Understanding the developmental mathematics student population: Findings from a nationally representative sample of first-time college entrants

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I. Introduction

Many students enroll in developmental mathematics courses in college (Bailey, Jeong, and Cho, 2010; Chen, 2016; Hodara, 2015; Hodara & Cox, 2016). Traditionally, incoming students are referred to developmental mathematics based on their performance on a standardized assessment, and developmental mathematics programs consist of a sequence of Algebra-based courses (for example, arithmetic, pre-algebra, introductory algebra, intermediate algebra) that students must complete before they reach college mathematics. These courses are intended to strengthen students' skills so that they are prepared for college-level coursework. Yet, there is a large body of evidence documenting the limitations of traditional forms of developmental mathematics programs, particularly at community colleges.

While developmental education courses may improve the academic skills of those who complete them (Attewell et al., 2006; Bahr, 2010a), on average, few students finish their developmental education course requirements, and they have lower credit accumulation and college completion rates than their counterparts who started college in college-level coursework (Attewell et al., 2006; Bailey et al., 2010; Jaggars & Hodara, 2011; Roksa et al., 2009). Further, most existing quasi-experimental studies fail to find any positive impacts of traditional forms of developmental coursework on students' academic outcomes (Bettinger & Long, 2005, 2009; Calcagno & Long, 2008; Martorell & McFarlin, 2011; Melguizo et al., 2016; Scott-Clayton & Rodriguez, 2015; Valentine et al., 2017; Xu & Dadgar, 2018).

In addition, we know that, historically, a majority of community college students enroll in developmental mathematics, and there are racial inequities related to developmental mathematics enrollment and completion (Attewell et al., 2006; Bailey et al., 2010; Bahr, 2010a; Chen, 2016; Hodara, 2015; Hodara & Cox, 2016). American Indian/Alaska Native, Black/African American, and Hispanic/Latino students are more likely to enroll in developmental mathematics, particularly in the lowest levels, and less likely to complete developmental mathematics.

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To address these challenges and improve student outcomes, nationwide, developmental education has undergone widespread reform (Hodara, Xu, Petrokubi, 2018). Yet, little is known about the characteristics and outcomes of students served in developmental mathematics during this current era of reform. Further, most existing research has focused on the community college student population with little to no research on students at other institution types.

The primary goal of this paper is to understand the characteristics of the developmental mathematics student population nationwide across all institution types. This paper focuses on a nationally representative sample of students who entered college for the first time in 2011/12. (The next section describes the data source in detail.) In 2011/12, some states, such as North Carolina and Virginia, and many individual community colleges across the country were beginning to implement developmental education innovations in an effort to reduce developmental education rates, improve outcomes in developmental education classes, and support overall student success (Bishop et al., 2018; Edgecombe et al., 2013; Hodara et al., 2012; Kalamkarian, Raufman, & Edgecombe, 2015; Quint et al., 2013). Additionally, some states, such as California and Florida, had implemented early assessment programs in their high schools that have shown evidence of reducing developmental education rates (Mokher et al., 2018; Howell et al., 2010). In more recent years, though, states and systems have undertaken larger state or systemwide reforms to developmental education, particularly at community colleges (Ganga, Mazzariello, Edgecombe, 2018).

Thus, this paper provides a baseline picture of the developmental mathematics population during the early years of reform, and future research should identify changes over time in the population after implementation of wide-scale reform. This paper also compares the 2011/12 entrants to a nationally representative sample of 2003/04 entrants, most of whom likely experienced traditional forms of assessment and placement and developmental mathematics education. Finally, this paper proposes further data and research to better understand the current population served by new and traditional developmental mathematics models.

II. Data Sources and Limitations

This paper primarily relies on a descriptive analysis of restricted-use student-level data from the Beginning Postsecondary Students (BPS) Longitudinal Study, conducted by the National Center for Education Statistics at the U.S. Department of Education. BPS collects a rich amount of information on first-time college students' background and college experiences and outcomes and is the only national dataset that includes information about developmental education enrollment. Thus, it is valuable resource to understand what the developmental education student population looks like across the country.

This paper focuses on a nationally representative sample of first-time college students who began postsecondary education in 2011/12 and were followed for a total of three academic years through June 2014 (called BPS:12/14). BPS:12/14 sample members were initially identified in the

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2011/12 National Postsecondary Student Aid Study (NPSAS:12) that collects data about how students finance college. The final dataset contains information on 24,766 students.

The analysis reports on 2011/12 student characteristics that were selected through an in-depth review of BPS documentation, codebooks, and data. Some of the data were self-reported through a student interview while financial aid data are from financial aid or institutional administrative records and postsecondary outcomes are from National Student Clearinghouse data. The analysis focuses on students who started college at two-year and four-year colleges and controls for institution type (public, private non-profit, private for-profit). The analysis excludes students who began college at less-than-two-year institutions[1] (4% of students or 1,021 students in the 2011/12 cohort) and students who only took developmental English (4% of students or 1,048 students in the 2011/12 cohort), except in the case of Table A1, which presents developmental education enrollment rates by subject across all institution types.

This paper also compares the 2011/12 cohort to a nationally representative sample of first-time college students who began postsecondary education in 2003/04 and were followed for a total of six academic years through June 2009 (called BPS:04/09). BPS:04/09 sample members were initially identified in NPSAS:04. The final dataset contains information on 16,684 students.

Table 1 presents the number and percent of students by their first institution type in both datasets.

Table 1. Percent and number of 2011/12 and 2003/04 first-time college students in the Beginning Postsecondary Study (BPS) sample, by first institution type

	2011/12 entrants		2003/04 entrants	
First institution	No.	%	No.	%
Public 4-year	4,293	17.3	4,643	27.8
Private nonprofit 4-year	4,133	16.7	3,684	22.1
Private for-profit 4-year	5,821	23.5	370	2.2
Public 2-year	7,299	29.5	5,549	33.3
Private nonprofit 2-year	227	0.9	363	2.2
Private for profit 2-year	1,972	8	521	3.1
Public less-than-2-year	121	0.5	425	2.5
Private nonprofit less-than-2-year	51	0.2	72	0.4
Private for profit less-than-2-year	849	3.4	1,057	6.3
Total	24,766	100	16,684	100

Source: Author's analysis of BPS:12/14 and BPS:04/09.

Developmental education data in BPS. There are two sources of information about developmental education enrollment in BPS:04/09 and one source of data on developmental

[1] Less-than-2-year institutions are occupational or vocational schools that only offer certificates. Many are in the for-profit sector.

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education enrollment in BPS:12/14. In both studies, students were asked about their enrollment in developmental education after their first year in college. Students in the BPS:12/14 study were asked the following question: *"In the 2011-2012 school year, how many times did you take remedial or developmental courses in each of the following subjects: English, mathematics, reading, writing. (Remedial or developmental courses are used to strengthen your skills before you take your first college-level course in mathematics, reading, or other subjects. Students are usually assigned to these courses on the basis of a placement test taken before the school year begins. Often, these courses do not count for credit toward graduation.) 0 = Never; 1 = One time; 2 = Two times; 3 = Three or more times."* Students in BPS:04/09 study were asked a similar question in 2004.

BPS:04/09 also has a second source of data about developmental education enrollment. In 2009, for the first and only time in the history of BPS, the study collected transcript data from every institution that BPS students attended between July 2003 and June 2009. Thus, the transcripts provided data on students' developmental education coursetaking over the entire six-year period. Chen (2016) analyzed BPS:04/09 to examine the characteristics and outcomes of students who entered public two-year and public four-year institutions in 2003/04 and took developmental education.

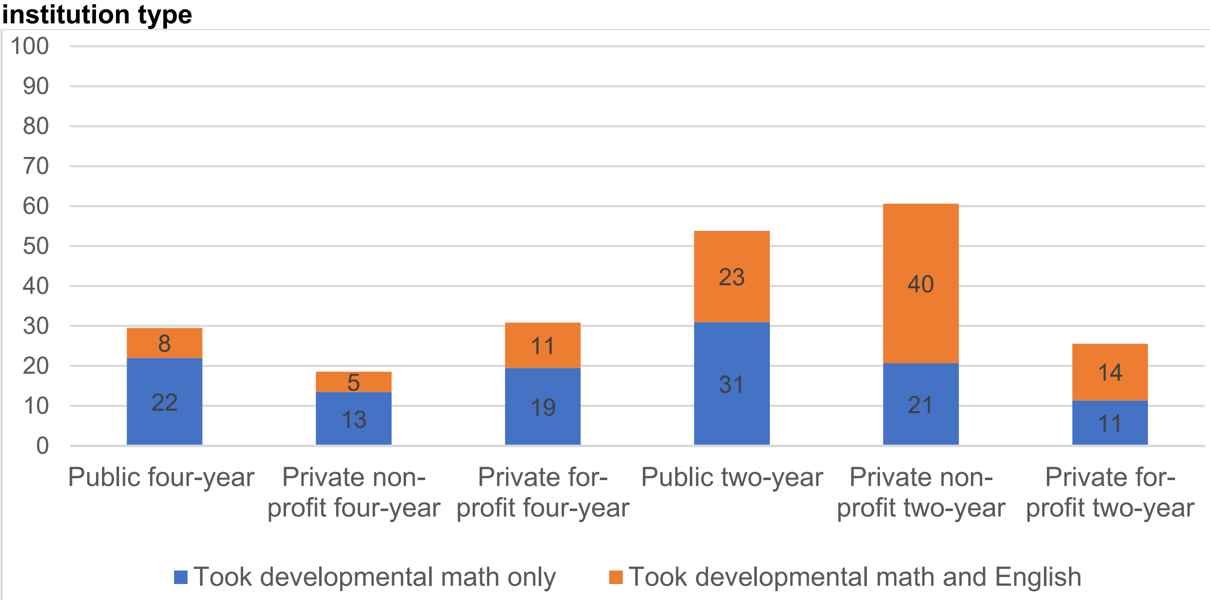
This paper focuses on the 2011/12 entrants who reported taking developmental math in their first year and compares this population to 2003/04 entrants who reported taking developmental math in their first year. (Where appropriate, the paper also presents findings on the 03/04 developmental math population based on course transcript data.) Self-reported data on developmental education in the first year of college has several limitations. We do not know the extent to which students who took developmental education in their first year failed to report taking these courses in the BPS interview. Further, we do not know if certain groups of students were less likely to accurately report whether they took developmental education in their first year in college. Finally, some students delayed enrollment in developmental education until after their first year in college. In the follow-up survey in June 2014, BPS:12/14 asked students about remedial coursetaking in general, but not by subject. Thus, we are unable to use data gathered from this question to understand the developmental mathematics student population, specifically. Overall, we may not have a complete picture of the full population of developmental mathematics students in the 2011/12 cohort. Nevertheless, there is still much to learn from this BPS dataset about the developmental mathematics student population, despite these limitations.

III. Prevalence of developmental mathematics enrollment over time

We know from national, state, and institutional data that, traditionally, large proportions of college students enroll in developmental mathematics (Bailey, Jeong, and Cho, 2010; Chen, 2016; Hodara, 2015; Hodara & Cox, 2016). This may be due to inadequate secondary preparation for college-level mathematics, a misalignment between high school graduation and college entrance requirements, gaps in education between students' last mathematics course and college entry, and assessment and placement processes that erroneously place students into developmental mathematics who could have succeeded in college mathematics (Hodara, 2013; Hodara & Cox, 2016; Melguizo et al., 2016; Melguizo & Ngo, under review).

Among 2003/04 entrants, 42 percent of students took developmental mathematics (N=5,574). Developmental mathematics enrollment rates ranged from 18 to 61 percent of students depending on the first institution type entered with the largest participation rates at public two-year colleges (54% of students) and private non-profit two-year colleges (61% of students) (see Figure 1).

