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Underrepresented Minority Students in College: The Role of Classmates

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Underrepresented Minority Students in College: The Role of Classmates

Accepted, Educational Evaluation and Policy Analysis

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Abstract

The role of racial diversity at college campuses has been debated for over a half a century with limited quasi-experimental evidence from classrooms. To fill this void, I estimate the extent that classmate racial compositions affect Hispanic and African-American students at a large and over-subscribed California community college where they are minorities. I find that when minority students are exposed to a greater share of same race classmates, they are more likely to complete the class with a pass and are more likely to enroll in a same subject course the subsequent term. The findings are robust to first-time students with the lowest registration priority vs. all students and different combinations of fixed effects (e.g., student, class, and instructor race).

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1 Introduction

Large racial and ethnic achievement gaps continue to persist at postsecondary institutions in the United States. Of students who start at any type of college or university, 39.5% of Black and 48.6% of Hispanic students complete a degree or certificate within six years; in comparison, 66.2% of White and 68.9% of Asian students complete their programs within six years (Shapiro et al., 2017). These gaps in postsecondary achievement contribute to long-term income inequalities (Altonji & Blank, 1999). The current earnings premiums for bachelor's degree and associate's degree holders relative to high school graduates are correspondingly $25,000 and $9,000 (Shambaugh et al., 2018).[1] While pre-enrollment characteristics of minority students are a major component of the achievement gap, the selection and role of postsecondary institutions are also important (Fry, 2004; Arcidiacono & Koedel, 2014; Flores et al, 2017). A critical aspect of academic achievement is a sense of belonging to the social environment (Baumeister & Leary, 1995; Akerlof & Kranton, 2002; Strayhorn, 2012). Whether students see many or only a few classmates who share their ethnicity or race is important in this regard.

In this paper, I provide the first study of the effects of classmates on African American and Hispanic students across course subjects at a postsecondary institution. The community college of interest is an oversubscribed campus where it is difficult for students to self-select their peers. The focus of this study is on first-time college students. These students are the least likely to be informed about the student composition of classes. They also receive the lowest priority in registering for classes. Students with a low registration priority succeed in enrolling in only 54.9 percent of the courses they first attempt to register for.[2]

Although these students cannot select their classmates, they must select their classes. I control for this issue in two ways. First, the parameter of interest is the differential effect between minority and non-minority students in the same class. To further address biases that may exist, the analysis examines combinations of individual, class, and course-by-race fixed effects. The use of individual fixed effects rules out bias from unobservable student characteristics such as ability and motivation. Class fixed effects controls for every characteristic related to a specific class. This includes all classmate characteristics, as well as the term, location, time, subject, class size, instructor, assessments, and common shocks. Course-by-race fixed effects controls for preferences and comparative advantages by race in a course.

I utilize a novel data set that contains comprehensive background information on students and instructors for each class, course-level academic outcomes, and student course-level data. The extent to which underrepresented minority students are affected by the racial composition of the classroom is estimated from these detailed administrative data. The term “underrepresented minority,” which I use interchangeably with “minority,” includes African American, Hispanic, Native American, and Pacific Islander students.[3]

The data and the setting allow for testing the “situational cues” hypothesis proposed by Purdie-Vaughns et al. (2008). Their hypothesis predicts that people who belong to groups that have been historically discriminated against may rely on social cues to determine identity-threat and identity-safety (social identity contingencies). When individuals can see the number of people who share an identity in a setting, they can develop an expectation for the level of threat or safety before they actually experience it. A consequential prediction from this hypothesis is that minority students are less likely to drop a course if they see classmates similar to themselves, and that White students are unlikely to be affected if they see more or fewer classmates like themselves.

The data allow for the observation of course enrollments and drops that occur before the census date. Being able to observe this timeframe is crucial because it is a juncture when students have a brief opportunity to look at the numerical representation of classmates and assess risk before they decide whether to remain registered for the course. Students who remain in a course after the census date must pay enrollment fees and absorb an official record of course enrollment on their transcript. After the census date, students no longer have the option to drop a course but must officially withdraw if they decide to unenroll. Because of these explicit and implicit enrollment costs, the choice made by students to remain in or drop a course reveals their true preferences.

In line with the situational cues hypothesis, I find that minority students react favorably to unanticipated increases in the portion of classmates who share their race/ethnicity; White students do not react with the same magnitude. For minority students, the decision to remain in or drop a course also has downstream consequences for academic performance and course selection. When minority students are in classes with greater proportions of classmates of the same race/ethnicity, they are less likely to drop the class; in addition, these students are more likely to enroll in a course in the same subject during the subsequent term, and to pass more classes. Specifically, I estimate that Hispanic students are 1.3 percentage points (on a sample base of 19.7 percent) less likely to drop, 1.3 percentage points (on a sample base of 60.4 percent) more likely to pass, and 1.0 percentage points (on a sample base of 29.4 percent) more likely to enroll in the same subject the next term when there is a 10 percentage point increase in classmates with a similar race/ethnicity.[4] The effects on passing for Hispanic students are driven by courses transferable to the University of California (UC) and California State University (CSU) systems.[5] For African American students, I estimate that they are 2.8 percentage points less likely to drop when their representation increases by 10 percentage points. This raises the number of classes they pass by 0.05 classes (on a sample base of 1.60 classes). In the spirit of intersectionality, I examine whether there are differential effects on minority students by gender, socioeconomic status by zip code income level, and ability. I find that African American women are differentially more likely to pass a class than their male counterparts of the same race/ethnicity. Throughout my analysis, I consistently find little or no evidence to suggest that the effects are driven by changes in the instructor's behavior or grading. I also find little or no evidence that non-minorities do better or worse when there are more minority classmates.

The rest of the paper proceeds as follows: Section 2 provides background on social interactions and common inferences from racial interactions in higher education classrooms. Section 3 discusses the institutional background of the study and summarizes the data. Section 4 introduces the econometric framework and tests for sorting. Section 5 presents results on racial interactions in educational outcomes. The final section concludes.

2 Existing Literature

A large and growing body of evidence suggests that the characteristics of instructors and peers can affect the academic decisions and performance of students attending postsecondary institutions. Research on instructors has uncovered academic benefits associated with a matching of instructors and students across similar genders, race, and nationalities (Borjas, 2000; Bettinger & Long, 2005; Hoffmann & Oreopoulos, 2009; Carrell et al., 2010; Price, 2010; Griffith, 2014; Fairlie et al., 2014; Solanki & Xu, 2018). Similarly, the matching of similar-race teaching assistants to students also has positive effects on academic outcomes (Lusher et al., 2018; Oliver et al., 2021).

In contrast, the few studies that have investigated effects stemming from the characteristics of classmates have often pointed to context-specific results. Influential characteristics can be categorized as dimensions of ability, gender, dual-enrollment status, and race. Feld & Zolitz (2017) document the effects that stem from peer ability by examining the random assignment of students to sections at a school of business and economics in the Netherlands. In general, they find that students benefit from peers with higher ability, but that low-achieving students are adversely affected when they are exposed to high-achieving peers. Booij et al. (2017) investigate peer effects by exogenously assigning students by ability to different tutorial sections at a business and economics school. They document that high-ability students are unaffected by the ability of their peers, but low- and medium-ability students benefit when they are assigned to sections with similar-ability peers. The findings from both studies suggest that low-achieving students are likely to benefit when they are exposed to more low-achieving peers and that these influences are unlikely to be a result of any instructor adjustments.

Context-specific effects related to gender have also been identified. Oosteerbeek & van Ewijk (2014) examine the exogenous assignment of students by gender in tutorial sections at a business and economics school; they document that there are no substantial gender peer effects on achievement in spite of perceived effects on their own, and their peers' behavior. Fairlie et al. (2020) find similar results when they examine randomly assigned partnerships (by gender) in chemistry laboratories. They document no effects on academic performance or subsequent choice of major. When Fisher (2017) investigates ability-based assignments to STEM classrooms, the researcher findings that women in classes with higher-ability peers are less likely to graduate in STEM fields, and that this effect is driven by women in the bottom third of the ability distribution. Research by Goulas et al. (2022) identifies a similar mechanism driving students to choose specializations. When they investigate random classroom assignments in 10% of public high schools in Greece, they find that the comparative STEM advantage (in the form of class rankings) explains a substantial amount of the underrepresentation of females earning STEM degrees.

Instead of focusing on ability or gender, Liu and Xu (2022) investigate the impact of high school dual-enrollment peers on community college students in gateway courses in English and mathematics. They find that college enrollees exposed to a greater share of dual-enrollment students pass classes at a lower rate and get lower grades. In their heterogeneity analysis they that find both high- and low-ability students are negatively affected by dual-enrollment students. Their study is the only other study to investigate peer effects in the community college setting and provides rare suggestive evidence that both high-ability and low-ability students can be affected by peers.

