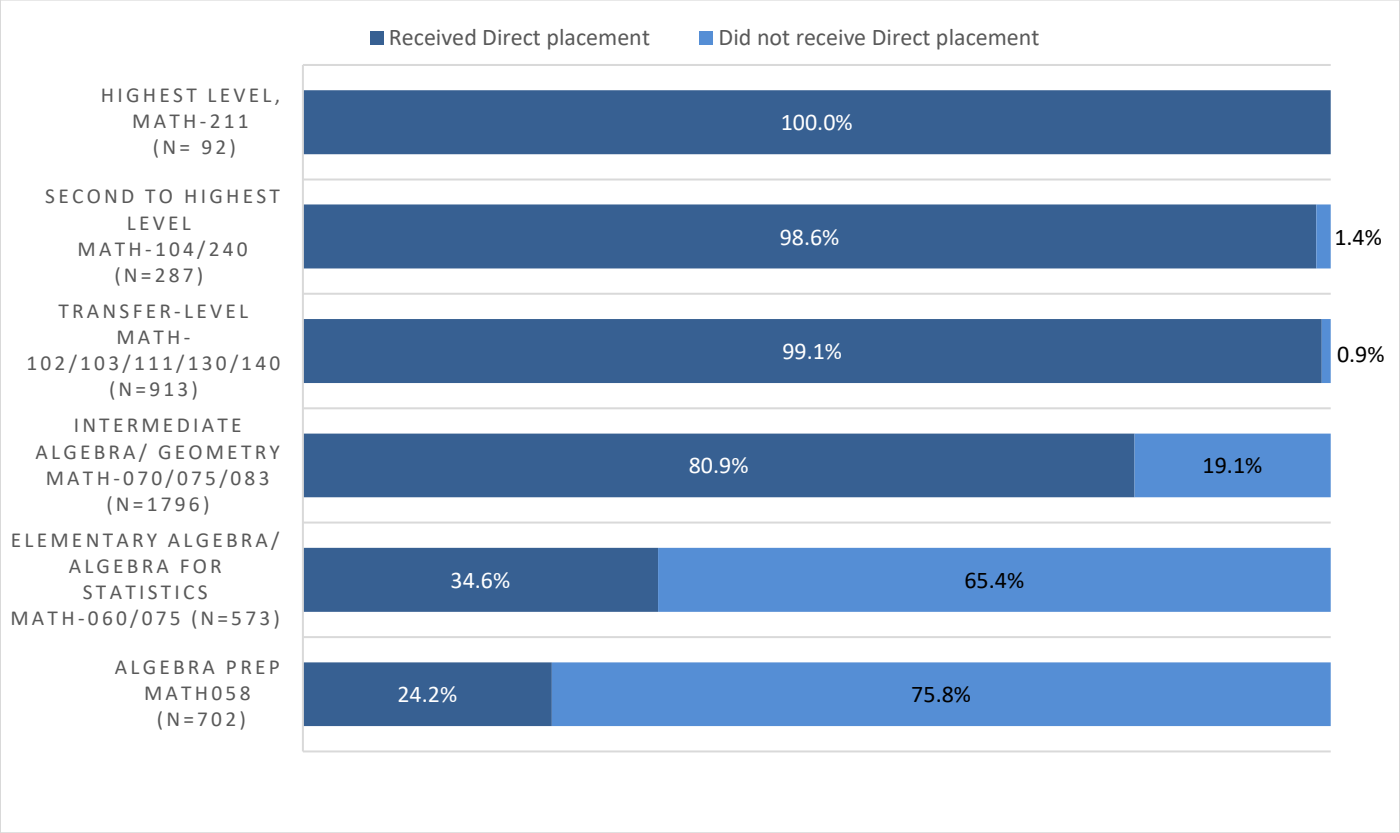
- High School GPA 3.0 or higher; or
- Trigonometry or Statistics or PreCalc/Calc with C or higher; or
- Algebra II or higher with C or better *and* GPA 2.7 or higher; or
- Algebra II with B- or higher; or
- Grade of B- or higher for an Algebra 1B or Geometry *and* GPA 2.7 or higher.

Students receiving the direct placement are eligible to enroll in transfer-level Statistics courses (i.e. Math140-Introductory Statistics, Soci137 or Psych104-Statistics for the Social & Behavioral Sciences). This placement is given to the student in addition to their placement derived from Accuplacer score, multiple measures weights applied to Accuplacer score and/or floor's applied to the student's placement. This direct placement also provides eligibility for enrollment in the lower-level statistics course (MATH-075) for students who prefer not to take a transfer-level statistics course. Students are advised to enroll in the Statistics courses if they are Non-STEM majors in general. However, some non-stem majors require intermediate algebra courses or have courses that have pre-requisites of intermediate algebra. Students in these majors are advised to speak to a counselor. The following message about the direct placement option is given to the students as part of their placement results:

> *You are also eligible for Liberal Arts (Statistics): Math 140 or Psych104 or Soci137.Your math choice depends on major and transfer plans. If you choose Liberal Arts path (e.g. sociology/history/English/social sciences/ humanities) take Statistics-Math140 or Psyc104 or Soci 137 UNLESS your transfer plan requires college algebra or calculus. Biology, physics, chemistry, math and business majors should choose the STEM Path. UNSURE? Speak with a program adviser or go to New Student Advising workshop.*

Of the total number of placements, 71% received a direct placement option into transfer-level Statistics courses (3,102 out of 4,634). Examining rates of direct placement within each Math placement level (based either on Accuplacer scores, floor's model or multiple measures) (Figure 6) indicated that fewer students received the direct placement option in the lower levels. For instance, approximately a quarter of those who placed in Algebra prep (Math058) received the transfer-level statistics option whereas 99% of those who placed in transfer-level Math received the direct placement option.

Figure 6. Direct placement in Statistics rates within each level of Math Placement



III. Positive Weights for Multiple Measure Questions

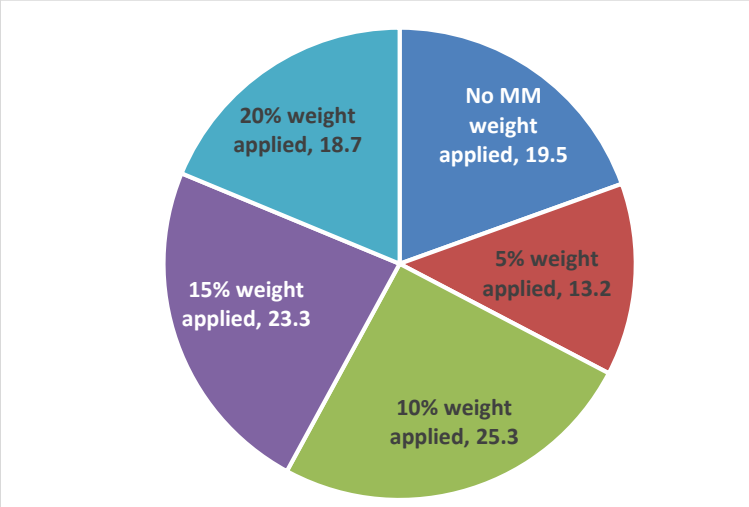
The Math department also changed the content of the multiple measure questions and increased the positive weights for responses to each question. The weights were increased to a possible total of 20% to be applied to the Accuplacer raw score using the following criteria:

a) If grade in highest Math class is

- A / A- then apply +10% increase to Accuplacer raw score
- B+ / B / B- then apply 5% increase to Accuplacer raw score

b) Cumulative HS GPA is greater than 2.699 then apply 10% increase to Accuplacer raw score

Figure 7. Percentage Applied to Score from Multiple Measure



Of the total number of students assessed, 80% received a boost from the multiple measure questions. The most common percentage increase was 10% (25% of the placement takers received this boost) Figure 7).

For high school GPA, 818 students (19%) indicated that they did not know or remember their high school GPA. Of the students who reported a GPA (n=3,545), 45% reported a GPA lower than 3.0, and 54% reported a GPA equal to, or higher than 3.0. With regard to grade in highest Math course, most students (97%) reported receiving a grade of C or better and 60% reporting an A or B.

Table 1. High School GPA reported

GPA	Frequency	Percent
1.99 or lower	65	1.8
2.00 - 2.69	766	21.6
2.70 - 2.99	770	21.7
3.00 - 3.49	1080	30.4
3.50 - 4.00 or higher	864	24.3
Total	3545	100.0

Table 2. Grade in Highest Math Course reported

Course Grade	Frequency	Percent
A-/A/A+	1040	23.8
B-/B/B+	1593	36.5
C/C+	1605	36.8
Did not receive 'C' or better	125	2.9
Total	4363	100.0