Figure 1. Percentage of 2003/04 entrants who enrolled in developmental math in college, by first institution type

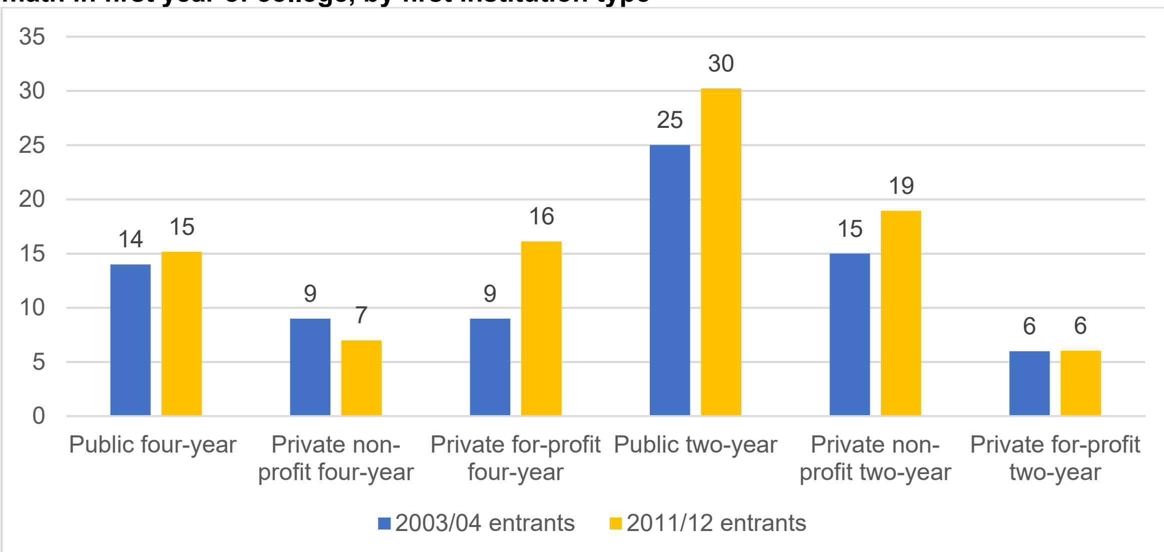


Note: Developmental education enrollment is based on a review of students' transcripts from 2003-2009. Sample sizes by institution type are as follows: Public four-year = 4,643; Private non-profit four-year = 3,684; Private for-profit four-year = 370; Public two-year = 5,549; Private non-profit two-year = 363; Private for-profit two-year = 521.
Source: Author's analysis of BPS:04/09.

Further, we observe few differences in self-reported developmental math enrollment in the first year of college between the 2003/04 and 2011/12 cohorts. Sixteen percent of students in 2003/04 cohort (N=2,605) and 17 percent of students in the 2011/12 cohort (N=4,290) reported they took developmental mathematics in their first year. Overall, the percent of students who took developmental mathematics in their first year ranged from 6 to 25 percent among the 2003/04 cohort and 6 to 30 percent among the 2011/12 cohort, depending on first institution type, with the highest proportions of developmental math students at public two-year colleges (see Figure 2). (A side-by-side comparison of 2003/04 and 2011/12 cohort developmental education enrollment for each subject and by institution level is shown in Table A1 of Appendix A.)

Developmental math enrollment rates significantly increased at private for-profit four-year colleges and public two-year colleges. During the period from 2003/04 to 2011/12, the for-profit sector grew at an extremely high rate[2], and we also observe developmental math enrollment rates almost doubled from 9 to 16 percent at for-profit four-year colleges, a statistically significant difference. Developmental math enrollment rates increased from 25 to 30 percent at public two-year colleges, which is also statistically different. Developmental math enrollment also increased at private non-profit two-year colleges, but the change is not statistically different (due to the small sample of students at this institution type).

Figure 2. Percentage of 2003/04 and 2011/12 entrants who reported enrolling in developmental math in first year of college, by first institution type



Note: Developmental education course enrollment was self-reported during an interview after the first year of college. For 2003/04 entrants, sample sizes by institution type are as follows: Public four-year = 4,643; Private non-profit four-year = 3,684; Private for-profit four-year = 370; Public two-year = 5,549; Private non-profit two-year = 363; Private for-profit two-year = 521. For 2011/12 entrants, sample sizes by institution type are as follows: Public four-year = 4,293 students; Private non-profit four-year = 4,133; Private for-profit four-year = 5,821; Public two-year = 7,299; Private non-profit two-year = 227; Private for-profit two-year = 1,972.
Source: Author's analysis of BPS:04/09 and BPS:12/14.

Over the years, states and institutions, particularly community colleges, have reported drops in developmental education rates, perhaps in part due to changes to the assessment and placement process and practices, better alignment between high school and college standards, and/or new course structures that allow students to enroll in developmental mathematics concurrently with college mathematics (i.e., the corequisite model). Examples of statewide decreases in developmental mathematics enrollment are the following. (This list is not exhaustive of all statewide reform efforts and documentation of decreases in developmental mathematics enrollment.):

- Virginia implemented a new diagnostic placement test in fall 2011 and modularized mathematics courses spring 2012 (Kalamkarian et al., 2015). Eighty-one percent of students enrolling in a Virginia community college for the first time in fall 2010 placed

[2] https://www.propublica.org/article/the-for-profit-higher-education-industry-by-the-numbers

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into developmental mathematics, compared with 57 percent of students in fall 2012, after the new placement policies were implemented (Rodríguez, 2014).

- North Carolina implemented a multiple measures policy that exempted students from developmental education based on high school grade point average in February 2013, a new diagnostic placement test April 2013, and full implementation of modularized mathematics course in fall 2013 (Kalamkarian et al., 2015). (Research has not yet documented decreases in developmental education enrollment rates in North Carolina.)
- Florida enacted legislation (SB 1720) in 2013 making placement tests optional and establishing criteria that exempts students from developmental education. Between 2013 and 2014, developmental mathematics enrollment in the Florida College System dropped 19 percentage points from 39 to 20 percent (Hu et al., 2016).
- The Tennessee SAILS program, scaled up to the majority of public high schools in the state in 2013, provides students who scored below a college-ready cutoff on ACT a developmental mathematics course during their senior year so that students can avoid remediation in college (Kane et al., 2018). SAILS participants were 29 percentage points more likely to enroll in college mathematics. (However, the effect of SAILS on community college developmental education rates became negligible with the statewide implementation of the corequisite model.)
- In California, community colleges increasingly use high school records in the placement process, and the share of students directly entering transfer-level English and mathematics has increased although this increase has been much greater in English than in mathematics. From 2009/10 to 2016/17, the share of students entering transfer level mathematics increased from 23 to 28 percent (see Figure 1 in Rodriguez, Mejia, & Johnson, 2018). The increase in direct enrollment in transfer-level English and math may increase even more with the passage of 2017 legislation (AB 705) requiring that high school records be used as the primary criteria

Overall, there is need for a more systematic documentation of developmental math enrollment rates over time to have a clear understanding of the extent to which enrollment rates have declined with the implementation of reform.

IV. Characteristics of 2011/12 developmental mathematics student population

In the narrative below, the 2011/12 entrants are described by characteristic, following the order of characteristics presented in Table A2. Students who reported they took developmental mathematics in their first year of college are compared to students who reported that they did not take any developmental education in their first year of college. The narrative focuses on students who began college at all four-year college types and public two-year colleges because the sample size in BPS:12/14 of the developmental mathematics population at private non-profit and for-profit two-year colleges is small (43 and 119, respectively). Table A2 presents all characteristics for the 2011/12 entrants who reported taking developmental mathematics and did not report taking any developmental education in their first year of college by first institution type.

Following a description of the 2011/12 entrants by characteristic are key takeaways for a set of variables. Following the key takeaways, changes in the developmental mathematics population from the 2003/04 cohort to 2011/12 cohort are highlighted. Table A3 presents all characteristics for the 2003/04 entrants who reported taking developmental mathematics and did not report taking any developmental education in their first year of college by first institution type. Table A4 presents all characteristics for the 2003/04 entrants who took developmental mathematics and did not take any developmental education based on course transcript data from 2003-2009.

Demographic information

Gender. Across all institution types, the 2011/12 college population was more female than male, and this is also true of the developmental math population at public four-year, private for-profit four-year, and public two-year colleges. Differences are largest at public institutions: 61 percent of the developmental math population at public four-year colleges and 58 percent of the developmental math population at public two-year colleges were female while 55 percent of the students who did not take developmental education in their first year at public four-year colleges and 52 percent of the students who did not take developmental education in their first year at public two-year colleges were female.

Race/ethnicity. Across all institution types, the 2011/12 developmental math population was more diverse than the population of students who did not take developmental education in their first year of college. The proportion of students of color in the developmental math population ranges from 60 percent at private for-profit four-year colleges, 56 percent at public four-year colleges, 51 percent at public two-year colleges, and 44 percent at private non-profit four-year colleges. In contrast, the proportion of students of color in the population of students who did not take developmental education ranges from 53 percent at private for-profit four-year colleges, 43 percent at public two-year colleges, and 34 percent at public and private non-profit four-year colleges. Section 5 examines the overrepresentation of students of color in developmental mathematics.

First language. At public four-year and private for-profit four-year colleges, a higher proportion of developmental math students learned to first speak an equal mix of English and another language or learned to first speak another language than students who did not take developmental education. At private non-profit four-year and public two-year colleges, a similar proportion of developmental math students and students who did not take developmental education learned to speak an equal mix of English and another language or another language (15 and 19 percent, respectively).

Immigrant status. Paralleling patterns in the student population related to the first language students learned to speak, at public four-year and private for-profit four-year colleges, a higher

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proportion of developmental math students had an immigrant status or were U.S. citizens with foreign-born parents than students who did not take developmental education. At private non-profit four-year and public two-year colleges, a similar proportion of developmental math students and students who did not take developmental education were first- and second-generation U.S. born citizens (94 and 91 percent, respectively).

Highest level of education of either parent. At public and private non-profit four-year colleges, a much higher proportion of developmental math students were the first in their families to go to college. For example, about one-third of developmental math students at these institution types had parents with a high school diploma or less, whereas only 20 and 16 percent of students who did not take developmental education had parents with a high school diploma or less at public and private non-profit four-year colleges (respectively). There were smaller differences in these two population at public two-year colleges, and more students were the first in their families to go to college overall: For example, 47 percent of developmental math students had parents with a high school diploma or less, whereas 43 percent of students who did not take developmental education had parents with a high school diploma or less. At private for-profit four-year colleges, the trend is reverse although again many more students were the first in their families to go to college: 52 percent of developmental math students had parents with a high school diploma or less, whereas 55 percent of students who did not take developmental education had parents with a high school diploma or less.

Locale of student's home. Across all institution types, a higher proportion of the developmental math population was from urban areas than the population of students who did not take developmental education.

Key takeaways from demographic information. Overall, patterns of findings demonstrate that developmental mathematics students are much more likely to come from historically underrepresented or underserved groups. This is especially true at public four-year colleges where the developmental math population and students who did not take developmental education have larger differences in characteristics across all demographic characteristics compared to these student populations at other institution types.

Changes over time in the developmental mathematics student population. The same patterns in demographic characteristics are present among students who entered in 2003/04 (table A3). Developmental math students were more likely to be female, students of color, and have parents whose highest level of education was a high school diploma or less. However, differences between the developmental math population and students who did not take developmental education are smaller in 2003/04 compared to 2011/12, and there are few differences in first language and immigrant status. Smaller differences between the two populations in 2003/04 compared to 2011/12 may be due in part to a less diverse college student population in 2003/04 compared to 2011/12. For example, in the 2003/04 cohort, 36 percent of students were students of color: 40 percent of students in the developmental math population were students of color, and 35 percent of students who did not take developmental education were students of color. In the 2011/12 cohort, 47 percent of students were students of color: 54 percent of students in the developmental math population were students of color, and 44 percent of students who did not take developmental education were students of color.

Box 1. A spotlight on developmental math enrollment by college locale

Higher education research typically does not examine student outcomes by college locale, yet we know from K12 literature that outcomes for rural high school students, particularly those related to postsecondary transitions, tend to be less positive than outcomes for students from nonrural high schools (Byun et al., 2012; Byun, Irvin, & Meece, 2015; Player, 2015). This analysis finds that **developmental mathematics course-taking is slightly higher at colleges located in rural areas.** Among the 2011/12 cohort, developmental education enrollment rates were slightly higher at two-year and four-year colleges located in rural areas compared to colleges in urban and suburban areas and towns.[1] These higher rates were driven by a higher proportion of students attending rural colleges taking developmental mathematics since the proportion of students who took developmental English only was lower (at four-year colleges) or the same (at two-year colleges) across locales. At rural two-year colleges, 29 percent of students took developmental mathematics compared to 24 percent of students at colleges in urban and suburban areas and towns. At rural four-year colleges, 17 percent of students took developmental mathematics compared to 13 percent of students at colleges in urban areas and 12 percent of students at colleges in suburban areas and towns.

High school academic performance

Highest mathematics course completed in high school. Across all institution types, a lower proportion of developmental mathematics students completed Trigonometry or higher compared to students who did not take developmental education, while a higher proportion completed less than Algebra 2 or Algebra 2.

Took college credit in high school. Across nearly all institution types, a lower proportion of developmental mathematics students took college credit in high school compared to students who did not take developmental education. At private for-profit four-year colleges, a similar proportion of developmental mathematics students and students who did not take developmental education took college credit in high school (29 percent).

High school grade point average (GPA). Across all institution types, a lower proportion of developmental mathematics students earned a 3.5-4.0 GPA compared to students who did not take developmental education. At pubic four-year and two-year colleges, a slightly lower proportion of developmental mathematics students earned a 3.0-3.4 GPA compared to students who did not take developmental education; however, the same proportion of developmental mathematics students and students who did not take developmental education in their first year earned a 3.0-3.4 GPA at private non-profit and for-profit four-year colleges.