The two prior studies that have examined effects stemming from the composition of minority student classmates at postsecondary institutions have shown mixed results. Dills (2018) examines first-time students assigned to sections in the development of Western civilization at a religious liberal arts college and finds that when minority students are in sections with a greater share of same-race classmates, their grades are adversely affected. The researcher finds that these effects occur exclusively among minority students with lower SAT scores. In contrast to prior peer effect studies, Dills (2018) finds that lower-ability students are adversely affected when they are in classes with a greater number of similar students. Griffith & Main (2019) examine first-time students enrolled in an engineering school at a research university and find that an increase in the minority share of students has positive effects on minority students' grades. The studies by Dills (2018) and Griffith & Main (2019) focus primarily on grades and do not shed light on whether classmates affect pass rates. Without being able to observe the effects on course pass rates, it is difficult to determine the salience of their findings. It is also unclear whether the subject matter or admissions process may be the source of the different findings in these studies.[6] I add to the research by estimating effects across course subjects and by including a within-student estimator in a setting where there are no selective admission policies. In addition, I estimate and detect effects on first-order outcomes with greater academic consequences such as passing a course and course subject persistence. In order to better assess the relevance and validity of the situational cues hypothesis in a college setting, I also observe and report the effects on courses dropped.

3 Data

3.1 Data Sources and Institutional Background

The analysis is based on administrative data from De Anza College, a large community college in the San Francisco Bay Area. It is part of the California Community College system, the largest higher education system in the United States with 116 colleges and 2.1 million students. De Anza College has an average enrollment of 16,000 students per year. It has a larger share of minority students than the nationally representative community college, reflecting the diversity of Northern California. The college operates on a quarter system, and the majority of classes enroll 50 or fewer students. The tuition at De Anza College is $31 per unit (roughly $1,515 per year in tuition and fees); a large percentage of students receive fee waivers because of financial need.

Like all community colleges in California, it has open enrollment. Anyone with a high school diploma or equivalent is automatically admitted.

The data set includes an extensive set of course outcomes as well as detailed demographic characteristics for every student registered at the community college from the fall quarter of 2002 to the spring quarter of 2010. For each student, the data include course registrations, dropouts, withdrawals, recorded grades, credits earned, and the demographic characteristics of their instructors. A student's registration priority together with any registration attempt is recorded at the beginning of each quarter. The course-level data set allows for observations of students enrolled before the first day of a term, regardless of whether they completed the class.

Open enrollment, low tuition costs, and the school's location in the San Francisco Bay Area create intense competition for courses at De Anza College. Because the demand for courses exceeds the supply, the college has established a strictly enforced registration priority system that determines the day on which students are allowed to register over an eight-day period. Registration priority is determined by whether the student is new, returning, or continuing, the number of cumulative units already earned at De Anza College, and enrollment in special programs. Incoming students have the lowest priority.

3.2 Sample Restrictions and Summary Statistics

I exclude orientation courses, online courses, and classes with enrollments of fewer than 15 students or more than 100 students in order to observe common classroom settings. Online courses are excluded because students were unlikely to see their classmates' race or ethnicity during the time the data were collected. The course subjects most commonly excluded because of enrollment size restrictions include physical education, ESL, arts, and computer applications (e.g., keyboarding). These courses represent 16.6 percent of observations from the total possible sample. In the main sample, I only analyze outcomes for first-time college students who are in their first term with the lowest registration priority and report an ethnicity/race of White, Asian, Hispanic, African American, or Native American/Pacific Islander. This sample accounts for

186,336 classroom-student observations. Table 1 reports descriptive statistics. Panel A displays the summary of student characteristics and the proportion of student-class observations that satisfy within-class and within-student variation requirements for the main fixed-effects model for this study. Asian students are most represented in the sample (46%), followed by White students (28%). The minority groups are less well represented. Hispanic students account for 17% and African American students for 6%. The remaining 3% are Native American and Pacific Islander students. Overall, 80% of the full sample satisfy the joint within-class and within-student variation requirement for the main fixed-effects model used in this study. When class fixed effects are used in the primary empirical model, all observed classes must include at least one minority and one non-minority student. In addition, when student fixed effects are included in the model, all observed students must be enrolled in at least two classes with different racial compositions.

Panel B in Table 1 reports the primary outcomes of interest. Included are drops, withdrawals, passes, grade points earned (where 4.0 is equivalent to an A), number of classes passed during the first term, taking same-subject courses the subsequent term, and returning the subsequent term. The largest differences between minority and non-minority students occur in the categories of passing for course credit, grades earned, and number of classes passed. White and Asian students have an average pass rate of nearly 88%, while minority students have a pass rate of approximately 78%. Across outcomes, the least-represented ethnic/racial groups, which include African American and Native American/Pacific Islander students, show consistently worse performance than the better-represented groups. With the exception of returning the next term, all of the outcomes across minority groups are statistically significantly different than non-minority students.

Panel C of Table 1 displays the mean classroom characteristics of the main sample.[7] The average enrollment in each class in this sample is 37.84 students. A majority of these classes are transferable to the UC and CSU systems. The average share of first-time students is approximately 17%. Also included are the shares of African American (6%), Hispanic (12%), and Other Minority (2%) students in classes. The Hispanic student enrollment at this college is slightly lower than the 16% national average for all colleges (Ma & Baum, 2016). Figure 1 displays the distribution of enrollment by classroom unit. The peak of the distribution is close to 30 students per class. Figure 2 displays the distribution by minority categories. The panels on ethnicity/race show that there is wide variation in the classroom share of Hispanic students, but the variation is considerably less for African American students and other minority students owing to their very small representation on the campus. African American and Native American/Pacific Islander students are frequently in classes where there are no other classmates that share their ethnicity/race.

4 Econometric Strategy

4.1 Main Model

The main model on student-classroom level outcomes is given by

$$y_{ic} = \alpha Minority_i \times MinorityClassmates_{ic} + \gamma_i + \lambda_c + \delta_{ik} + u_{ic} \quad (1)$$

where students are indexed by i, classes by c, and courses by k. The student variable Minority is an indicator variable for whether student i belongs to an underrepresented minority group. The student and class variable MinorityClassmates represents the underrepresented minority classmate share value for class c in which student i is enrolled.[8] The values are between 0 and 1. Zero indicates there are no minority classmates, while a value of 1 indicates that all classmates are minority students. Fixed effects are represented by γ_i, λ_c, δ_{ik}. They represent individual, class, and course-by-race fixed effects, respectively. The general parameter of interest is α, which determines the difference in effect of minority classmates on minority and non-minority students.[9] I refine this equation and incorporate specific minority groups to obtain the preferred empirical model:

$$y_{ic} = \alpha_1 H_i \times HCmates_{ic} + \alpha_2 AA_i \times AACmates_{ic} + \gamma_i + \lambda_c + \delta_{ik} + u_{ic} \tag{2}$$

where I have separated the variable Minority by H (Hispanic) and AA (African American). Similar to the MinorityClassmates variable in equation 1, HCmates and AAmates represent the classmate share value by the corresponding racial/ethnic categories.[10] The α parameters separately represent the difference in effects between each minority group and non-minority students.

The interaction terms between the race/ethnicity of students and classmates allows for the use of student and class fixed effects. This set of fixed effects helps overcome the common threats to validity associated with observed and unobserved differences across students and classes. Student fixed effects provide additional controls for unobserved student characteristics such as motivation and previous educational experiences. Class fixed effects comprehensively control for observable characteristics that include but are not limited to course, term, day/time, class size, and instructor. Unobservable classroom characteristics that are also controlled for by class fixed effects include peer quality and all common shocks such as grade curving and disruptions. Course-by-race fixed effects control for racial preferences and advantages that may exist for a course.

I estimate equation (2) for four student class outcome variables. They include a dummy variable for whether a student drops the class during the first three weeks of the term, a dummy variable for whether a student drops or withdraws anytime during the term, a dummy for whether a student unconditionally passes a class, and a dummy for whether a student takes a course in the same subject in the subsequent term.