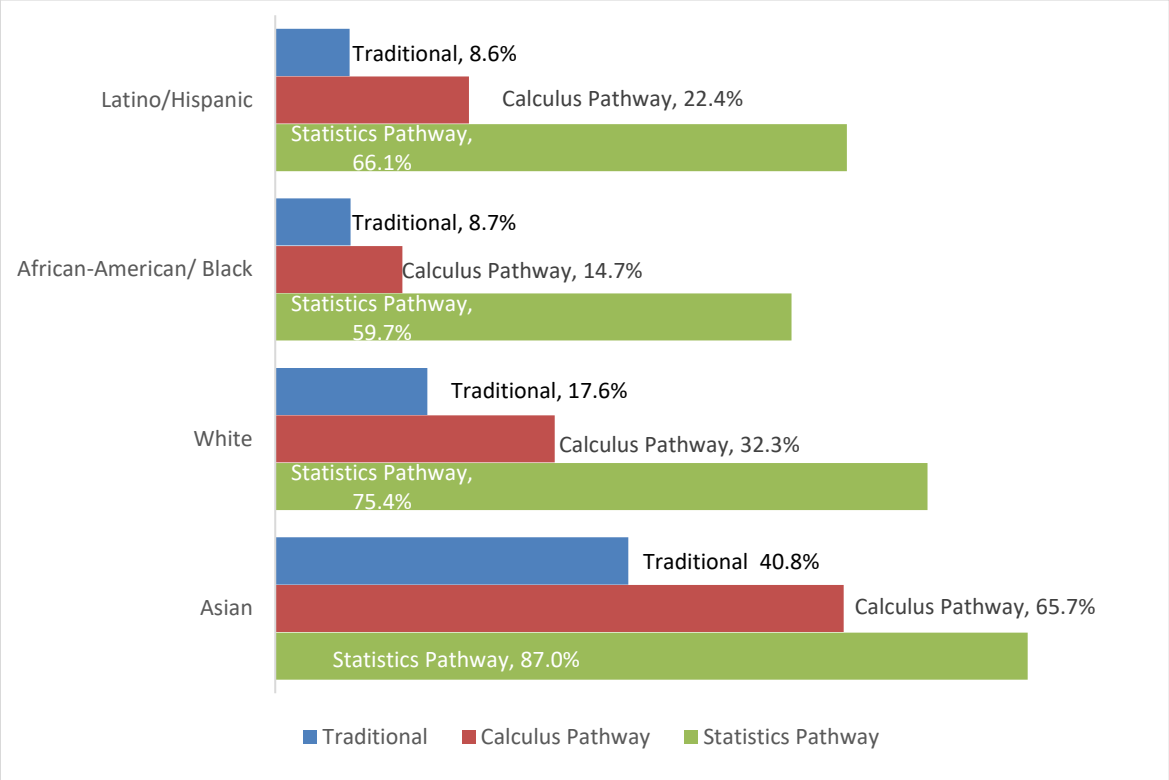
Given these changes to the placement process, students participating in the placement process have the potential to benefit from all three models. For instance, a student may benefit from a 'floor' for passing Algebra II with a C or higher as the last highest Math course (Algebra courses are blocked from placement). The student also may benefit from multiple measure weights if the student received an A or B in that course and had a cumulative GPA greater or equal to 2.7 (20% increase in raw Accuplacer score). Lastly, because the student passed Algebra II with a C or higher and had a GPA of 2.7, the student would also receive the direct placement into Statistics option.

Of all the Math placement test takers, 10% did not benefit from either of the placement changes (i.e. did not receive direct placement, did not receive blocked levels, and did not increase their raw scores through multiple measures). Conversely, 90% of the students taking the placement have benefited from at least one of the placement model changes.

Disproportionate Impact Placement

Disaggregating placement by ethnicity indicates a closing of the gap in transfer-level placement between ethnicity groups in 2016 (vs. 2015). In the Statistics Pathway, 66% of Latino/Hispanic students and 60% of African-American/Black students placed into transfer level respectively, compared to the 71% overall rate. Both of the rates are higher than the 80% threshold indicating no disproportionate impact. In the Calculus Pathway, the disjunctive model increased the placement rate into transfer level courses for both Latino/Hispanic and African-American/Black students, but did not eliminate disproportionate impact.

Figure 8. Transfer-level Placement for 2015 (Traditional) vs. 2016 (Calculus/Statistics) by Ethnicity



Recommendations

Upon review of the results of the Math placement data analysis, the following recommendations should be taken into consideration:

- Continue monitoring placement data.
- Examine changes in enrollment in transfer-level Math before and after changes.
- Conduct success and retention analyses to assess the effectiveness of placement changes.
- Conduct analyses of the successful completion of transfer-level Math courses for placement cohorts before and after implementation of placement changes.

Action Implications

- With the more recent adjustment of the criteria for the "first floor," we will continue to collect data on how the success rates change in Math 060 and 070.
- The Mathematics Department, in collaboration with Student Services, will create simpler, easier-to-understand pathways guides and course sequence charts to hand out to new students.
- The Department Chair and colleagues will explain to counselors and advisors various implications of the recent placement changes and discuss how to better guide students who get two placements.

References

Gribbons, B. C., & Meuschke, D. M. (2013, June). *Research Brief #59 Math Course Success Rates and Placement from High School to College*. College of the Canyons; Santa Clarita, CA.

Gribbons, B.C., & Meuschke, D.M. (2015, January) *Research Brief #78 Models for Combining Multiple Measures in Student Placement and Use of Self-Report Measures Compared to Transcript Data.* College of the Canyons; Santa Clarita, CA.

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Huntsman, H., Hern, K., & Snell, M. (2016, October). *Capacity Unleashed: The Faces of Community College Math Pathways*. California Acceleration Project (CAP). Sacramento, CA. Retrieved from Acceleration Project.org

For more detailed information on this research brief, stop by the Institutional Research, Planning, and Institutional Effectiveness office located in BONH-224, or contact Preeta Saxena, Senior Research Analyst at 661.362.3072, or Daylene Meuschke, Dean of Institutional Research, Planning and Institutional Effectiveness at 661.362.5329.