High school completion type. Most students in the BPS data completed high school. The primary difference in high school completion across the populations under study is that at public four-year colleges and private non-profit four-year colleges, a higher proportion of developmental mathematics students had a GED (4-5 percent) compared to students who did not take developmental education (1 percent). This trend is reverse at private for-profit colleges where a lower proportion of developmental mathematics students had a GED (14 percent) compared to students who did not take developmental education (17 percent). At public two-year colleges, a similar proportion of developmental mathematics students had a GED (12 percent) compared to students who did not take developmental education (11 percent).

Key takeaways from high school academic performance. Overall, patterns of findings demonstrate that developmental mathematics students entered college with somewhat lower high school academic preparation than their peers who did not take developmental education in their first year in college. However, it is perhaps surprising that developmental mathematics students overall seem to have a fairly high level of high school preparation: For example, over half of developmental mathematics students at public and private non-profit four-year colleges, 29 percent of developmental mathematics students at public two-year colleges, and 24 percent of developmental mathematics students at private for-profit four-year colleges completed Trigonometry or higher in high school. Similarly, over half of developmental mathematics students at public and private non-profit four-year colleges, 33 percent of developmental mathematics students at public two-year colleges, and 29 percent of developmental mathematics students at private for-profit four-year colleges took college credit in high school. Finally, differences in GPA are mainly among students earning the highest GPAs (A- to A).

Changes over time in the developmental mathematics student population. We see the same patterns among students who entered college in 2003/04 (table A3). Developmental math students entered college with somewhat lower high school academic preparation than their peers who did not take developmental education. However, overall, the 2011/12 college population and developmental math population is much more prepared than the 2003/04 college population and developmental math population. The 2011/12 entrants were more likely to have completed Trigonometry or higher, much more likely to have taken college credit courses in high school, and they had higher GPAs than 2003/04 entrants.

Income information (and information used to determine financial aid)

Dependent/Independent status. At public and private non-profit four-year colleges, most students were dependent students, but more developmental mathematics students were independent (12 percent and 20 percent, respectively) than students who did not take developmental education (5 percent). There is a reverse trend at private for-profit four-year colleges where the population is split more evenly between dependent and independent students, and developmental mathematics students were more likely to be dependent (57 percent) compared to students who did not take developmental education (49 percent). There is no difference in the proportion of dependent and independent students in these two populations at public two-year colleges where about 70 percent of students were dependent.

Had Dependents. We see a similar pattern related to if students had children in their first year in college. At public and private non-profit four-year colleges, most students did not have children, but more developmental mathematics students had children (6 percent and 12 percent, respectively) than students who did not take developmental education (2 percent). There is a reverse trend at private for-profit four-year colleges where developmental mathematics students were less likely to have children (27 percent) compared to students who did not take developmental education (31 percent). There is no difference in the proportion of students in these two populations who had children at public two-year colleges where about 16 percent of students had children.

Income group. Across all institution types, a higher proportion of developmental mathematics students came from lower income backgrounds compared to students who did not take developmental education in their first year in college. Differences are largest at public and private non-profit four-year colleges where about 30 percent of developmental mathematics students were low-income and 18-15 percent of students who did not take developmental education were low-income. At public two-year colleges, 35 percent of developmental mathematics students and 30 percent of students who did not take developmental education were low-income. Differences at private for-profit four-year colleges are smaller: 33 percent of developmental mathematics students and 34 percent of students who did not take developmental education were low-income, while 30 percent of developmental mathematics students and 26 percent of students who did not take developmental education were low middle-income.

Received federal benefits[3]*.* Across all institution types, except private for-profit four-year colleges, a higher proportion of developmental mathematics students received federal benefits compared to students who did not take developmental education in their first year in college. Again, differences are largest at public and private non-profit four-year colleges where 28-32 percent of developmental mathematics students received federal benefits compared to about 14 percent of students who did not take developmental education. At public two-year colleges, 35 percent of developmental mathematics students and 28 percent of students who did not take developmental education received federal benefits. Differences at private for-profit four-year colleges are minimal: 41 percent of developmental mathematics students and 40 percent of students who did not take developmental education received federal benefits.

[3] Federal benefits include Food Stamps (SNAP) Benefits, Free/Reduced Price School Lunch Benefits, Supplemental Security Income (SSI) Benefits, Temporary Assistance for Needy Families (TANF) Benefits, and the Special Supplemental Nutrition program for Women, Infants, and Children (WIC) Benefits.

Received Pell. Across all institution types, a higher proportion of developmental mathematics students received Pell, federal aid for low-income students, compared to students who did not take developmental education in their first year in college. Again, differences are largest at public and private non-profit four-year colleges where about two-thirds of developmental mathematics students received Pell compared to about 14 percent of students who did not take developmental education. At public two-year colleges, 70 percent of developmental mathematics students and 61 percent of students who did not take developmental education received Pell. Again, differences at private for-profit four-year colleges are smaller: 84 percent of developmental mathematics students and 81 percent of students who did not take developmental education received Pell.

Worked while enrolled. At public and private non-profit four-year colleges, a slightly higher proportion of developmental mathematics students worked while enrolled in college in their first year compared to students who did not take developmental education. At private for-profit four-year colleges and public two-year colleges, a slightly lower proportion of developmental mathematics students worked while enrolled in college compared to students who did not take developmental education.

Key takeaways from income information. Overall, patterns of findings demonstrate that developmental mathematics students came from lower income background than their peers who did not take developmental education. This is especially true at public and private non-profit four-year colleges, where differences between the two populations across measures of income are larger than at other institutions. It is important to take note of the large proportion of developmental mathematics students who receive Pell across all institution types, suggesting this population entered college with larger financial challenges than their peers who did not take developmental education in their first year in college.

Changes over time in the developmental mathematics student population. We see the same patterns among students who entered in 2003/04 (table A3). Developmental mathematics students came from lower income backgrounds than their peers who did not take developmental education. However, these differences have grown over time, and a larger proportion of the overall college population and developmental mathematics population came from lower income backgrounds in the 2011/12 cohort than in the 2003/2004 cohort. For example, in the 2003/04 cohort, 47 percent of students received Pell: 53 percent of students in the developmental math population received Pell, and 46 percent of students who did not take developmental education received Pell. In the 2011/12 cohort, 64 percent of students received Pell: 72 percent of students in the developmental math population received Pell, and 61 percent of students who did not take developmental education received Pell.

Attitudes/mental health

Sense of belonging. Overall, the majority of college students reported a sense of belonging to their first institution. But, across all four-year college types, developmental mathematics students were less likely to report that they somewhat or strongly agreed that "I am a part of my first institution" compared to students who did not take developmental education in their first year in college. The opposite was true at public two-year colleges where developmental mathematics students were more likely to report that they somewhat or strongly agreed that "I am a part of my first institution" compared to students who did not take developmental education.

Confidence. Overall, the majority of college students reported confidence in their ability to succeed. But, at public and private non-profit four-year colleges, developmental mathematics students were less likely to report that they somewhat or strongly agreed that "I am confident that I have the ability to succeed" compared to students who did not take developmental education in their first year in college. These two populations reported similar levels of confidence at private for-profit four-year colleges and public two-year colleges.

Change in mental health rating 2011/12-2013/14. Across all institution types, a slightly larger proportion of developmental mathematics students reported declines in mental health over a three-year period compared to students who did not take developmental education in their first year in college. Across the four college types, between 23-26 percent of developmental mathematics students reported declines in mental health while between 19-24 percent of students who did not take developmental math reported declines in mental health.

Key takeaways from attitudes/mental health. Overall, patterns of findings demonstrate that developmental mathematics students reported slightly lower sense of belonging, confidence, and mental health ratings compared to their peers who did not take developmental education in the first year of college.

Changes over time in the developmental mathematics student population. These variables are not available in BPS:04/09.

College enrollment information

Full-time/Part-time status. At public and private non-profit four-year colleges, most students were full-time in their first term although a lower proportion of developmental mathematics students were full-time compared to their peers who did not take developmental education. At private for-profit and public two-year colleges, a higher proportion of developmental mathematics students were full-time compared to their peers who did not take developmental education.

Major. At all four-year colleges, a lower proportion of developmental mathematics students declared a major in science, engineering, and mathematics compared to their peers who did not take developmental education. At public two-year colleges, a slightly higher proportion of developmental mathematics students declared a major in science, engineering, and mathematics and health and medicine compared to their peers who did not take developmental education.

Key takeaways from college enrollment information. College enrollment information varies by first institution type.

Changes over time in the developmental mathematics student population. There are slight differences across cohorts among public two-year college students. In 2003/04, at public two-year colleges, a lower proportion of developmental mathematics students were full-time in the first term and declared a STEM major compared to their peers who did not take developmental education. These trends reverse in 2011/12.

College outcomes

Selected STEM major in first year and still in STEM major. Across all institution types, developmental mathematics students who declared a STEM major in their first year were less likely to still be in the STEM major three years later compared to their counterparts who did not take developmental mathematics in their first year in college.

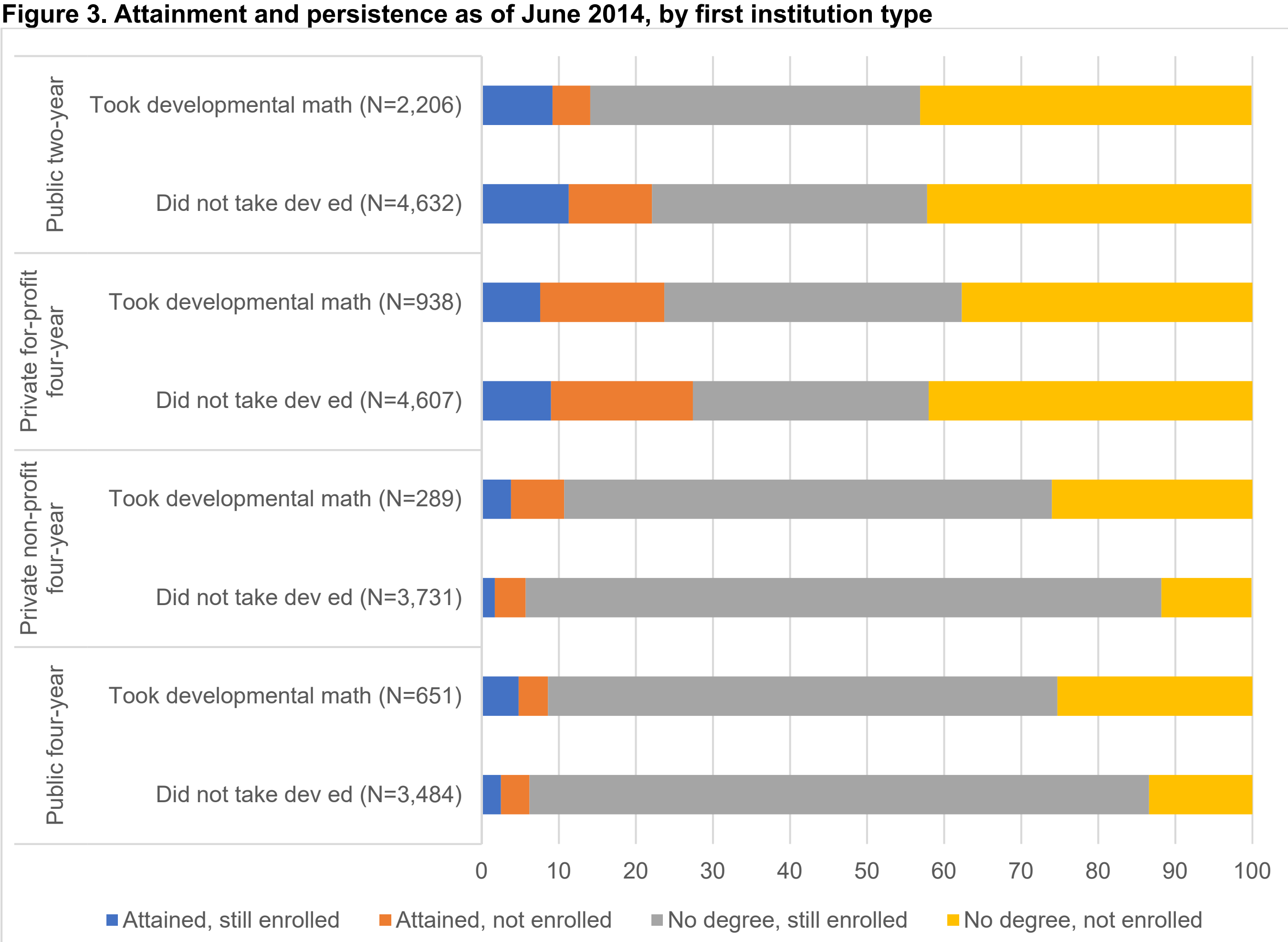
Number of institutions attended. There are no differences in the number of institutions attended across the two populations of interest who began college at a public four-year college or private for-profit four-year college. Among students who started at private non-profit four-year colleges, a higher proportion of developmental mathematics students attended more than one institution compared to their counterparts who did not take developmental mathematics in their first year in college (37 percent compared to 28 percent). Among students who started at public two-year colleges, a lower proportion of developmental mathematics students attended more than one institution compared to their counterparts who did not take developmental mathematics in their first year in college (23 percent compared to 26 percent). This could be due to lower rates of four-year college transfer among developmental mathematics students (rather than less swirl among institutions): 11 percent of developmental mathematics students transferred to a four-year college compared to 13 percent of students who did not take developmental mathematics in their first year in college.