4.2 Cumulative and Intermediate Outcomes Model

The second set of outcomes I examine is the number of classes students pass and whether they persist to the next term. A consequence of analyzing these outcomes is that only one observed outcome can be made per student, regardless of the number of classes in which they enroll in their first-term. For this reason, student fixed effects cannot be included. Instead, I include controls on gender, a fourth-order polynomial on age, and indicators for zip codes. Similar to the preferred model as described by equation (2), I use class and course-by-race fixed effects. I follow the style of Fairlie et al. (2014) to also generate a subject-level-term-set as a replacement for student fixed effects. The subject-level-term-set account for 3,386 realized combinations of course subjects, levels (UC or CSU transferable, only CSU transferable, only associate's degree applicable, or non-degree applicable), and the term in which first-time students enrolled. Including subject-level-term-set fixed effects as a replacement for student fixed effects allows for comparisons across students that are likely to be very similar. For example, a first-time student enrolled in remedial reading and mathematics courses in Fall 2008 would be compared with another first-time student in remedial reading and mathematics courses in Fall 2008. Overall, the subject-level-term-set fixed effects variation requirement satisfies 52% of the full sample, and the joint within-class and within-subject-level-term variation requirement satisfies 44% of the full sample. [11]

4.3 Empirical Test for Sorting

A normal concern with econometric models occurs when the identifying variation is correlated with the error term. In this case, the α parameters would be biased if highly motivated minority students sort into classes with more minority students and/or highly motivated non-minority students sort into classes with more non-minority students. This issue is largely addressed by the inclusion of individual fixed effects, which allows for comparisons to be made for the same highly motivated student across classes.

To further address the potential for sorting, I restrict the analysis to a sample of first-term-ever college students who have the lowest priority in course registration. As first-time students, they are unlikely to know or predict the racial composition of specific classes. As the students with the lowest enrollment priority on campus, they are the least likely to be able to enroll in the classes that are their top choice. Many classes fill up early because the demand for courses exceeds the supply at this college, and sorting is generally difficult.

When individual fixed effects are removed, sorting poses an increased threat to validity. To empirically test for sorting in this scenario, I replace the outcome variable y_{ic} with individual characteristics X_i.

$$X_i = \varphi_1 H_i \times HCmates_{ic} + \varphi_2 AA_i \times AACmates_{ic} + \kappa_c + \psi_{ik} + \nu_{ic} \quad (3)$$

The φ parameters provide an empirical estimate of sorting by observable characteristics for each minority group interacted with the corresponding share of similar classmates. κ and ψ represent class and course-by-race fixed effects, respectively. I test for sorting by gender, log of age, financial aid receipt, percent of families with income below $30,000 in the home zip code, and the median income of the home zip code.

Panel A in Table 2 reports these tests. Column 1 examines a dummy outcome variable that indicates whether an individual is female. Column 2 and column 3 examine log of age and financial aid status. The remaining two columns rely on the 2000 census reports at the zip code level. Column 4 examines the percent of families below $30,000 in income, and column 5 examines the median income.

I also run a placebo test using the preferred model on online courses. In an online setting (especially between 2002 and 2010), it is unlikely that students could observe or be affected by the racial composition of classmates in the form of a situational cue. I do not find evidence of effects on any of the outcomes.

My final sorting test examines whether minority students sort toward similar race instructors. This test is important because prior studies have consistently shown academic benefits related to a racial match between instructors and students. I conduct this test by removing class fixed effects and by introducing student fixed effects into the model outlined by equation 3. Panel B reports these tests. I do not detect any evidence of sorting for either Hispanic students or African

American students. These results, combined with the restrictive nature of being a first-time student, provide confidence that the regressors of interest are unbiased.

5 Results

5.1 Main Results

Estimates of minority interactions between students and their classmates for all four behavioral class outcomes are reported in Table 3.[12] All the reported estimates are unconditional to drops or withdrawals.[13] I examine the sensitivity of the econometric model by including different fixed effects. The inclusion of these fixed effects progressively restricts the variation used to identify the parameters of interest. All columns include course-by-race fixed effects. Column 1 presents the least restrictive estimates using term fixed effects. This provides an estimate to compare the outcomes of first-time students who enter the college in the same term. Column 2 presents a more rigorous restriction with classroom fixed effects. This allows for comparisons of outcomes across first-time students who enroll in the same unique class with the same classmates and instructor. Column 3 introduces student fixed effects. These fixed effects allow for comparison of outcomes for the same student across multiple classes. Column 4 reports the preferred specification from equation (2), which includes student and class fixed effects. Finally, column 5 includes race-by-instructor-race fixed effects. This specification is included for robustness to ensure and display that the race of instructors is not driving the estimates. Standard errors are clustered by course.

Both Hispanic and African American students are more likely to remain in classes with higher representations of their own racial/ethnic group. Within the first three weeks of the term, Hispanic students compared to non-minority students are 1.3 percentage points less likely to drop a class due to a 10 percentage point increase in composition of Hispanic classmates. African American students are 2.8 percentage points less likely to drop a class due to a 10 percentage point increase in composition of African American classmates (henceforth, estimates are stated relative to a 10 percentage point increase in students of a similar race/ethnicity). For comparison, the base drop rate for students is 19.7 percent. The estimates are robust across specifications that include class and race-by-instructor-race fixed effects. This implies that the effects are driven by the racial composition of classmates and not by other factors.

The second outcome displayed in Table 3 focuses on whether students drop or withdraw from a class. This is displayed to provide further insight into understanding the juncture at which students un-enroll from classes due to the racial/ethnic composition of their classmates. The estimates for this outcome are very similar to the outcome on dropping a class. This suggests that the composition of classmates primarily affects students within the first few days of class.

The class passing outcome provides evidence that Hispanic students are also 1.3 percentage points more likely to pass (on a base of 60.4 percent). Although I do not detect statistical significance for African American students under the preferred specification, my estimates range from 2.1 to 3.5 percentage point effects. The similar magnitudes for the effect on class drops and passing suggest that students are not harmed by their decision to persist in a class. This is also confirmed when attention is focused on the grade outcomes for students that remain in the course. These estimates are presented on Table A2. The estimates suggest inconclusively that minority students are not harmed when they are enrolled with a higher share of similar classmates.

The final outcome examined in Table 3 is whether students enroll in a course in the same subject in the next term. The estimates for all specifications show that Hispanic and African American students are more likely to do so as a result of increased exposure to similar ethnicity/race classmates. The effect is a statistically significant 1.0 percentage point effect for Hispanic students and a non-statistically significant 0.8 percentage point effect for African American students (on a base of 29.4 percent).

5.2 Robustness

Although it is unlikely that first-time students with the lowest registration priority can control their exposure to students of a particular race, non-first-time students who have high priority in registration may sort into classrooms with unobserved racial/ethnic advantages. An example would be high-registration-priority minority students sorting into classes with minority instructors. I rule out this threat to validity in two ways. First, I include race-by-instructor-race fixed effects in the preferred model and see little or no changes in estimates. This indicates that the main results are driven by classmates and not by a match with an instructor. The estimates are displayed in column 5 of Table 3. Second, I re-run the preferred model solely on the minority classmate share of students who are first-timers. I focus on first-time students who are classmates because they also have the lowest registration priority and little choice in selecting classes that may have unobserved racial/ethnic advantages. When I focus on this variation of classmates, the estimates are still consistent with the main results of the study. The estimates are presented in Table A3. These two findings provide corroborating evidence that the class share of minority students is orthogonal to non-classmate factors that may influence academic outcomes.

An empirical study of minority students is generally difficult due to the literal definition of minority. Minority students are observed less often than their counterparts. I take three approaches to ensure that outliers do not drive the results. In Table 4, I report the estimates for a full sample of students, which includes first-time students and the remaining non-first-time students at the college. The estimates are consistent with the preferred specification as reported in Table 3. I also examine a common strategy that pools minority groups as outlined in equation (1) and find consistent estimates.[14] These are reported in Table A4.

To check whether outliers may be generating spurious results, I winsorize the classmate share variables for all three minority groups at the .05 level. This process censors both the top and bottom 5% of observed class shares of each minority group. Specifically, this replaces the values that between 0 and the top 5% with the 5th percentile classmate share value and values between 95 and 100% with the 95th percentile value. I ensure that the censoring applies to only 5 percent of each tail of the distribution with a random selection for ties. Table A5 displays the results using the censored values with the preferred specification. The signs and estimates are overall unchanged.

I also check whether factors that may be correlated with race are driving the main estimates. Table A6 displays the preferred model with additional control variables of classmate shares of students residing in a lower-than-median income zip code and classmate share of female students. Each classmate share variable is interacted with the corresponding indicator variable (e.g., ClassmateShare LowerIncome × LowerIncome and ClassmateShare Female × Female). Included are also fixed effects of each course interacted by each indicator used (e.g., Course × LowerIncome and Course × Female). This specification is extremely rich and absorbs identifying variation beyond the standards of the literature on peer effects and social interactions (see Sacerdote (2014) for a list of related literature). The estimated effects from the preferred specification remain intact.

Many students at community colleges enroll in remedial and developmental courses. Consequently, there is great interest in understanding the effects of remediation and ways that it can be improved.[15] This is important for the Latina/o population because remediation is likely to be a substantial barrier for access to college level courses and vertical transfer opportunities (Crisp & Nora, 2010; Crisp, Reyes & Doran, 2017). For this reason, I investigate remedial courses, which include writing, reading, math, and ESL (English as a Second Language). In Table A7, I report estimates using the preferred model on all students enrolled in these courses. Although the estimates are less precise because of the limited enrollment in remedial courses, the point estimates are consistent with the findings on all the main outcomes. Since this sample is highly restrictive (due to a sample restriction focused on remedial courses), I view these estimates as suggestive.

5.3 Cumulative and Intermediate Outcomes

I also rely on the compositional variation of classmates by race and ethnicity to identify effects on the number of classes passed during the term and on the probability of returning the next term. Since each student can have only one outcome, I replace student fixed effects with subject-term and subject-level-term fixed effects as described in section 4.2. Table 5 reports both outcomes across four specifications with an increasingly restrictive set of controls. The estimates are generally consistent across specifications. Specification (1) reports estimates with class fixed effects, and specification (2) reports estimates with class and number-of-courses-enrolled-in-by-race fixed effects. The purpose of the fixed effects introduced specification (2) is to compare students with similar enrollment intensities. Specification (3) introduces subject-term-set fixed effects and specification (4) reports the preferred estimates with subject-level-term fixed effects. For Hispanic students I estimate a statistically insignificant increase of 0.01 classes passed. For African American students I detect an increase in 0.05 classes passed. The base rate for the number of classes passed is 1.96. This shows that the effects on net credit accumulation per term are more pronounced for African American students than for Hispanic students. Alternatively, when I examine term persistence, there appears to be no noticeable effect for either Hispanic or African American students across all four specifications.

5.4 Potential Mechanisms

In this section, I report findings that rule out peer effects and instructor adjustments as a substantive source of the effects documented in this study. I also highlight additional evidence that suggests situational cues are a key channel affecting students.

As discussed in Section 5.1, the estimated effect on course drop rates for Hispanic students is 1.3 percentage points, while the corresponding effect on course pass rates is 1.3 percentage points. For African American students the estimated effect on course drop rates is 2.8 percentage points, while the effect on course pass rates is 2.3 percentage points. For both groups, the ratio between the effect on the course drop rates and pass rates is approximately 1 to 1. On the surface, it appears that student decisions to remain in a course are entirely driving the effects on passing.

In order to better understand whether classmates can affect minority students beyond just a decision to remain enrolled in a course, I extend the main model to examine the unconditional rates at which students earn a B or better, or an A or better. I focus on unconditional rates of grades earned in order to provide causal estimates without attrition bias. These estimates are presented in Table 6 under Panel A. For both Hispanic students and African American students, I do not find evidence that minority students are more likely or less likely to earn higher grades when they are exposed to similar classmates. Instead, the most that can be inferred from these estimates is that greater exposure to similar classmates can help a student finish a course and obtain a grade good enough to pass. This evidence is also consistent with the fact that there are detectable spillovers into the next term. Table A8 shows that students are unaffected the next term across course performance outcomes using the cumulative course outcomes model described in section 4.2. If students had learned substantially more or developed better study habits during the first term as a result of their exposure to similar classmates, they should also perform better in the subsequent term. I also leverage the main model to observe the academic outcomes of students conditional on enrolling in a course in the same subject in the next term in order present descriptive evidence with student fixed effects. This is displayed in Table A9. Column 1 reports the effects of taking a same-subject course. Columns 2 through 4 report that students' academic outcomes in these courses are unaffected in the next term. Overall, there is little evidence to suggest that classmates directly affect the academic performance of minority students beyond a visual cue on the first days of class.

An alternative mechanism that might affect academic performance may be teacher adjustments. A prior study by Duflo, Dupas & Kremer (2011) suggests that instructors may change their behavior and instruction to target the abilities of the students in a class. In order to examine whether instructors at the college change their instruction in ways that substantively affect students, I relax the main model and remove class fixed effects to reclaim coefficients for control variables that measure changes in class average outcomes as the share of minority student varies.

These estimates are reported along with the main effect coefficients in Panel B of Table 6. All the control coefficients are substantially smaller than the main effects. Most important, the control coefficients for the unconditional pass outcome are very close to zero and exchange signs depending on whether they focus on the Hispanic or African American share of classmates. The evidence from this panel shows that the net instructor influence on students or any grading adjustments they make are likely to be uncorrelated with the racial makeup of the class. These coefficients also show that non-minority students do not do any better or worse when then are more minority classmates. Although it is possible that instructors differentially adjust their instruction for minority students as the racial composition changes, this is unlikely. If such a scenario were true, the addition of race-by-instructor-race fixed effects to the main model as reported under specification 5 of Table 3 would drastically alter the estimates. The stability of the estimates between specifications 4 and 5 of Table 3 shows that this is not the case.

My last test for instructional changes relies on observing spillover effects across race and ethnicities. I examine for spillover effects among minority students (Hispanic and African American) to check whether instructional changes related to racial composition may drive the results. At this college, all the minority groups receive substantially lower grades than non-minority groups. If instructors systematically change their teaching or grading method to accommodate more minority students, an increase in the share of Hispanic students should affect both Hispanic students and African American students equally. The same condition would also apply when there is an increase in the share of African American students. To investigate whether this phenomenon exists, Table 7 reports regression estimates on interactions between each of the minority race/ethnicity categories. Each panel corresponds to a single regression. The cells represent the interaction term between the column variable and the row variable. Highlighted in bold are the interactions between students with a similar race/ethnicity (these are the diagonal cells in each panel). Although “Other Minority” is included in the regression as a control, it is unreported because this category is combined with multiple underrepresented groups and the sample is small. This table shows that the effects for both Hispanic students and African American students are only driven by exposure to classmates along their own race/ethnicity. For both the dropped and passing outcomes, there appears to be little or no spillover in effects across Hispanic and African American students. The effects are primarily contained within each race/ethnicity. If teacher adjustments by ability were driving the main effects presented in this study, spillover effects across minority groups would appear, but this is clearly not the case.

The last mechanism that I explore is the situational cues hypothesis outlined by Purdie-Vaughns et al. (2008). The hypothesis predicts that people who belong to groups that have been historically discriminated against rely on social cues such as minority representation of peers to determine identity-threat and identity-safety. There are two testable predictions from this hypothesis. The first prediction is that minority students will reveal a preference for a class with a greater share of similar race/ethnicity classmates. The large effect on course drops for both minority groups provides strong evidence to confirm this hypothesis. The second prediction is that White students are less likely to respond to the social cues than minority students because they are less likely to have experienced restrictions, stereotypes, social exclusion, and discrimination. To examine this prediction, I add an interaction term with a variable indicating a student is White to the classmate share of White students in the preferred model. By including this additional term, I am able to show a comparison of effects for minority students and White students separately. Table 8 displays these estimates. The estimates provide evidence to confirm the predictions of the cues hypothesis. The magnitude of the effect for White students is substantially smaller than for minority students. The estimated effects for White students are also insignificant.

5.5 Heterogeneity

In this section I examine the students and the settings that may be most sensitive to the racial and ethnic composition of classmates by estimating differential effects. To identify differential effects, I include additional interaction terms that represent the type of student or the classroom setting type in the main model for this study.

I start the examination of differential effects with gender in Panel A of Table 9. The coefficients of interest are the lower two coefficients in each panel. In this case, the differences in effects between males and females are reported. The only statistically significant differential effects that I detect are on the passing outcome. For this outcome, I detect that African American females are 3.6 percentage points more likely to pass a class than African American males as a result of a 10 percentage point increase in African American classmates. This suggests that classroom compositional changes affect African American women more than African American men. Although the other two displayed outcomes do not show statistically significant differential effects for females, they also suggest that African American females are differentially less likely to drop classes. African American men appear to be affected by classroom compositions as well, but the magnitudes are much larger for females.

Socio-economic comparisons may also be relevant, especially for social identity and a sense of belonging. Previous research on social identities (Ostrove & Long, 2007; Oyserman, Johnson & James, 2011) finds that social-class background has important implications for a student's sense of belonging and are likely to be intertwined with minority-ethnic group memberships. Panel B of Table 7 examines the distinction between these potentially interacting effects. In this examination, student zip codes are linked to median incomes that are made available to the public by the U.S. Census Bureau. The students are categorized by whether they live in a zip code that has a median income in the lower 50th percentile of the sample or not.[16] This panel displays no detectable differential effects, nor a consistent pattern.