Stopouts[4]. A slightly higher proportion of students who started at public and private non-profit four-year colleges and took developmental mathematics had more stopouts than their peers who did not take developmental mathematics. Differences in stopouts among these two populations of students who started at private for-profit four-year colleges and public two-year colleges are minimal.

[4] A stopout is defined as a break in enrollment of five or more consecutive months.

Attainment and persistence. As of June 2014, a much lower proportion of students who began college at a public four-year or private non-profit four-year and took developmental mathematics were still enrolled or had earned a degree compared to students who did not take any developmental education in their first year. In contrast, at private for-profit four-year colleges and public two-year colleges, a higher or comparable (respectively) proportion of developmental mathematics students were still enrolled in college compared to students who did not take developmental education. But at both institution types, degree attainment rates for developmental mathematics student were lower compared to students who took no developmental education.

Figure 3. Attainment and persistence as of June 2014, by first institution type



Note: Attainment and persistence rates for private non-profit and for-profit two-year colleges are not displayed in the figure but can be found in table A2. Developmental education course enrollment was self-reported during an interview

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in 2012. Sample sizes by institution type are as follows: Public four-year = 4,293 students; Private non-profit four-year = 4,133; Private for-profit four-year = 5,821; Public two-year = 7,299.
Source: Author's analysis of BPS:12/14.

Key takeaways from college outcomes as of June 2014. Overall, early outcomes of developmental mathematics students are slightly lower compared to students who did not take developmental education in their first year in college. However, since the data only follow these students for three years, we do not know to what extent their degree outcomes may catch up to students who did not take developmental education in their first year in college. Further, across all institution types, future degree expectations are relatively high among developmental math students: The majority expect to earn a bachelor's degree or higher.

Changes over time in the developmental mathematics student population. Data on the 2003/04 entrants tell a similar story in that six-year completion rates are lower among developmental mathematics students compared to their peers who did not take developmental education in their first year in college. BPS data parallel a wide array of literature on developmental education students that finds that students who begin college in developmental education complete college at lower rates than their peers (e.g., Attewell et al., 2006). In the 2003/04 cohort, there are particularly large differences in outcomes between developmental mathematics students and students who did not take developmental education at public and private non-profit four-year colleges.

V. Developmental mathematics enrollment and equity considerations

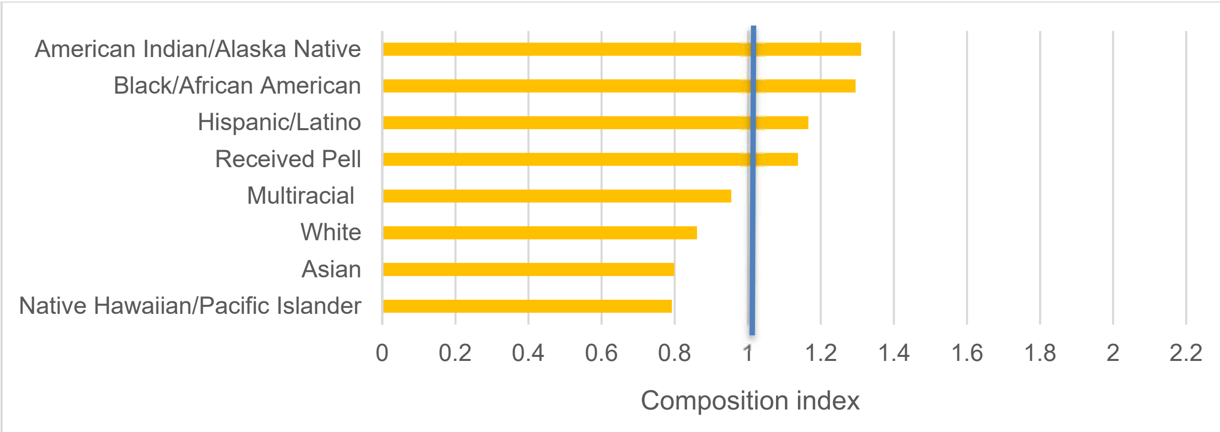
Some of the key differences between the populations of developmental mathematics students and students who did not take developmental education are found across race/ethnicity and income. In this section, disproportionality in developmental education participation by race/ethnicity and income (measured by receiving the federal Pell grant) for all students in the 2011/12 cohort and students who first attended a public four-year or two-year college are examined in more depth.

There are many different measures of disproportionality, and for this paper, a composition index is used to illustrate disproportionality in developmental mathematics enrollment. Similar methods have been used in the literature to understand disproportionality in special education (e.g., Gibb & Skiba, 2008) and discipline (Nishioka, Shigeoka, & Lolich, 2017) referrals in K12 schools, as well as participation in dual credit (Pierson & Hodara, 2018). A composition index is the proportion of the student group in the developmental mathematics population divided by the proportion of the student group in the student population. Ratios above 1 indicate the student group is overrepresented in the developmental mathematics population (compared to their representation in the overall population). For example, 16 percent of students in the total population of the 2011/12 cohort and 21 percent of students in the developmental mathematics population were Black/African American, indicating a ratio of 1.3 (21/16) and an overrepresentation of Black/African American students in the developmental mathematics population. Composition indexes can also capture disproportionality among smaller populations. For example, 1.0 percent of students in the 2011/12 cohort and 1.35 percent of students in the developmental mathematics population were American Indian/Alaska Native, also indicating a ratio of 1.3 (1.35/1) and an overrepresentation of American Indian/Alaska Native students in the developmental mathematics population.

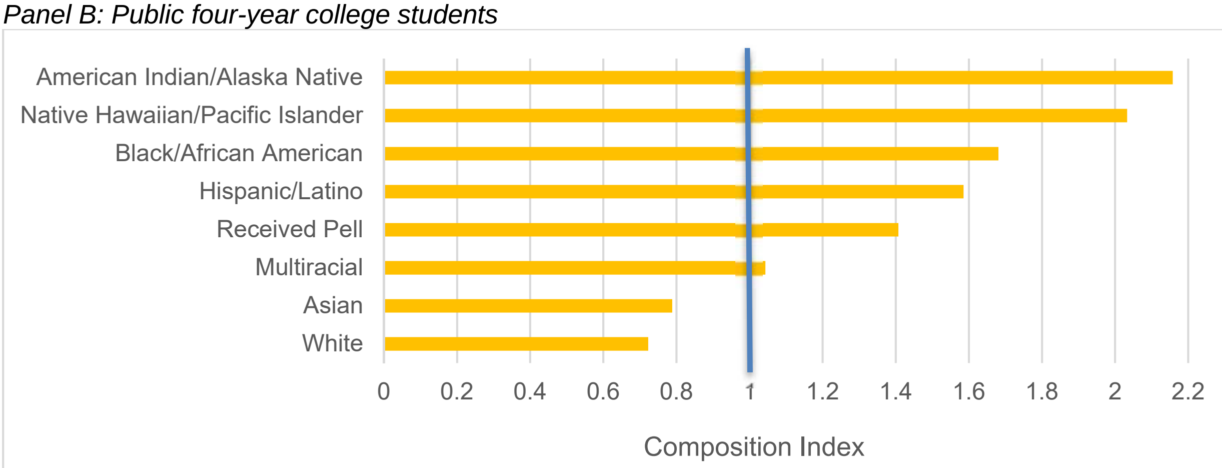
Across all college types, American Indian/Alaska Native, Black/African American, Hispanic/Latino, and students who received Pell are overrepresented in the developmental mathematics population (Figure 4). Overrepresentation of these groups in the developmental mathematics population is much greater at public four-year colleges compared to public two-year colleges, and Native Hawaiian/Pacific Islanders and Multiracial students are also overrepresented in the developmental mathematics population at four-year public colleges.

Figure 4. Overrepresentation in developmental mathematics for each racial/ethnic group and students who received Pell, 2011/12 entrants (overrepresentation represented by ratios above 1)

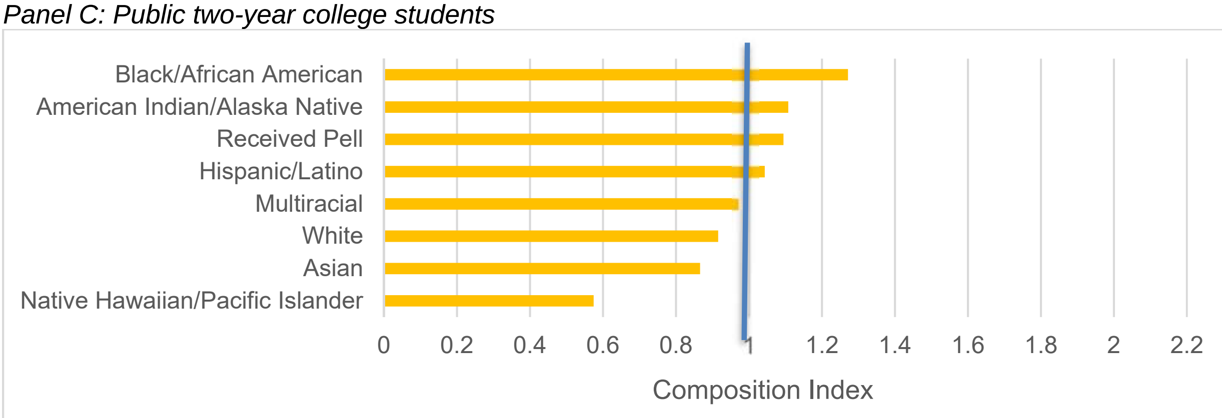
Panel A: All students



Panel B: Public four-year college students



Panel C: Public two-year college students



Note: Figures illustrate the composition index of developmental mathematics enrollment for each racial/ethnic group and students who received Pell. Developmental education course enrollment was self-reported during an interview in 2012. The composition index measures if students are represented in the developmental mathematics population at the same rate they are represented in the overall student population. Ratios greater than one indicate overrepresentation. For example, 63.6 percent of students in the sample received Pell and 72.3 percent of the developmental mathematics population received Pell, indicating a ratio of 1.14 (72.3/63.6) and overrepresentation of students who received Pell in the developmental mathematics population. The exact rates underlying the composition

indexes are in Appendix Table A4. Sample sizes are as follows: All students = 24,766; Public four-year = 4,293 students; Public two-year = 7,299.
Source: Author's analysis of BPS:12/14.

Disproportionality in developmental mathematics enrollment can be further explored by examining developmental mathematics enrollment rates by race/ethnicity and income among students who performed similarly in high school. Many community colleges have implemented alternative or additional measures to assess incoming students' college readiness, including high school grades and GPA. A number of states (e.g., North Carolina) and institutions have set a 2.6 high school GPA (roughly equivalent to a B-) or higher as a measure of college readiness that allows students to be placed directly into college-level coursework (Cullinan et al., 2018; Ganga et al., 2018). In addition, some states and institutions consider high school course grades in mathematics as a measure of college readiness, particularly passing Algebra 2 or higher (Barnett & Reddy, 2017). Thus, developmental mathematics enrollment rates by race/ethnicity and income among students who earned a B- or higher in high school and among students who completed Algebra 2 or a higher mathematics class in high school, measures that roughly demonstrate some level of college readiness in mathematics were examined.

Developmental mathematics enrollment among students with the same level of college readiness varies by race/ethnicity and income (Figure 5). Among all students in the 2011/12 cohort who earned a B- or higher cumulative high school GPA, developmental mathematics enrollment rates are highest for American Indian/Alaska Native students (26%) and lowest for students who receive Pell grants (11%). The same pattern is observed among students who passed Algebra 2 or higher: developmental mathematics enrollment rates are highest for American Indian/Alaska Native and Black/African American students (24%) and lowest for students who receive Pell grants (12%). Disparities in developmental mathematics enrollment among students with the same level of college-readiness are greater at four-year public colleges than at two-year public colleges.