The final student characteristic that I include for differential analysis is ability. Understanding patterns by ability is important in the peer effects literature because numerous studies of college students have identified that low-ability students are the most sensitive to peer composition (e.g., Carrell, Sacerdote & West, 2013; Booij, Leuven & Oosterbeek, 2017; Kimbrough, McGee & Shigeoka, 2022). At the community college level, this measure is difficult to capture because they are open-access institutions. This means that high school grade point averages and standardized test scores such as the SAT are not widely available. This is also a limitation of this study. In order to overcome this, I generate an indicator variable for ability based on current and future course-taking patterns of first-time students. I proxy for ability by indicating whether a student ever enrolls in a remedial course. I select this approach because it is conservative to assume that, on average, students who enroll in a remedial course have less academic ability than students who never enroll in a remedial course. The potential that this variable is endogenous is greatly reduced because students must take remedial courses early in their academic career. Estimates using this proxy variable are displayed in Panel C of Table 9. Overall, the panel shows that there is very little evidence to suggest that lower-ability Hispanic students are differentially more sensitive than their higher-ability peers. This is in contrast to what is observed for African American students. Lower-ability African American students are substantially more sensitive to their peer composition than their higher-ability peers. When comparing the coefficients between lower-ability African American students with higher-ability peers, the magnitudes of the estimates for the drop and unconditional pass outcomes are twice as large. Nonetheless, the evidence presented in this table suggests that minority students with both lower- and higher-ability backgrounds are affected by the racial/ethnic composition of classmates.

In Table 10, I extend the differential analysis to the type of course students are enrolled in. Panel A examines whether the transferability of a course to a UC or CSU has differential effects relative to other courses. These courses are inherently high-stakes because both passing and the grades earned are crucial for entry into UC and CSU schools. The notable finding among these estimates is the 2.9 percentage point differential effect on passing a transferable course relative to a non-transferable course for Hispanic students. A potential explanation for these “peer effects” may be that increased access to friendship formations and study partnerships are important when the stakes are high. I emphasize the potential for peer effects in this context because differential effects are observed for the pass outcome while the magnitude of the differential effects on the drop outcome is considerably closer to zero. Together, these estimates provide a rare specification and context where the situational cues are unlikely to be the sole mechanism driving outcomes. These estimates suggest that the prior experiences that form the expectation for Hispanic students are validated when they enroll in transferable courses.

The marginal effects of being underrepresented may be magnified as minorities face an environment with very limited representations (Steele, 2010). To examine this potential mechanism, I generate an indicator variable for minority groups when their representation in a class is below the median in a course's history. Panel B of Table 10 reports these differential effects. Although the signs of the differential effects are mixed for Hispanic and African American students, the only statistically significant differential effect shows that Hispanic student in classes with representations below the median are 1.4 percentage points less likely to drop a course. This also aligns with a statistically insignificant 1.1 percentage increase in the probability of passing. Overall, differential effects for African American students might not be detected because they constitute such a small share of the student population.

6 Conclusion

The detailed administrative data from an over-subscribed community college provide critical insights into understanding how classroom racial composition affects the racial achievement gap. In this examination of first-time college students with limited class choices, I find evidence to support the situational cues hypothesis by observing that minority students are more likely to persist in and pass classes when they are enrolled in classes with more students of a similar race or ethnicity. This behavior also leads to increases in rates of enrollment in same-subject courses in the next term.

Race and ethnicity appear to be distinct in decisions to drop classes, with little or no spillover across minority groups. The outcome of passing a class to earn credit shows heterogeneous effects. African American females benefit more than African American males when they are exposed to more students of a similar race or ethnicity. Hispanic students who enroll in UC and

CSU transferable courses also experience additional positive effects relative to their Hispanic student counterparts.

The class drop outcome reflects student preferences during the first three weeks of college. These early decisions are likely to be based on projections from previous experiences in social settings. Related studies examining racial and ethnic interactions between instructors (Fairlie et al., 2014) and teaching assistants (Lusher et al., 2018; Oliver et al., 2021) have also found that students respond favorably to similar races and ethnicities.

The policy implications related to the findings of this study are twofold. First, lack of diversity in postsecondary settings is likely to perpetuate academic achievement gaps and sorting across field specializations for minority students. Continued progress on increasing the representation of disadvantaged racial groups in institutions and specialized fields is likely to help in this regard. Second, in instances where minority representation is limited, institutions may improve the environment for minority students by increasing their opportunities to opt into classrooms and/or smaller learning communities to ensure they are not marginalized. The two research universities closest to the community college of interest offer some examples of practices that may be fruitful. UC Santa Cruz allows incoming students to select from one of ten thematic colleges that provide unique introductory curriculum and residential accommodations. Stanford University offers incoming students the opportunity to apply to ethnic-themed housing focused on histories and cultures. Programs focused on specific fields with low minority representation may also be effective. An example of this type of program is the Enhanced Academic Success Experience (EASE) at UC Irvine. This STEM learning communities' program for first-year students has shown promising results for the success and persistence of minority students (Solanki, McPartlan, Xu & Sato, 2019). Both colleges and researchers should continue to innovate and identify similar learning community programs that support minority students in settings where they are numerically marginalized.

People do not choose their race or ethnicity; nor do they choose the educational options that they are provided. Instead, they must choose between the available social and academic environments and find ways to fit in and succeed. In this crucial setting with long-term economic consequences, minority students demonstrate that racial environments matter. They are more likely to pass classes and persist in a subject area when in the presence of peers like themselves.

Notes

[1]Career technical certificates and degrees at California community colleges provide average returns between 14 and 45 percent (Stevens et al., 2018). Additional studies have also shown that students who accumulate course credits benefit from schooling regardless of whether they are awarded a degree or certificate (Liu et al., 2015; Belfield & Bailey, 2017; Bahr, 2019).

[2]I examine the same community college as Fairlie et al. (2014).

[3]This is the definition used for "underrepresented minority" by the National Science Foundation and California public higher education.

[4]I state estimates in terms of 10 percentage points for simplicity and statistical support. For reference, one standard deviation of the Hispanic classmate share is approximately 9%.

[5]Courses transferable to UC and CSU are inherently competitive due to vertical transfer requirements and the enrollment constraints at most campuses.

[6]Engineering schools often have selective admissions due to their extensive course requirements and/or limited physical capacity.

[7]Classes are unique sections for each course. Each class has an instructor, location, and set schedule. Econ1 is an example of a course that has multiple class offerings in a term. This distinction is also relevant for the subscripts used in the econometric model. Classes identify a course, but a course does not identify a class.

[8]Classmate share values represent the class mean excluding student *i*. This is commonly referred to as the leave-out mean.

[9]It is important to note that this identification strategy requires course-by-race or similar fixed effects when multiple course subjects are observed. See Fairlie et al. (2014), Lusher et al. (2018), and Hoffmann & Oreopoulos (2009) for recent examples.

[10]The interaction between an indicator for other minorities (Native American/Pacific Islander) and share of other minorities (Native American/Pacific Islander) classmates is included in the regression as a control.

[11]Table A1 displays the characteristics of students with non-unique and unique subject-level-term sets.

[12]Other Minorities are included in the model, but their coefficients are not reported because of their small sample size and distinct differences between Native Americans and Pacific Islanders.

[13]Drops must occur within the first three weeks of the term. Withdrawals occur after the first three weeks.

[14] Recent examples include Dills (2018); Fairlie et al. (2014); Hurtado and Ruiz Alvarado (2015).

[15]For example, Bahr (2008), Boatman and Long (2018), and Martorell and McFarlin Jr (2011).

[16]The average of the median zip code incomes for Hispanic and African -American students are $69,000 and $67,000 respectively. This compares with an average of $86,000 for non-minority students.

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Table 1
Descriptive statistics.

Panel A: Sample Characteristics, Student-Class Level

Demographics	Mean
White	0.278
Asian	0.460
Hispanic	0.173
African American	0.060
Other Minority	0.030
Female	0.499
Receives Financial Aid	0.207
Age (SD)	23.806 (8.556)
Zip code Median Income (SD)	81,651 (23,618)
Within-Class and Within-Student Variation Requirements	
Class has at least one minority and one non-minority student	0.963
Enrolled in classes with different racial compositions	0.828
Combined	0.801
Observations	*186,336*

Panel B: Student Outcomes By Race/Ethnicity

	White	Asian	Hispanic	African American	Other Minority
	Mean	Mean	Mean	Mean	Mean
Short-Term Outcomes					
Dropped	0.170	0.179	0.157	0.192	0.196
Withdraw	0.118	0.094	0.127	0.126	0.133
Passed - Unconditional on Drop or Withdraw	0.637	0.659	0.581	0.548	0.574
Passed - Conditional	0.873	0.889	0.792	0.780	0.826
Grade Points (SD)	3.007 (1.248)	3.05 (1.197)	2.491 (1.302)	2.37 (1.265)	2.712 (1.330)
Intermediate / Long-Term Outcomes					
Number of Classes Passed During First Term	1.846	2.112	1.727	1.666	1.868
Takes Same Subject Next Term	0.255	0.287	0.318	0.365	0.25
Returns Next Term	0.568	0.636	0.619	0.615	0.608
Observations	*51,712*	*85,762*	*32,194*	*11,169*	*5,499*

Panel C: Characteristic of Classes

	Mean	SD
Enrollment	37.842	14.879
UC/CSU Transferable Course	0.799	0.401
Associate Degree Course	0.139	0.346
Development Course (Writing, Reading, Mathematics, ESL	0.056	0.229
Share of Students: First Time	0.172	0.157
Share of Students: Underrepresented Minority	0.186	0.113
Share of Students: Hispanic	0.123	0.091
Share of Students: African American	0.039	0.046
Share of Students: Other Minority	0.024	0.029
Classes	*32,867*	

Notes: Other Minority indicates that a student is Native American or a Pacific Islander. An A is the equivalent of a 4.0 in grade points.

Table 2
Tests for endogenous sorting into classes.
186,336 Observations

Panel A: By Student Characteristic

	Female	Ln(age)	Receives Financial Aid	Percent Low Income By Zip code	Median Income By Zip code
Hispanic X Classmate Share Hispanic	0.039	-0.009	0.029	-0.714	303.325
	(0.039)	(0.024)	(0.039)	(0.712)	(1,995.687)
African American X Classmate Share A.A.	-0.073	-0.046	-0.004	-1.418	2,295.559
	(0.067)	(0.037)	(0.049)	(1.205)	(2,118.282)
Fixed Effects					
Classroom	X	X	X	X	X
Student	-	-	-	-	-

Panel B: By Instructor Race

	Instructor	
	Hispanic	African American
Hispanic X Classmate Share Hispanic	-0.033	-0.012
	(0.045)	(0.092)
African American X Classmate Share A.A.	-0.023	-0.015
	(0.137)	(0.120)
Fixed Effects		
Classroom	-	-
Student	X	X

Notes: This table displays results from the sorting regressions. All specifications include course-by-race fixed effects. The coefficient on the interaction of other minorities (Native American / Pacific Islanders) with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 3
Estimated effect of classmates on related outcomes.

	(1)	(2)	(3)	(4)	(5)
186,336 Observations					
Dropped Course					
Hispanic X Classmate Share Hispanic	-0.069*	-0.092**	-0.147***	-0.134**	-0.126**
	(0.036)	(0.043)	(0.047)	(0.053)	(0.052)
African American X Classmate Share A.A.	-0.156*	-0.141	-0.270**	-0.279	-0.267
	(0.082)	(0.098)	(0.135)	(0.170)	(0.167)
Dropped or Withdrew					
Hispanic X Classmate Share Hispanic	-0.116**	-0.104**	-0.136**	-0.100*	-0.095
	(0.046)	(0.048)	(0.055)	(0.058)	(0.058)
African American X Classmate Share A.A.	-0.248**	-0.197*	-0.380***	-0.308*	-0.292*
	(0.101)	(0.101)	(0.131)	(0.167)	(0.166)
Passed Course (Unconditionally)					
Hispanic X Classmate Share Hispanic	0.153***	0.058	0.183***	0.129**	0.122*
	(0.055)	(0.056)	(0.062)	(0.065)	(0.065)
African American X Classmate Share A.A.	0.276***	0.252***	0.345***	0.226	0.214
	(0.089)	(0.095)	(0.123)	(0.157)	(0.156)
Takes Course in Same Subject Next Term					
Hispanic X Classmate Share Hispanic	0.228***	0.102**	0.101	0.103*	0.098*
	(0.068)	(0.052)	(0.095)	(0.053)	(0.053)
African American X Classmate Share A.A.	0.093	0.070	0.181	0.079	0.089
	(0.095)	(0.088)	(0.111)	(0.127)	(0.129)
Controls					
Student	X	X	-	-	-
Classroom	X	-	X	-	-
	-	-	-	-	-
Fixed Effects					
Term	X	-	-	-	-
Classroom	-	X		X	X
Student	-	-	X	X	X
Race X Instructor Race	-	-	-	-	X

Notes: This table displays results from the main outcome regressions. All specifications include course-by-race fixed effects. Controls for students include gender, quadratic polynomial of age, and indicators for zip code. Controls for classrooms include the classmate share for each minority race or ethnicity. The coefficients on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 4

Estimated effects of classmates on related outcomes (Including first time & non-first time students)

	Dropped	Dropped or Withdrew	Passed-Unconditional	Takes Same Subject Next Term
	(1)	(2)	(3)	(4)
1,443,627 Observations				
Hispanic X Classmate Share Hispanic	-0.142***	-0.127***	0.132***	0.030*
	(0.019)	(0.020)	(0.022)	(0.016)
African American X Classmate Share A.A.	-0.159***	-0.198***	0.182***	0.008
	(0.044)	(0.048)	(0.048)	(0.038)

Notes: This table displays results from the main outcome regressions that correspond to equation 2. The sample include all first-time and non-first-time students. Course-by-race, class, and student fixed effects are included in all regressions. The coefficient on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 5
Estimated effect of classmates on cumulative outcomes.

	(1)	(2)	(3)	(4)
186,336 Observations				
Number of Classes Passed				
Hispanic X Classmate Share Hispanic	0.128	0.095	-0.017	0.069
	(0.176)	(0.160)	(0.155)	(0.154)
African American X Classmate Share A.A.	0.398**	0.236	0.535***	0.495***
	(0.162)	(0.176)	(0.200)	(0.191)
Returns Next Term				
Hispanic X Classmate Share Hispanic	-0.006	-0.021	0.005	0.017
	(0.048)	(0.034)	(0.047)	(0.047)
African American X Classmate Share A.A.	-0.002	-0.043	-0.006	-0.001
	(0.045)	(0.054)	(0.042)	(0.042)
Student Controls	X	X	X	X
Fixed Effects				
Number of Courses Enrolled X Race	-	X	-	-
Subject-Term Set	-	-	X	-
Subject-Level-Term Set	-	-	-	X

Notes: This table displays results from the cumulative outcomes model. All specifications include course-by-race fixed effects and class fixed effects. Controls for students include gender, quadratic polynomial of age, and indicators for zip code. The coefficients on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels,

Table 6
Potential mechanisms.

	(1)	(2)	(3)
186,336 Observations			
Panel A: Peer Effects on Grades			
	Passed (Unconditional)	B or Better (Unconditional)	A or Better (Unconditional)
Hispanic X Classmate Share Hispanic	0.129**	0.074	-0.003
	(0.065)	(0.049)	(0.054)
African American X Classmate Share A.A.	0.226	-0.017	-0.140
	(0.157)	(0.123)	(0.155)
Fixed Effects			
Classroom	X	X	X
Student	X	X	X
Panel B: Adjustments by Instructor			
	Dropped	Dropped or Withdrew	Passed (Unconditional)
Controls			
Classmate Share Hispanic	0.020	-0.006	-0.027
	(0.023)	(0.026)	(0.029)
Classmate Share A.A.	-0.071*	-0.061	0.013
	(0.039)	(0.046)	(0.044)
Effects			
Hispanic X Classmate Share Hispanic	-0.147***	-0.136**	0.183***
	(0.047)	(0.055)	(0.062)
African American X Classmate Share A.A.	-0.270**	-0.380***	0.345***
	(0.135)	(0.131)	(0.123)
Fixed Effects			
Classroom	-	-	-
Student	X	X	X

Notes: This table examines two potential mechanisms. Panel A examines whether peers are affect performance outcomes. Panel B examines control coefficients to see whether instructors maybe systematically changing the delivery of instructor or assessments as the minority share changes. Included in the regressions are course-by-race fixed effects. The coefficient on the interaction of other minorities (Native American / Pacific Islanders) with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 7
Estimated effect of classmates and spillovers.

	Hispanic	African American
186,336 Observations		
Panel A: Dropped		
Classmate Share Hispanic	**-0.148*** **	-0.039
	(0.055)	(0.135)
Classmate Share African American	-0.005	**-0.296***
	(0.089)	**(0.174)**
Panel B: Passed (Unconditional)		
Classmate Share Hispanic	**0.131** **	-0.077
	(0.066)	(0.128)
Classmate Share African American	0.016	**0.257**
	(0.109)	**(0.158)**
Panel C: Takes Same Subject Next Term		
Classmate Share Hispanic	**0.108** **	-0.034
	(0.053)	(0.107)
Classmate Share African American	0.123	**0.115**
	(0.112)	**(0.135)**

Notes: The table displays coefficients from a regression fully interacting each minority group (columns) with corresponding classmate groups (rows). Interactions with other minorities and other minority classmates are included in the regression but are not reported. Each panel is composed of coefficients from a single corresponding regression. Similar to the preferred specification, the regressions in panel A and panel B include student, class, and course-by-race fixed effects. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 8
Including White student interactions.