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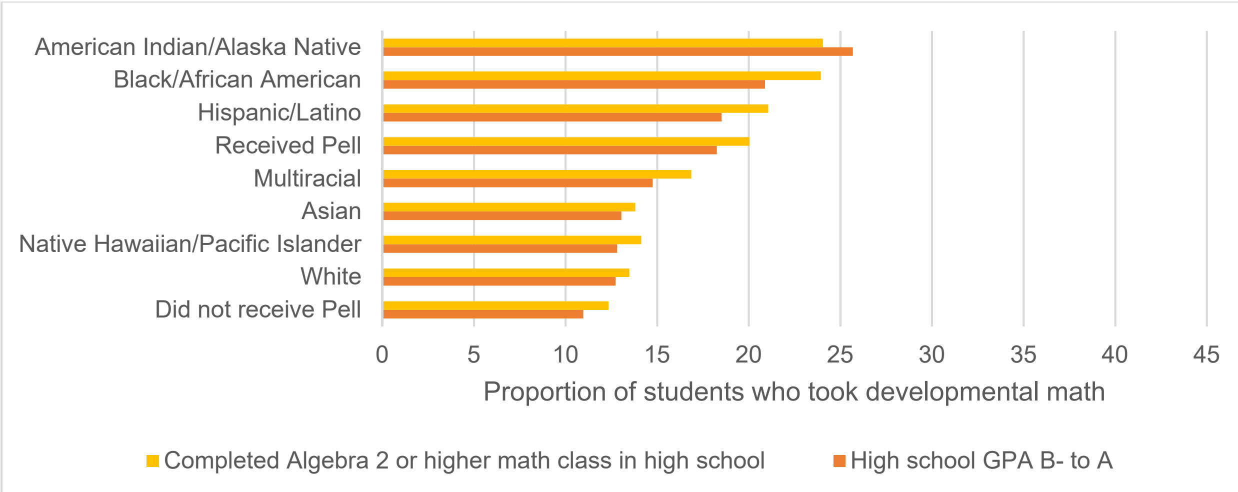
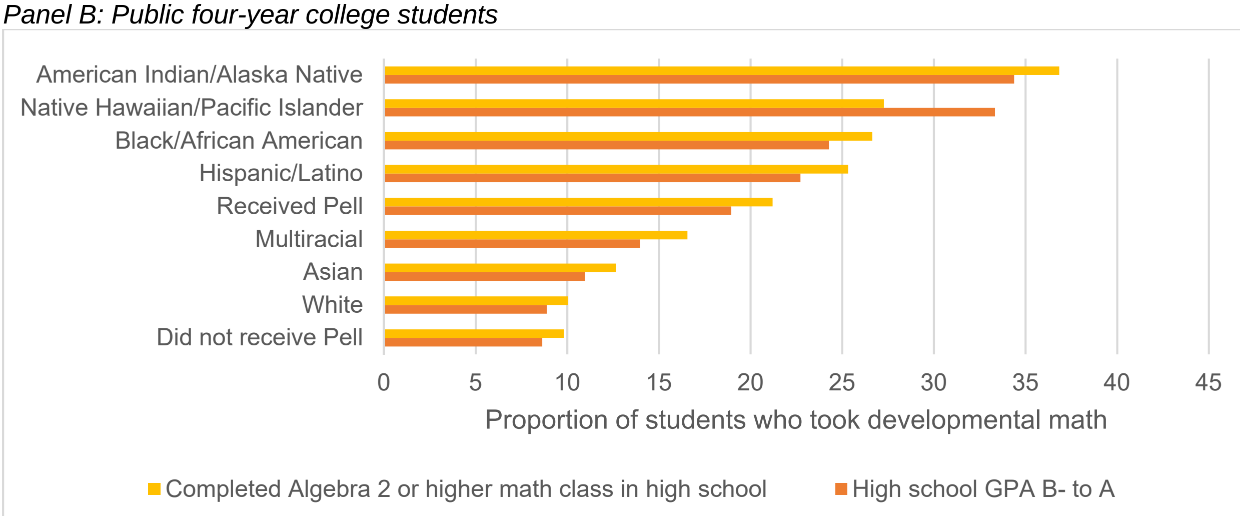
Figure 5. Percentage of students with the same level of college readiness who took developmental math in first year in college, 2011/12 entrants

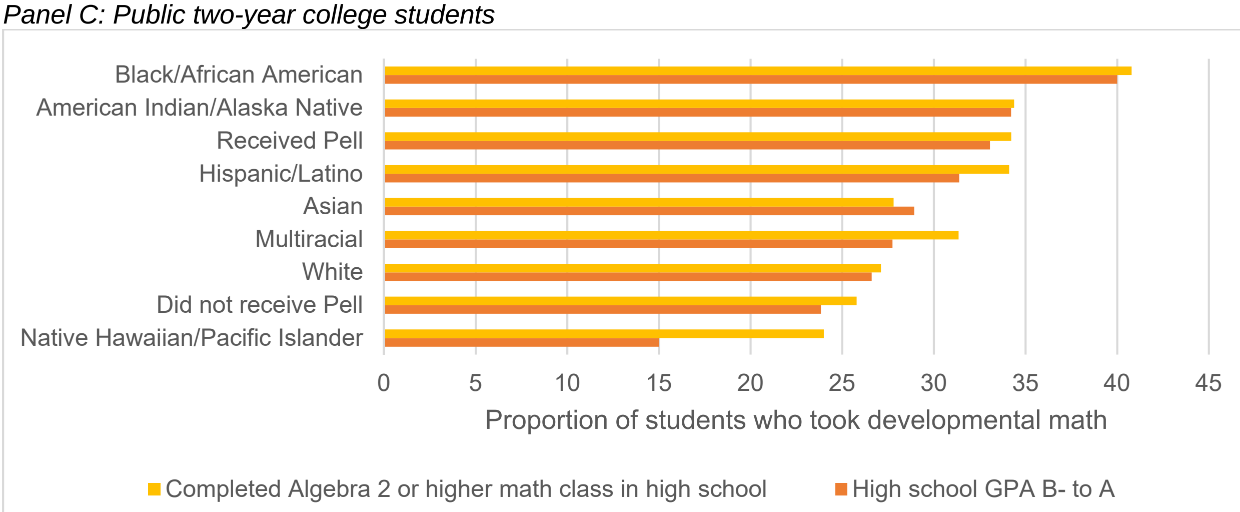
Panel A: All students



Panel B: Public four-year college students



Panel C: Public two-year college students



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Note: Figures illustrate the proportion of each student group who passed Algebra 2 or a higher mathematics class in high school and enrolled in developmental mathematics in their first year in college and the proportion of each student group who earned a cumulative high school grade point average of B- to A and enrolled in developmental mathematics in their first year in college. Developmental education course enrollment was self-reported during an interview in 2012. Sample sizes are as follows: All students who completed Algebra 2 or higher = 17,376; All students who earned a GPA of B- to A = 15,567; Public four-year students who completed Algebra 2 or higher = 3,825; Public four-year students who earned a GPA of B- to A = 3,543; Public two-year students who completed Algebra 2 or higher = 3,982; Public four-year students who took Algebra 2 or higher = 3,982.
Source: Author's analysis of BPS:12/14.

I. Conclusion and next steps for research

The analysis of BPS data surfaced a number of key findings with related suggestions for future research and data inquiry.

First and foremost, there is a critical need for a more systematic understanding of the percentage of students currently enrolling in developmental mathematics and the characteristics of these students. While there is suggestive evidence from across states that developmental math enrollment rates have decreased over time, research on developmental math reform does not report on changes in developmental math enrollment rates over time in the same way. For example, some reports provide enrollment in transfer-level math over time, but not developmental math, while other reports only provide developmental math rates for a specific population (e.g., students who participated in the developmental math reform). Other research reports present the causal impact of reform on the likelihood of developmental math enrollment, but do not provide the straightforward descriptive developmental math enrollment rates over time. Finally, overall, there is a lack of information about the current characteristics of students served in developmental math. Research reports on state and systemwide reforms of developmental math should report descriptive rates of changes over time in developmental math enrollment and describe the population served in the reform models. This information will help stakeholders understand the current prevalence of developmental math and the characteristics of the student population served in the current models.

Second, the developmental mathematics population has larger proportions of students from historically underrepresented student groups than students who did not take developmental education. This finding is consistent with the literature on community college developmental mathematics students, where a relatively large body of literature has explored developmental education enrollment rates in different contexts and inequities or disproportionality in developmental education enrollment across student groups (e.g., Attewell et al., 2006; Bailey et al, 2010; Bahr, 2010b; Cox et al., 2018; Hu, 2016). This research agenda should continue, particularly in this era of reform. Developmental education reforms at community college have gained momentum, but there is little understanding of who is specifically served by the new models and if all populations benefit from new models equally (Braithwaite & Edgecombe, 2018). It is critical to examine variation in reform model impacts by subpopulation to understand if all students benefit from reform models.

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Third, differences between developmental mathematics students and students who did not take developmental education are largest at public and private non-profit four-year colleges, and disproportionality or overrepresentation of students of color (particularly American Indian/Alaska Native, Hispanic/Latino, and Black/African America) and low-income students is much larger at four-year colleges than at two-year colleges. However, much less is known about the developmental mathematics population in the four-year sector; therefore, there is a need to build a research agenda around studying this population in the four-year sector, particularly at public four-year institutions where state and local policy have some level of influence on institutional change. Furthermore, it is critical for institutions to examine their own data on developmental education participation by student group, so that they can address disparities in participation and outcomes through a data-driven process of continuous improvement. For example, straightforward data, such as the data displayed in Figures 5 and 6, can help institutions intentionally address the overrepresentation of students of color and low-income students in developmental mathematics.

The analysis also surfaced two findings that may be new to higher education researchers and practitioners and worth exploring further through research. First, a slightly larger proportion of developmental mathematics students at all types of institutions reported declines in mental health over a three-year period compared to their peers who did not take developmental mathematics in their first year. It is unknown what caused this decline, but regardless, it is important to further explore potential mental health issues among the developmental mathematics population and attend to these issues since trauma and mental health cause college students to achieve below their potential (Davidson, 2017).

Finally, across all institution types, developmental mathematics students who declared a STEM major in their first year were less likely to still be in a STEM major three years later compared to their peers who did not take developmental mathematics in their first year. Supporting developmental mathematics students' STEM aspirations is important to increasing the number of college graduates entering STEM fields and contributing to the growing economy.

Overall, research much begin to keep pace with the current pace of reform implementation. We have yet to answer the following: *Are rates of developmental mathematics consistently decreasing across the country for all or only some student groups? Are students being more accurately placed in their first mathematics course in college, and if yes, are new placement policies and practices more or less effective for certain groups of students? Are developmental mathematics students more successful in new models of developmental mathematics, and if yes, are benefits accrued to all or only certain groups of students?* These questions and others are critical to answer to ensure state and institutional investments in developmental mathematics reforms are benefiting *all* college students as intended.

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Appendix
Detailed Results

Table A1. Percentage of 2003/04 and 2011/12 entrants who reported enrolling in developmental education in first year of college, by first institution level

	2011/12 entrants				**2003/04 entrants**			
	All students N=24,766	Four-year N=14,247	Two-year N=9,498	Less than two-year N=1,021	All students N=16,684	Four-year N=8,697	Two-year N=6,433	Less than two-year N=1,554
Did not take developmental courses	78	83	70	95	79	83	71	92
Took developmental mathematics	**18**	**13**	**25**	**4**	**16**	**12**	**23**	**6**
Developmental mathematics only	7	5	9	1	7	5	10	2
Developmental mathematics and English	11	8	16	3	9	7	13	4
Took developmental English only	4	4	5	1	5	5	6	2

Source: Author's analysis of BPS:12/14 and BPS:04/09

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Table A2. Characteristics of students who took and did not take developmental mathematics in their first year in college, by first institution type (2011/12 entrants)

	Public four-year		Private non-profit four-year		Private for-profit four-year		Public two-year		Private non-profit two-year		Private for-profit two-year	
Student reported during 2012 interview that s/he took developmental mathematics	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Demographic information												
Gender												
Male	45.4	39.2	39.4	38.4	47.4	45.3	48.3	41.6	39.8	55.8	38.4	27.7
Female	54.6	60.8	60.6	61.6	52.6	54.7	51.7	58.4	60.2	44.2	61.6	72.3
Race/ethnicity												
White	65.6	44.4	66.4	56.4	46.6	39.6	56.6	49	51.2	30.2	41.3	32.8
Black or African American	10	19.8	10.3	18.3	22.2	22.5	13.3	20.3	28.3	55.8	15	12.6
Hispanic or Latino	12.4	23.2	10.7	16.3	22.9	29.7	20.8	22.4	14.5	7	36.4	48.7
Asian	6.8	5.2	7.6	4.5	2.4	1.8	4.3	3.8	3.6	7	1.5	0.8
American Indian/Alaska Native	0.8	2.5	0.3	0.3	1.1	1.6	0.8	0.8	2.4	0	2.1	4.2
Native Hawaiian/Pacific Islander	0.3	0.6	0.4	0	0.8	0.9	0.6	0.3	0	0	1.1	0
Multiracial	4.1	4.3	4.1	4.2	4	3.9	3.6	3.4	0	0	2.6	0.8
First language learned to speak												
English	86.5	80.5	86.1	84.8	83.8	78.7	80.8	81.1	90.4	97.7	75.4	63.9
An equal mix of English and another language	4.9	6.8	5.1	8	4.9	6.1	6	6.5	0.6	2.3	6.9	10.9
Another language	8.6	12.7	8.8	7.3	11.3	15.2	13.2	12.5	9	0	17.7	25.2
Immigrant status												
Foreign student with visa	0.9	0.6	1.7	1	0.3	0.2	0.9	0.6	4.8	0	0.1	0
Non-citizen	3.1	3.4	2.3	1.7	3.4	5.7	4.9	5.5	1.2	0	3.6	8.4
Foreign-born citizen	3.7	5.1	4	3.8	3.3	4.5	4	3	4.2	0	3.7	0.8
US born citizen, foreign born parent(s)	16.4	22.7	17	17	18.2	21.3	18.7	19.2	13.3	7	26.3	35.3
All other citizens	75.9	68.2	75	76.5	74.7	68.3	71.6	71.6	76.5	93	66.2	55.5
Highest level of education of either parent												
HS diploma or less	19.5	34.4	16.1	33.6	54.6	52	42.7	46.7	48.2	39.5	62	63.9
Some college, no degree	12.9	18.7	12.2	14.5	14.3	15.2	17.7	17.8	12.7	16.3	13	10.9
Vocational training or AA	10.7	12.1	9.6	14.5	12.4	12.7	13.7	13.3	13.9	11.6	12.4	10.9

Student reported during 2012 interview that s/he took developmental mathematics	Public four-year		Private non-profit four-year		Private for-profit four-year		Public two-year		Private non-profit two-year		Private for-profit two-year	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
BA or higher	56.9	34.7	62.1	37.4	18.7	20	25.9	22.2	25.3	32.6	12.7	14.3
Locale of student's home												
Urban	27.9	32.9	29.2	32.2	38.5	43	32.2	36.7	30.9	35.7	41.7	55.1
Suburban/town	53.4	51	54	49.1	46.5	43.6	46.8	43.8	49.4	33.3	43.8	34.7
Rural	18.7	16.2	16.9	18.7	15	13.4	21	19.5	19.8	31	14.5	10.2
High school academic performance												
Highest mathematics completed in high school												
less than Algebra 2	6.4	13.4	7.5	22.8	40.9	40.6	29.6	33.8	27.1	16.3	42.3	44.5
Algebra 2	16.3	33.3	15	26.6	31.5	35.1	33	37	44	44.2	34.6	31.9
Trigonometry or higher	77.3	53.3	77.5	50.5	27.6	24.3	37.3	29.1	28.9	39.5	23.1	23.5
Took college credit in high school												
Missing	0.9	4.1	1.9	9.7	18.7	16.5	10.2	10.8	10.8	7	13.8	14.3
No	22.4	41	21.6	40.1	52.7	54.9	49.6	56.6	47	65.1	58.7	63
Yes	76.8	54.8	76.5	50.2	28.5	28.6	40.1	32.6	42.2	27.9	27.5	22.7
High school grade point average												
Missing	0.9	4.1	1.9	9.7	18.7	16.5	10.2	10.8	10.8	7	13.8	14.3
0.5-0.9 (D- to D)	0.1	0	0	0	0.3	0.4	0.2	0.2	0.6	7	0.3	0
1.0-1.4 (D to C-)	0.3	1.2	0.5	2.4	2.5	2.7	2	2.6	9.6	11.6	1.9	2.5
1.5-1.9 (C- to C)	1.1	3.2	1.3	2.1	5.2	5.5	5.2	6.7	21.7	41.9	6.1	3.4
2.0-2.4 (C to B-)	9.1	20.9	6.8	19.4	21.3	27.8	21.7	26.5	13.9	4.7	24.1	33.6
2.5-2.9 (B- to B)	12.7	17.7	9.9	14.2	12.6	12.7	14.6	15.7	30.1	20.9	13.4	9.2
3.0-3.4 (B to A-)	43.3	39.5	38.5	40.8	27	26.9	30.7	27.2	13.3	7	28.1	31.1
3.5-4.0 (A- to A)	32.5	13.4	41	11.4	12.4	7.5	15.3	10.3	0	0	12.4	5.9
High school completion type												
HS Diploma	97.5	93.9	95.7	91.7	81.3	84.1	85.3	84	81.3	81.4	79.4	74.8
GED	1.1	4.3	1.4	4.8	16.9	14.3	11	12.1	12	14	15.1	21
HS completion certificate	0.5	0.3	0.3	0	0.7	0.3	0.9	1	5.4	2.3	1.2	0
Foreign HS	0.4	0.6	1.5	0.7	0.6	0.7	1.1	1.4	0.6	2.3	1.1	0.8

Student reported during 2012 interview that s/he took developmental mathematics	Public four-year		Private non-profit four-year		Private for-profit four-year		Public two-year		Private non-profit two-year		Private for-profit two-year	
	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes
No HS diploma	0	0.3	0.3	1.4	0.2	0.4	1	0.5	0.6	0	2.8	3.4
Home schooled	0.4	0.6	0.8	1.4	0.4	0.1	0.7	1	0	0	0.3	0
Income information												
Dependent/Independent												
Dependent student	95.1	87.7	94.7	80.3	48.9	56.9	70.6	71.2	66.9	74.4	54.3	47.9
Independent student	4.9	12.3	5.3	19.7	51.1	43.1	29.4	28.8	33.1	25.6	45.7	52.1
Had Dependents												
No	98.2	94.2	97.7	88.6	68.8	73.5	83.8	83.1	76.5	88.4	70	67.2
Yes	1.8	5.8	2.3	11.4	31.2	26.5	16.2	16.9	23.5	11.6	30	32.8
Income group												
Low income	17.8	31.2	15.1	30.1	34.3	33.2	29.8	34.7	28.3	41.9	37.1	44.5
Low middle-income	21	26.9	20.6	23.2	26.1	29.5	29.5	28.9	30.1	32.6	29.7	24.4
High middle-income	27.8	22	24.7	25.6	22.2	22.1	24.4	21.4	24.7	16.3	19.6	19.3
High-income	33.4	20	39.7	21.1	17.4	15.2	16.3	15	16.9	9.3	13.6	11.8
Received federal benefits[1]												
No	85.2	71.9	85.9	67.8	60.4	59.1	71.7	64.6	71.7	60.5	61.6	44.5
Yes	14.8	28.1	14.1	32.2	39.6	40.9	28.3	35.4	28.3	39.5	38.4	55.5
Received Pell												
No	59.2	36.9	60.6	36.3	19.1	16.2	39.1	30.3	28.3	18.6	16.9	6.7
Yes	40.8	63.1	39.4	63.7	80.9	83.8	60.9	69.7	71.7	81.4	83.1	93.3
Worked while enrolled 11-12												
No	66.8	63.6	65.3	63.3	63.6	67	56.6	59.1	68.1	62.8	71.7	73.1
Yes	33.2	36.4	34.7	36.7	36.4	33	43.4	40.9	31.9	37.2	28.3	26.9
Attitudes & Mental Health												
Somewhat or strongly agree that I am a part of my first institution												
No	23.3	28.7	17.6	27	23.7	25.4	33.7	28.9	13.3	9.3	17.6	12.6
Yes	76.7	71.3	82.4	73	76.3	74.6	66.3	71.1	86.7	90.7	82.4	87.4

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Student reported during 2012 interview that s/he took developmental mathematics	Public four-year No	Public four-year Yes	Private non-profit four-year No	Private non-profit four-year Yes	Private for-profit four-year No	Private for-profit four-year Yes	Public two-year No	Public two-year Yes	Private non-profit two-year No	Private non-profit two-year Yes	Private for-profit two-year No	Private for-profit two-year Yes
Somewhat or strongly agree that I am confident that I have the ability to succeed												
No	11.5	15.8	9.7	16.6	17.7	16.6	13.6	14.6	7.8	11.6	10.1	10.1
Yes	88.5	84.2	90.3	83.4	82.3	83.4	86.4	85.4	92.2	88.4	89.9	89.9
Change in mental health rating from 11-12 to 13-14												
Mental health declined	19.8	22.7	19.4	22.5	23.9	26.1	23.4	26	23.5	16.3	24	31.1
Mental health remained constant	47.5	49.3	46.4	50.2	42.8	44.7	44.9	45.1	43.4	62.8	43.5	33.6
Mental health improved	32.7	28	34.2	27.3	33.3	29.2	31.7	28.9	33.1	20.9	32.5	35.3
College enrollment information												
Full-time/part-time in first term												
Part-time	7.9	11.1	4.8	17	45	40.9	39.7	33.3	24.7	9.3	37.3	35.3
Full-time	92.1	88.9	95.2	83	55	59.1	60.3	66.7	75.3	90.7	62.7	64.7
Major[2]												
Missing	0.4	0.3	0.1	1	0.2	0.2	2.2	2.2	0.6	0	0.1	0.8
Undecided	4.4	5.1	8	2.4	0.3	0.4	3.3	2.5	0.6	0	0.2	0
Science, engineering, and mathematics	33.4	27.3	26.6	20.8	21.5	18.9	17.6	19.1	7.8	7	4.3	5.9
Psychology and other social science	9.9	9.4	10.5	11.8	2.6	3.2	3.6	3.7	1.8	4.7	0.1	0
Health and medicine	4.7	5.5	4.9	9	13.6	12.7	11.3	12.1	25.3	14	52.4	50.4
Other field	47.3	52.4	50	55	61.9	64.6	62	60.3	63.9	74.4	43	42.9
College outcomes as of June 2014												
Selected STEM major in first year and still in STEM major												
No	27.7	40.6	25.2	31.4	26.8	31.4	33.9	38.1	16.4	44.4	19.2	23.9
Yes	72.3	59.4	74.8	68.6	73.2	68.6	66.1	61.9	83.6	55.6	80.8	76.1
Number of institutions attended												
1	68.3	69.1	72.1	63.3	79.4	78.8	73.6	76.6	72.3	53.5	86.5	88.2
2	27.4	27.2	23.4	27	19.1	19	24.5	21.4	26.5	41.9	12.6	10.9
3	3.9	3.5	4.2	9	1.4	2	1.8	1.9	1.2	4.7	0.9	0.8
4	0.4	0.2	0.2	0.7	0.1	0.2	0.2	0	0	0	0	0

Student reported during 2012 interview that s/he took developmental mathematics	Public four-year		Private non-profit four-year		Private for-profit four-year		Public two-year		Private non-profit two-year		Private for-profit two-year	
	No	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Student transferred to four-year												
No	N/A	N/A	N/A	N/A	N/A	N/A	87.4	89.5	87.3	79.1	97.3	99.2
Yes	N/A	N/A	N/A	N/A	N/A	N/A	12.6	10.5	12.7	20.9	2.7	0.8
Number of stopouts[3]												
0	88.7	85.9	89.3	84.4	79	81.8	78.6	78.1	84.9	69.8	84.2	85.7
1	10.6	13.1	9.8	13.5	19.2	16.8	19.7	20.6	14.5	25.6	15.2	14.3
2	0.7	1.1	0.9	2.1	1.7	1.3	1.7	1.3	0.6	4.7	0.7	0
Attainment and persistence												
Attained, still enrolled	2.5	4.8	1.7	3.8	9	7.6	11.3	9.2	14.5	14	6.5	9.2
Attained, not enrolled	3.7	3.8	4	6.9	18.4	16.1	10.8	4.9	39.2	27.9	61.2	53.8
No degree, still enrolled	80.4	66.1	82.5	63.3	30.6	38.6	35.7	42.8	19.3	27.9	5.6	4.2
No degree, not enrolled	13.4	25.3	11.7	26	42	37.7	42.1	43	27.1	30.2	26.7	32.8
Highest degree attainment												
No degree	93.8	91.4	94.2	89.3	72.6	76.3	77.9	85.8	46.4	58.1	32.3	37
Certificate	0.8	1.8	1.5	4.2	9.5	3.8	8.9	3.7	25.9	14	54.6	44.5
Associate's degree	2.9	4.5	1.6	3.8	14.9	15.4	13.1	10.5	27.7	27.9	13.1	18.5
Bachelor's degree	2.5	2.3	2.7	2.8	3	4.5	0.1	0	0	0	0	0
Highest degree expected												
No credential	2	3.1	2.4	3.8	7.1	8.4	6	6.9	5.4	11.6	7.4	9.2
Certificate	0.9	2.8	1.5	3.8	8.2	6.3	10.7	7.2	12	4.7	30.8	21
Associate's	4	6.5	2.5	8.3	23.4	21.7	22.3	23.7	25.3	25.6	27.6	31.1
Bachelor's	35.9	39.3	28.9	38.8	40.7	42.6	36.7	38	40.4	37.2	22.6	28.6
Graduate degree	57.1	48.4	64.7	45.3	20.6	20.9	24.3	24.2	16.9	20.9	11.5	10.1

Notes: [1] Federal benefits include Food Stamps (SNAP) Benefits, Free/Reduced Price School Lunch Benefits, Supplemental Security Income (SSI) Benefits, Temporary Assistance for Needy Families (TANF) Benefits, and the Special Supplemental Nutrition program for Women, Infants, and Children (WIC) Benefits.
[2]This variable indicates if the student's major field of study in 2011-12 was a major supported by the National Science Foundation (NSF). Based on Classification of Instructional Programs (CIP) code of student's major. A list of majors supported by NSF and their associated CIP codes is at https://webcaspar.nsf.gov/nsf/srs/webcasp/attribs/RFDISC2007_2009_2011.xls.
[3]A stopout is defined as a break in enrollment of five or more consecutive months