	Dropped	Passed (Unconditional)	Takes Same Subject Next Term
	(1)	(3)	(4)
130,133 Observations			
Hispanic X Classmate Share Hispanic	-0.129**	0.125*	0.107**
	(0.053)	(0.065)	(0.053)
African American X Classmate Share A.A.	-0.275	0.223	0.083
	(0.171)	(0.157)	(0.126)
White X Classmate Share White	-0.049	0.039	-0.038
	(0.045)	(0.044)	(0.041)

Notes: This table displays results from the main outcome regressions using the preferred model with the addition of the interaction term between an indicator for a White student with shares of White classmates. Course-by-race, class, and student fixed effects are included in all regressions. The coe cient on the interaction of other minorities (Native-American / Pacific-Islanders) with similar classmates are not reported. Standard errors are in parentheses clustered at the course and term level. One, two, and three asterisks indicate statistical significance at 10, 5, and 1% levels, respectively.

Table 9
Heterogenous effects (by student characteristic)

	Dropped	Passed-Unconditional	Takes Same Subject Next Term
	(1)	(2)	(3)
186,336 Observations			
Panel A: By Gender			
Hispanic X Classmate Share Hispanic	-0.127**	0.134*	0.138**
	(0.055)	(0.071)	(0.057)
African American X Classmate Share A.A.	-0.226	0.083	-0.003
	(0.188)	(0.159)	(0.147)
Hispanic X Classmate Share Hispanic X Female	-0.011	-0.008	-0.065
	(0.038)	(0.057)	(0.046)
African American X Classmate Share A.A. X Female	-0.134	0.358**	0.205
	(0.155)	(0.148)	(0.147)
Panel B: By Median Income of Zip code			
Hispanic X Classmate Share Hispanic	-0.130*	0.089	0.023
	(0.075)	(0.074)	(0.068)
African American X Classmate Share A.A.	-0.164	0.222	-0.006
	(0.186)	(0.196)	(0.146)
Hispanic X Classmate Share Hispanic X Lower Income Zip	0.027	0.031	0.099
	(0.058)	(0.049)	(0.069)
African American X Classmate Share A.A. X Lower Income Zip	-0.144	-0.053	0.105
	(0.130)	(0.159)	(0.123)
Panel C: By Ability (Indicated by Ever Enrolling in a Remedial Course)			
Hispanic X Classmate Share Hispanic	-0.140**	0.129*	0.088
	(0.057)	(0.069)	(0.059)
African American X Classmate Share A.A.	-0.135	0.118	0.029
	(0.174)	(0.180)	(0.138)
Hispanic X Classmate Share Hispanic X Ever Takes Remedial	0.016	0.001	0.035
	(0.044)	(0.055)	(0.064)
African American X Classmate Share A.A. X Ever Takes Remedial	-0.316**	0.234	0.111
	(0.124)	(0.151)	(0.149)

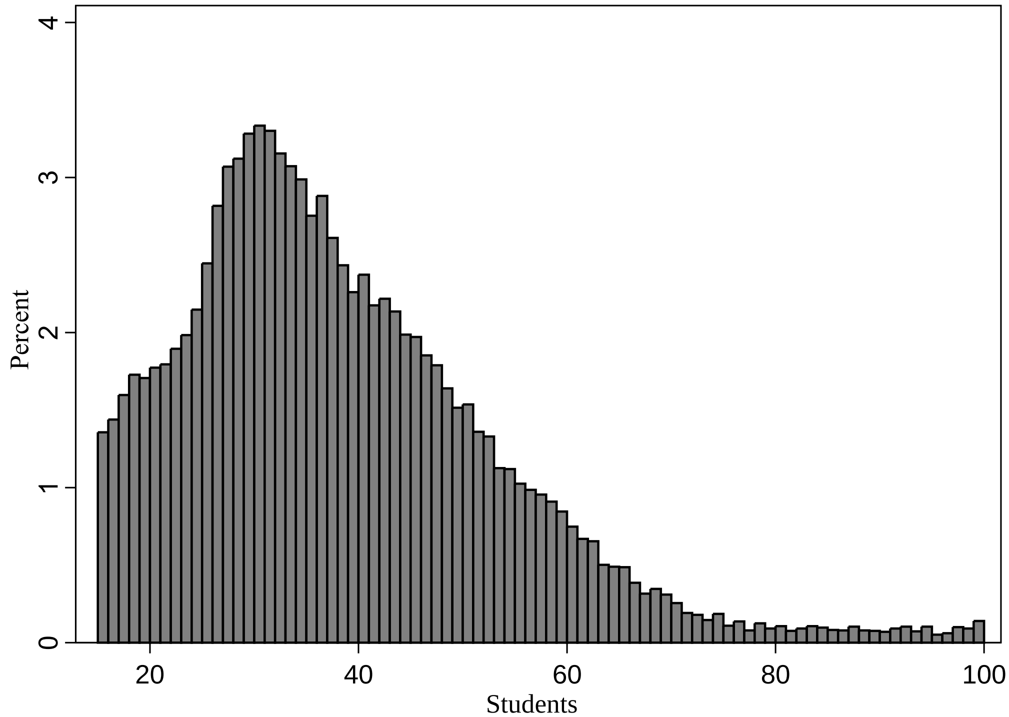
Notes: This table displays results from the main outcome regressions using the preferred model with the addition of interaction terms as specified by the panel to the three minority groups. Course-by-race, class, and student fixed effects are included in all regressions. The coefficient on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table 10
Heterogenous effects (by class type)

	Dropped	Passed-Unconditional	Takes Same Subject Next Term
	(1)	(2)	(3)
186,336 Observations			
Panel A: By UC/CSU Transferable Course			
Hispanic X Classmate Share Hispanic	-0.108*	-0.030	0.036
	(0.062)	(0.079)	(0.081)
African American X Classmate Share A.A.	-0.615**	0.382	-0.248
	(0.259)	(0.283)	(0.256)
Hispanic X Classmate Share Hispanic X Transferable	-0.046	0.287***	0.123
	(0.089)	(0.103)	(0.109)
African American X Classmate Share A.A. X Transferable	0.467	-0.220	0.453
	(0.311)	(0.307)	(0.307)
Panel B: By Level of Representation (Class is Below Course Median)			
Hispanic X Classmate Share Hispanic	-0.179***	0.176**	0.139**
	(0.060)	(0.078)	(0.055)
African American X Classmate Share A.A.	-0.277	0.213	0.043
	(0.181)	(0.165)	(0.125)
Hispanic X Classmate Share Hispanic X Low Rep	-0.136*	0.143	0.113
	(0.082)	(0.095)	(0.097)
African American X Classmate Share A.A. X Low Rep	-0.000	-0.059	-0.221
	(0.213)	(0.157)	(0.163)

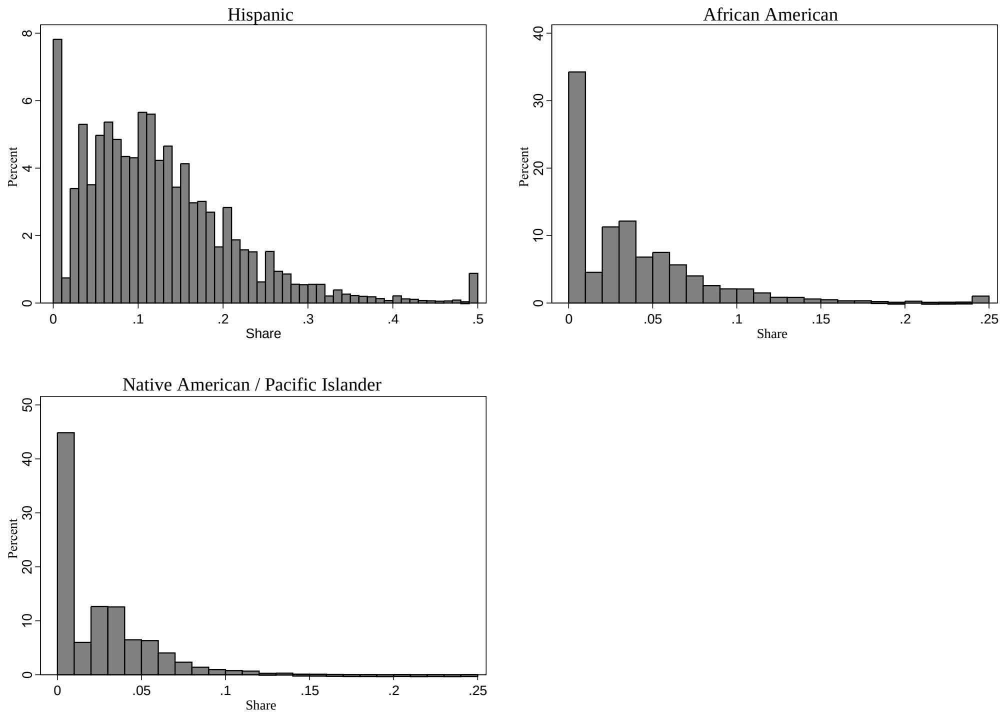
Notes: This table displays results from the main outcome regressions using the preferred model with the addition of interaction terms as specified by the panel to the three minority groups. In Panel B, "Low Rep" indicates that the class has representation below the observed median share within a course for the corresponding minority group. Course-by-race, class, and student fixed effects are included in all regressions. The coefficient on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Figure 1: Distribution of Class Enrollment



Notes: This is the full distribution of the analytic sample.