Sample sizes by institution type are as follows: Did not take developmental education: Public four-year = 3,484; Private non-profit four-year = 3,731; Private for-profit four-year = 4,607; Public two-year = 4,632; Private non-profit two-year = 166; Private for-profit two-year = 1,837. Took developmental mathematics: Public four-year = 651 students; Private non-profit four-year = 289; Private for-profit four-year = 938; Public two-year = 2,206; Private non-profit two-year = 43; Private for-profit two-year = 119.
Source: Author's analysis of BPS:12/14

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Table A3. Characteristics of students who took and did not take developmental mathematics in their first year in college, by first institution type (2003/04 entrants)

	Public four-year		Private non-profit four-year		Private for-profit four-year		Public two-year		Private non-profit two-year		Private for-profit two-year	
Student reported during 2004 interview that s/he took developmental mathematics	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Demographic information												
Gender												
Male	45.2	36.8	42.6	34.2	47.6	41.2	44.5	35.7	36.7	29.1	43.7	37.9
Female	54.8	63.2	57.4	65.8	52.4	58.8	55.5	64.3	63.3	70.9	56.3	62.1
Race/ethnicity												
White	71.3	65.9	73.5	69.9	44.6	41.2	64.2	56.7	46.8	36.4	52.2	65.5
Black or African American	8.8	14.2	8.7	12.7	21.7	26.5	14.5	18.7	13	23.6	21.5	17.2
Hispanic or Latino	9.1	10.7	7.7	8.8	21.7	20.6	12.2	16.1	22.4	20	18.3	10.3
Asian	6	4.4	5.6	4.1	3.9	2.9	4.1	2.9	5.8	7.3	2.6	0
American Indian/Alaska Native	0.5	0.8	0.3	0.3	1.5	2.9	0.7	0.8	4.2	5.5	0.4	3.4
Native Hawaiian/Pacific Islander	0.2	0.3	0.1	0.6	0.9	2.9	0.2	0.6	1.3	3.6	0.2	0
Other	1.5	1.2	1.3	1.2	1.5	0	1.5	1.4	1	0	1.4	3.4
More than one race	2.7	2.6	2.7	2.4	4.2	2.9	2.6	2.7	5.5	3.6	3.3	0
English is the primary language 2003-04												
No	10.2	10.5	7.5	9.1	13.4	20.6	11.1	9.7	15.3	12.7	10.4	0
Yes	89.8	89.5	92.5	90.9	86.6	79.4	88.9	90.3	84.7	87.3	89.6	100
Immigrant status 2003-04												
Foreign students with visas	1	0.8	2.1	2.9	0.3	0	1.3	0.7	1	1.8	0.2	0
Resident aliens or eligible non-citizens	3.9	2.9	2.1	2.7	9.5	5.9	5.9	4.9	8.8	9.1	5.7	0
Foreign born citizen	5.3	4.4	5.1	2.1	4.2	5.9	4	3.9	3.9	7.3	2.6	0
US born citizen, foreign born parent(s)	11	10.7	11.2	9.4	18.8	20.6	10.8	12.4	15.6	10.9	12	0
All other citizens	78.8	81.3	79.6	82.9	67.3	67.6	78	78.1	70.8	70.9	79.5	100
Parent's highest level of education												
HS diploma or less	19.7	28.9	17	20.1	51.8	55.9	42.1	44.6	51.9	34.6	54.7	55.1
Some college, no degree	12.6	14.8	9.4	18.3	15.2	14.7	14.6	16.2	13.3	23.6	14.2	24.1
Vocational training or AA	10.5	11.4	9.6	11.5	10.4	17.7	13.7	13.9	10	14.5	11.6	6.8
BA or higher	57.4	44.9	64	50.2	22.6	11.8	29.4	25.4	24.7	27.3	19.5	13.7
High school academic performance												

Highest level of high school mathematic												
Missing	3	5.9	3.8	3.8	36.6	20.6	24	18.1	21.8	14.5	37	24.1
less than Algebra 2	4	8.7	4.8	9.1	13.7	17.6	17.3	22.5	19.2	38.2	18.3	24.1
Algebra 2	17.8	28	15.4	25.4	18.2	26.5	28.4	35.8	31.8	30.9	28	31
Trigonometry or higher	75.2	57.4	75.9	61.6	31.6	35.3	30.4	23.6	27.3	16.4	16.6	20.7
Earned any college level credits in high school												
Missing	3	5.9	3.8	3.8	36.6	20.6	24	18.1	21.8	14.5	37	24.1
No	56	69.7	52.2	67	51.8	64.7	58.9	68.2	61	70.9	57.3	58.6
Yes	41	24.4	44	29.2	11.6	14.7	17.1	13.8	17.2	14.5	5.7	17.2
High school grade point average (GPA)												
Missing	5.3	9.4	8	8.8	42	29.4	31.7	25.6	27.6	29.1	47.4	31
0.5-0.9 (D- to D)	0.1	0.2	0	0	0.9	5.9	0.3	0.1	0	1.8	0.6	0
1.0-1.4 (D to C-)	0.1	0.3	0.2	0.6	1.8	0	0.8	0.6	1.9	9.1	4.3	0
1.5-1.9 (C- to C)	0.4	0.8	0.8	2.4	10.7	8.8	3.6	2.9	9.7	14.5	14.6	27.6
2.0-2.4 (C to B-)	4.4	8.8	3.9	7.7	9.5	5.9	13	15.2	9.4	20	8.5	20.7
2.5-2.9 (B- to B)	9.2	12.2	6.8	10.3	26.5	35.3	14.1	16.7	36.4	21.8	18.7	10.3
3.0-3.4 (B to A-)	34.3	36.5	25.8	36.9	8.6	14.7	23.1	29	14.9	3.6	5.9	10.3
3.5-4.0 (A- to A)	46.1	31.8	54.4	33.3	0	0	13.5	9.9	0	0	0	0
High school degree type												
High school diploma	97.1	95.4	94.9	93.5	83.9	88.2	85.8	87.1	88.6	80	78	75.9
GED or other equivalency	1	3.5	1.6	2.4	13.4	11.8	9.4	10.3	7.1	16.4	16.3	20.7
High school completion certificate	0.1	0.2	0.1	0.3	0.3	0	0.6	0.4	0.6	1.8	0.8	0
Attended foreign high school	1.5	0.8	2.7	3.5	1.8	0	2.7	1.4	2.3	1.8	1.6	0
No high school degree or certificate	0	0	0.1	0	0.3	0	1	0.3	0.3	0	3	3.4
Home schooled	0.3	0.2	0.6	0.3	0.3	0	0.5	0.5	1	0	0.2	0
Income information												
Dependency status												
Dependent	94.5	91	94.4	93.8	53.3	76.5	66.8	73.3	65.3	70.9	45.3	58.6
Independent	5.5	9	5.6	6.2	46.7	23.5	33.2	26.7	34.7	29.1	54.7	41.4
Has dependents												
No dependents	97.1	94.5	96.9	96.8	69.3	94.1	78.6	81.1	78.6	81.8	62.2	69
Has dependents	2.9	5.5	3.1	3.2	30.7	5.9	21.4	18.9	21.4	18.2	37.8	31
Income group in												
Low	19.3	26.3	19	22.4	39	23.5	31.3	36.7	46.4	45.5	41.3	41.4

Low middle	23.9	23.4	21.3	30.4	33.6	50	29.2	29.4	25.6	27.3	31.5	24.1
High middle	27.7	28.8	23.9	25.4	18.2	17.6	23.2	22.2	17.5	21.8	16.7	20.7
High	29	21.5	35.8	21.8	9.2	8.8	16.3	11.8	10.4	5.5	10.6	13.8
Received federal benefits[1]												
No	98.9	98.3	99.1	98.8	90.8	100	93.4	93.8	93.5	89.1	87.2	93.1
Yes	1.1	1.7	0.9	1.2	9.2	0	6.6	6.2	6.5	10.9	12.8	6.9
Received Pell ever												
No	64.3	51.3	66.1	56.3	31	35.3	52.7	45.6	34.1	32.7	28.5	37.9
Yes	35.7	48.7	33.9	43.7	69	64.7	47.3	54.4	65.9	67.3	71.5	62.1
Worked while enrolled 2006												
No	32.4	31.7	32.2	28	30.7	32.4	38.9	34.3	36.4	41.8	39.4	13.8
Yes	67.6	68.3	67.8	72	69.3	67.6	61.1	65.7	63.6	58.2	60.6	86.2
College enrollment information												
Full-time/part-time												
Full-time	92.7	91	94.3	96.5	78.9	73.5	62.3	70.4	84.1	89.1	88.8	86.2
Part-time	7.3	9	5.7	3.5	21.1	26.5	37.7	29.6	15.9	10.9	11.2	13.8
Transcript: STEM major field of study indicator												
No	71.4	81.5	71.4	84	63.5	59.1	83	86.8	86.2	77.8	79.5	79.2
Yes	28.6	18.5	28.6	16	36.5	40.9	17	13.2	13.8	22.2	20.5	20.8
College outcomes as of June 2009												
Student transferred to four-year												
No	82.7	82	83.5	77.9	86.3	79.4	70.2	72.9	72.1	74.5	91.1	93.1
Yes	17.3	18	16.5	22.1	13.7	20.6	29.8	27.1	27.9	25.5	8.9	6.9
Persistence and attainment												
Attained, still enrolled	2.4	3	1.4	2.1	4.8	0	8.1	9.2	8.1	5.5	7.5	10.3
Attained, not enrolled	65.7	59.2	74.9	62.5	32.7	20.6	31.2	27.5	35.1	29.1	35	27.6
No degree, still enrolled	12	14.6	8.1	13	14.3	20.6	18	19.6	12.3	25.5	9.3	10.3
No degree, not enrolled	19.9	23.1	15.6	22.4	48.2	58.8	42.8	43.7	44.5	40	48.2	51.7
Highest degree attained												
No degree	31.9	37.7	23.6	35.4	62.5	79.4	60.8	63.3	56.8	65.5	57.5	62.1
Certificate	1.8	1.7	1.3	2.1	3.3	0	9.1	7.5	7.5	1.8	21.1	6.9
Associate's degree	3.7	5.6	2.8	6.5	19.3	5.9	16.6	17.5	23.7	23.6	19.9	31
Bachelor's degree	62.6	54.9	72.3	56	14.9	14.7	13.5	11.7	12	9.1	1.4	0

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Notes: [1] Federal benefits include Food Stamps (SNAP) Benefits, Free/Reduced Price School Lunch Benefits, Supplemental Security Income (SSI) Benefits, Temporary Assistance for Needy Families (TANF) Benefits, and the Special Supplemental Nutrition program for Women, Infants, and Children (WIC) Benefits. Variables differ between BPS:12/14 and BPS:04/09, so this table has fewer characteristics than table A2. Sample sizes by institution type are as follows: Did not take developmental education: Public four-year = 3,774; Private non-profit four-year = 3,146; Private for-profit four-year = 326; Public two-year = 3,788; Private non-profit two-year = 290; Private for-profit two-year = 477. Took developmental mathematics: Public four-year = 657 students; Private non-profit four-year = 339; Private for-profit four-year = 34; Public two-year = 1,395; Private non-profit two-year = 55; Private for-profit two-year = 29.
Source: Author's analysis of BPS:04/09

Table A4. Table A3. Characteristics of students who took and did not take developmental mathematics (2003-2009), by first institution type (2003/04 entrants)