Figure 2: Distribution of Minority Shares in Class Enrollment



Notes: Hispanic shares are right censored at 0.5 while the other minority groups are right censored at 0.25.

Results Appendix

Table A1

Characteristics of students by non-unique and unique subject-level-term sets.

	Set shared by at least two students	Set is unique to a student	Difference
	(a)	(b)	(a)-(b)
White	0.27	0.29	-0.03
Asian	0.45	0.47	-0.02
Hispanic	0.19	0.15	0.04
African-American	0.06	0.05	0.01
Other Minority	0.03	0.03	-0.01
Female	0.51	0.49	0.03
Age	25.64	21.80	3.84
Zip code Income	80196.39	83236.81	-3040.42
Receives Financial Aid	0.15	0.26	-0.11
Observations	97,261	89,075	186,336

Notes: Subject-level-term sets fixed effects are included in the cumulative outcomes model. This model requires that each set is shared by at least two students. The subject-level-term-set account for 3,386 realized combinations of course subjects, levels (UC or CSU transferable, only CSU transferable, only associate's degree applicable, or non-degree applicable), and term which first-time students enrolled.

Table A2

Estimated effects of classmates on grades (conditional on remaining in the course).

	(1)	(2)	(3)	(4)	(5)
186,336 Observations					
Hispanic X Classmate Share Hispanic	0.249	-0.151	0.294*	0.105	0.134
	(0.167)	(0.153)	(0.163)	(0.200)	(0.197)
African American X Classmate Share A.A.	-0.658***	0.284	0.456	0.597	0.568
	(0.217)	(0.210)	(0.307)	(0.415)	(0.410)
Controls					
Student	X	X			
Classroom	X		X		
Fixed Effects					
Term	X				
Classroom		X		X	X
Student			X	X	X
Race X Instructor Race					X

Notes: This table displays results from the main outcome regressions. Grades are normalized to zero with a standard deviation of one. All specifications include course-by-race fixed effects. Controls for students include gender, quadratic polynomial of age, and indicators for zip code. Controls for classrooms include the classmate share for each minority race or ethnicity. The coefficients on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table A3

Estimated effects of classmates (Who are also first time students).

	Dropped (1)	Dropped or Withdrew (2)	Passed (Unconditional) (3)	Takes Same Subject Next Term (4)
186,336 Observations				
Hispanic X Classmate Share Hispanic (First Time)	-0.170**	-0.075	0.182*	0.144*
	(0.080)	(0.093)	(0.107)	(0.082)
African American X Classmate Share A.A. (First Time)	-0.317	-0.335	0.158	0.363*
	(0.208)	(0.228)	(0.242)	(0.195)

Notes: This table displays results from the main outcome regressions that correspond to equation 2. Each specification examines the share of classmates that are first time and minority in a single regression. The denominator used to calculate shares include all classmates. Course-by-race, class, and student fixed effects are included in all regressions. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table A4
Estimated effects of classmates (pooled).

	Dropped (1)	Dropped or Withdrew (2)	Passed (Unconditional) (3)	Takes Same Subject Next Term (4)
186,336 Observations				
Minority X Classmate Share Minority	-0.112**	-0.071	0.092*	0.075*
	(0.044)	(0.048)	(0.049)	(0.039)

Notes: This table displays results from the main outcome regressions that correspond to equation 1. Course-by-race, class, and student fixed effects are included in all regressions. The classmate share variable is constructed from the share of classmates who are minorities. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table A5

Estimated effect of classmates (Winsorized by .05).

	Dropped	Dropped or Withdrew	Passed (Unconditional)	Takes Same Subject Next Term
	(1)	(2)	(3)	(4)
186,336 Observations				
Hispanic X Classmate Share Hispanic (W .05)	-0.132**	-0.090	0.115*	0.104*
	(0.060)	(0.065)	(0.068)	(0.059)
African American X Classmate Share A.A. (W .05)	-0.402*	-0.622***	0.425*	0.069
	(0.240)	(0.241)	(0.221)	(0.180)

Notes: This table displays results from the main outcome regressions with the share of classmates ethnicity winsored at the 5% level. Course-by-race, class, and student fixed effects are included in all regressions. The coefficient on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table A6

Estimated effect of classmates (Including interactions with other demographic shares).

	Dropped	Dropped or Withdrew	Passed (Unconditional)	Takes Same Subject Next Term
	(1)	(2)	(3)	(4)
186,336 Observations				
Hispanic X Classmate Share Hispanic	-0.111**	-0.076	0.099	0.084
	(0.056)	(0.058)	(0.065)	(0.052)
African American X Classmate Share A.A.	-0.257	-0.345*	0.180	0.034
	(0.181)	(0.176)	(0.166)	(0.130)

Notes: This table displays results from the main outcome regressions using the preferred model with the addition of interaction terms on classmate share by an indicator for residence at a zip code with income below the median, and gender. The fixed effects include student, class, course by race, course by lower income zip code, and course by female. The coefficient on the interaction of other minorities (Native American / Pacific Islanders) with similar classmates are not reported. Standard errors are in parentheses clustered at the course and term level. One, two, and three asterisks indicate statistical significance at 10, 5, and 1% levels, respectively.

Table A7

Estimated effect of classmates (All students in remedial courses).

	Dropped	Dropped or Withdrew	Passed (Unconditional)	Takes Same Subject Next Term
	(1)	(2)	(3)	(4)
67,333 Observations				
Hispanic X Classmate Share Hispanic	-0.109	-0.098	0.134*	0.246***
	(0.072)	(0.074)	(0.077)	(0.058)
African American X Classmate Share A.A.	-0.329	-0.455*	0.191	-0.035
	(0.211)	(0.257)	(0.281)	(0.218)

Notes: This table displays results from the main outcome regressions that correspond to equation 2. Course-by-race, class, and student fixed effects are included in all regressions. The sample includes all students in remedial courses. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table A8

Estimated effect of classmates on next term outcomes (conditional on next term enrollment).

	(1)	(2)	(3)	(4)
114,023 Observations				
Probability of Dropping				
Hispanic X Classmate Share Hispanic	0.002	0.020	-0.012	-0.022
	(0.037)	(0.038)	(0.034)	(0.033)
African American X Classmate Share A.A.	0.015	-0.002	0.012	0.014
	(0.019)	(0.036)	(0.019)	(0.018)
Probability of Dropping or Withdrawing				
Hispanic X Classmate Share Hispanic	0.021	0.028	0.034	0.022
	(0.050)	(0.047)	(0.050)	(0.046)
African American X Classmate Share A.A.	0.015	0.053	0.003	0.004
	(0.039)	(0.051)	(0.038)	(0.037)
Probability of Passing				
Hispanic X Classmate Share Hispanic	0.025	-0.004	-0.005	-0.011
	(0.067)	(0.062)	(0.072)	(0.069)
African American X Classmate Share A.A.	-0.064*	-0.074	-0.044	-0.037
	(0.037)	(0.056)	(0.038)	(0.038)
Student Controls	X	X	X	X
Fixed Effects				
Number of Courses Enrolled X Race	-	X	-	-
Subject-Term Set	-	-	X	-
Subject-Level-Term Set	-	-	-	X

Notes: This table displays results from the cumulative outcomes model. All specifications include course-by-race and class fixed effects. Controls for students include gender, quadratic polynomial of age, and indicators for zip code. The coefficients on the interaction of other minorities with similar classmates are not reported. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.

Table A9
Estimated effect of classmates on next term outcomes (conditional on next term enrollment).

		Conditional on Taking a Same Subject Course		
	Takes Same Subject Course	Dropped	Dropped or Withdrew	Passed (Unconditional)
	(1)	(2)	(3)	(4)
114,023 Observations				
Hispanic X Classmate Share Hispanic	0.098	-0.096	-0.047	0.004
	(0.068)	(0.081)	(0.103)	(0.117)
African American X Classmate Share A.A.	0.081	0.097	-0.076	0.314
	(0.163)	(0.164)	(0.203)	(0.319)

Notes: This table displays results from the main outcome regressions that correspond to equation 2. Course-by-race, class, and student fixed effects are included in all regressions. Standard errors are in parentheses clustered at the course level. One, two, and three asterisks indicate statistical significance at the 10, 5, and 1% levels, respectively.