	Public four-year		Private non-profit four-year		Private for-profit four-year		Public two-year		Private non-profit two-year		Private for-profit two-year	
Took developmental education	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*
Demographic information												
Gender												
Male	46.4	40.4	41.4	41.6	51.4	38.6	46.4	38.7	33.9	35.9	43.9	42.1
Female	53.6	59.6	58.6	58.4	48.6	61.4	53.6	61.3	66.1	64.1	56.1	57.9
Race/ethnicity												
White	74.1	68.5	76.7	64.3	47.3	35.1	69.3	58.8	65.3	34.1	50.7	58.6
Black or African American	6.9	14.7	7	17.3	21.2	27.2	11.6	18	16.1	14.5	22.9	18
Hispanic or Latino	6.9	9.9	5.6	12.2	18	30.7	10.9	14.8	9.7	28.2	18.8	14.3
Asian	6.6	3.1	5.9	2.8	4.1	3.5	3.6	2.9	0	9.5	2.2	3.8
American Indian/Alaska Native	0.4	0.4	0.3	0.6	2.3	0.9	0.8	0.7	2.4	5.5	0.5	0.8
Native Hawaiian/Pacific Islander	0.3	0.1	0.2	0	1.4	0	0.3	0.3	0	2.3	0	0.8
Other	1.6	1.2	1.4	0.9	0.9	1.8	1	1.7	1.6	0.5	1.6	1.5
More than one race	3.1	2	3	2	5	0.9	2.5	2.8	4.8	5.5	3.3	2.3
English is the primary language 2003-04												
No	8.3	9	6.3	8.6	13.5	14.9	9	10.4	6.5	19.5	10.4	6.8
Yes	91.7	91	93.7	91.4	86.5	85.1	91	89.6	93.5	80.5	89.6	93.2
Immigrant status 2003-04												
Foreign students with visas	0.9	0.6	2.1	0.9	6.8	13.2	1	0.9	0.8	1.4	0.3	0
Resident aliens or eligible non-citizens	3.6	3	1.9	3.1	3.2	5.3	4.8	5.1	7.3	9.5	6	4.5
Foreign born citizen	4.3	4.3	3.7	6	20.3	18.4	3.8	4.2	4	4.1	2.5	2.3
US born citizen, foreign born parent(s)	11	10.2	11.4	9.5	69.8	63.2	10.2	12.1	8.9	18.6	10.6	12
All other citizens	80.2	81.9	81	80.5	100	100	80.4	77.7	79	66.4	80.7	81.2
Parent's highest level of education												
HS diploma or less	17.1	27.3	14	28.8	50.5	55.3	41.8	42.5	50	50.4	55.3	53.3
Some college, no degree	11.6	15.5	9.4	13.5	14.4	17.6	14.9	15.8	13.8	16.4	13.6	19.6
Vocational training or AA	10.3	11.8	9.2	10.8	12.2	8.7	13.6	13.8	11.3	10	11.4	9
BA or higher	61.1	45.3	67.5	46.8	23	18.3	29.8	27.7	25	23.2	19.6	18.1
High school academic performance												
Highest level of high school mathematics												

Missing	1.9	6.7	2.7	8.1	35.1	31.6	24.8	20.7	24.2	17.7	35.7	39.1
less than Algebra 2	3	8	3.2	12	11.7	19.3	16	20.2	14.5	27.3	18.3	18
Algebra 2	13.4	31.1	12.7	31	22.1	16.7	25.5	34.5	29.8	32.7	29.4	25.6
Trigonometry or higher	81.7	54.2	81.5	49	31.2	32.4	33.6	24.6	31.5	22.2	16.5	17.4
Earned any college level credits in high school												
Missing	1.9	6.7	2.7	8.1	35.1	31.6	24.8	20.7	24.2	17.7	35.7	39.1
No	52.9	67.1	49.1	68.8	55	53.5	56.2	64.5	56.5	66.8	58.3	53.4
Yes	45.2	26.2	48.2	23.1	9.9	14.9	18.9	14.9	19.4	15.5	6	7.5
High school grade point average (GPA)												
Missing	3.8	10.2	6.7	12	40.5	36	32.2	28.1	29	26.4	46.3	48.1
0.5-0.9 (D- to D)	0	0.3	0	0	1.4	1.8	0.1	0.3	0	0.5	0.5	0.8
1.0-1.4 (D to C-)	0.1	0.1	0.1	0.4	2.3	0.9	1	0.6	0.8	4.5	4.1	4.5
1.5-1.9 (C- to C)	0.3	0.8	0.5	2.5	8.1	17.5	3.6	3.3	10.5	10.5	16.3	13.5
2.0-2.4 (C to B-)	3.5	8	2.6	10.1	11.3	7	11.2	14.6	12.1	10.9	9.3	8.3
2.5-2.9 (B- to B)	7	15.4	5.1	13.5	28.8	27.2	13	16.2	25	39.1	18.3	18.8
3.0-3.4 (B to A-)	32.5	37.3	24.4	35.9	7.7	9.6	21.9	26.6	22.6	8.2	5.2	6
3.5-4.0 (A- to A)	52.7	27.9	60.6	25.6	0	0	17	10.3	0	0	0	0
High school degree type												
High school diploma	97.8	95.2	95.3	94	84.7	86	86.2	86.6	89.5	85.9	78.5	75.2
GED or other equivalency	0.5	3.4	1.2	3.8	12.6	13.2	8.9	10.4	8.1	9.1	15.8	18.8
High school completion certificate	0.1	0.1	0.1	0.3	0.5	0	0.6	0.5	0	0.9	0.8	0.8
Attended foreign high school	1.4	0.9	2.7	1.6	1.4	0.9	2.4	1.6	1.6	2.7	1.6	1.5
No high school degree or certificate	0	0	0.1	0.1	0.5	0	1.5	0.3	0	0.5	3.3	3
Home schooled	0.2	0.4	0.6	0.1	0.5	0	0.4	0.5	0.8	0.9	0	0.8
Income information												
Dependency status												
Dependent	96.1	89.3	95.7	88.6	55.9	59.6	66.4	70.1	65.3	66.4	48.2	39.1
Independent	3.9	10.7	4.3	11.4	44.1	40.4	33.6	29.9	34.7	33.6	51.8	60.9
Has dependents												
No dependents	98	93.7	97.8	92.7	73.4	70.2	78.4	79.7	73.4	81.8	62.4	60.9
Has dependents	2	6.3	2.2	7.3	26.6	29.8	21.6	20.3	26.6	18.2	37.6	39.1
Income group in												
Low	16.3	24.7	16.3	28.4	36	40.4	27.9	35.4	37.9	49.5	42.8	36.8
Low middle	23.4	24.9	20.8	26.2	36.9	36.8	29.1	29.4	31.5	23.6	29.2	34.6

High middle	29.2	27	24.2	23.3	18	16.7	25.4	21.3	17.7	19.1	16.1	20.3
High	31.1	23.4	38.7	22.1	9	6.1	17.7	13.8	12.9	7.7	12	8.3
Received federal benefits[1]												
No	99.3	97.7	99.4	97.5	91.4	93	94	93.2	94.4	91.8	88.3	85
Yes	0.7	2.3	0.6	2.5	8.6	7	6	6.8	5.6	8.2	11.7	15
Received Pell ever												
No	68.1	54.5	69.9	50.2	34.7	23.7	58	45.7	44.4	28.6	31.1	23.3
Yes	31.9	45.5	30.1	49.8	65.3	76.3	42	54.3	55.6	71.4	68.9	76.7
Worked while enrolled 2006												
No	33	31.7	32.2	31.2	31.1	28.9	41.6	34.2	30.6	40.5	39.8	37.6
Yes	67	68.3	67.8	68.8	68.9	71.1	58.4	65.8	69.4	59.5	60.2	62.4
College enrollment information												
Full-time/part-time												
Full-time	93.7	89.3	95.3	90.9	82.9	68.4	61.2	66.9	85.5	84.1	89.1	88
Part-time	6.3	10.7	4.7	9.1	17.1	31.6	38.8	33.1	14.5	15.9	10.9	12
Transcript: STEM major field of study indicator												
No	68.8	81.6	70.4	81.9	62.1	65.1	82	85.2	88.7	83.2	81	78.8
Yes	31.2	18.4	29.6	18.1	37.9	34.9	18	14.8	11.3	16.8	19	21.2
College outcomes as of June 2009												
Student transferred to four-year												
No	N/A	N/A	N/A	N/A	N/A	N/A	71.3	70.6	72.6	72.3	92.9	88.7
Yes	N/A	N/A	N/A	N/A	N/A	N/A	28.7	29.4	27.4	27.7	7.1	11.3
Persistence and attainment												
Attained, still enrolled	1.2	4.8	1	2.8	4.1	6.1	6.5	9.8	8.1	8.2	4.9	15
Attained, not enrolled	71.6	52	79.7	51.4	31.1	28.1	34.3	26.9	36.3	33.2	36	27.8
No degree, still enrolled	10.1	16.1	6.3	16.3	11.7	23.7	13.8	21.8	11.3	16.8	8.2	12.8
No degree, not enrolled	17.1	27.1	13	29.6	53.2	42.1	45.4	41.5	44.4	41.8	51	44.4
Highest degree attained												
No degree	27.2	43.2	19.3	45.8	64.9	65.8	59.2	63.3	55.7	58.6	59.1	57.1
Certificate	1.4	2.3	0.9	2.8	2.7	4.4	10.2	7.1	12.1	4.1	24.8	9.8
Associate's degree	2.6	6.6	2.2	6.0	19.8	17.5	16.0	17.6	19.4	26.4	15.5	29.3
Bachelor's degree	68.8	47.9	77.7	45.4	12.6	12.3	14.5	12.1	12.9	10.9	0.5	3.8

Notes: [1] Federal benefits include Food Stamps (SNAP) Benefits, Free/Reduced Price School Lunch Benefits, Supplemental Security Income (SSI) Benefits, Temporary Assistance for Needy Families (TANF) Benefits, and the Special Supplemental Nutrition program for Women, Infants, and Children (WIC) Benefits.

Variables differ between BPS:12/14 and BPS:04/09, so this table has fewer characteristics than table A2. Sample sizes by institution type are as follows: Did not take developmental education: Public four-year = 2,962; Private non-profit four-year = 2,734; Private for-profit four-year = 222; Public two-year = 2,102; Private non-profit two-year = 124; Private for-profit two-year = 367. Took developmental mathematics: Public four-year = 1,368 students; Private non-profit four-year = 683; Private for-profit four-year = 114; Public two-year = 2,985; Private non-profit two-year = 220; Private for-profit two-year = 133.
Source: Author's analysis of BPS:04/09

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Table A4. Among first-time college students in 2011/12, Hispanic/Latino, Black/African American, and American Indian/Alaska Native students and students who received Pell are overrepresented in the developmental mathematics population at most institution types

	All students (%)	Developmental mathematics students (%)	**Difference** *Developmental mathematics students – All students*	**Composition index** *Developmental mathematics students ÷ All students*
All students				
Native Hawaiian/Pacific Islander	0.53	0.42	-0.11	0.79
Asian	4.38	3.50	-0.88	0.80
White	53.26	45.87	-7.39	0.86
Multiracial	3.78	3.61	-0.17	0.96
Received Pell	63.57	72.31	8.74	**1.14**
Hispanic/Latino	20.97	24.45	3.48	**1.17**
Black/African American	16.05	20.79	4.74	**1.30**
American Indian/Alaska Native	1.03	1.35	0.32	**1.31**
Four-year public				
White	61.40	44.39	-17.01	0.72
Asian	6.62	5.22	-1.40	0.79
Multiracial	4.12	4.30	0.18	1.04
Received Pell	44.86	63.13	18.27	**1.41**
Hispanic/Latino	14.63	23.20	8.57	**1.59**
Black/African American	11.79	19.82	8.03	**1.68**
Native Hawaiian/Pacific Islander	0.30	0.61	0.31	**2.03**
American Indian/Alaska Native	1.14	2.46	1.32	**2.16**
Four-year private nonprofit				
Native Hawaiian/Pacific Islander	0.41	0.00	-0.41	0.00
Asian	7.48	4.50	-2.98	0.60
White	65.47	56.40	-9.07	0.86
Multiracial	4.09	4.15	0.06	**1.01**
American Indian/Alaska Native	0.34	0.35	0.01	**1.03**
Hispanic/Latino	11.23	16.26	5.03	**1.45**
Received Pell	41.62	63.67	22.05	**1.53**
Black/African American	10.98	18.34	7.36	**1.67**
Four-year private for-profit				
Asian	2.28	1.81	-0.47	0.79
White	45.03	39.55	-5.48	0.88
Multiracial	4.09	3.94	-0.15	0.96
Black/African American	22.23	22.49	0.26	**1.01**
Received Pell	81.57	83.80	2.23	**1.03**

	All students (%)	Developmental mathematics students (%)	**Difference** *Developmental mathematics students – All students*	**Composition index** *Developmental mathematics students ÷ All students*
Native Hawaiian/Pacific Islander	0.77	0.85	0.08	**1.10**
Hispanic/Latino	24.41	29.74	5.33	**1.22**
American Indian/Alaska Native	1.19	1.60	0.41	**1.34**
Two-year public				
Native Hawaiian/Pacific Islander	0.47	0.27	-0.20	0.57
Asian	4.34	3.76	-0.58	0.87
White	53.46	48.96	-4.50	0.92
Multiracial	3.55	3.45	-0.10	0.97
Hispanic/Latino	21.47	22.40	0.93	**1.04**
Received Pell	63.90	69.97	6.07	**1.09**
American Indian/Alaska Native	0.74	0.82	0.08	**1.11**
Black/African American	15.97	20.31	4.34	**1.27**
Two-year private nonprofit				
Multiracial	2.20	0.00	-2.20	0.00
Hispanic/Latino	12.78	6.98	-5.80	0.55
White	44.93	30.23	-14.70	0.67
Received Pell	74.00	81.40	7.40	**1.10**
Black/African American	35.68	55.81	20.13	**1.56**
American Indian/Alaska Native	4.41	6.98	2.57	**1.58**
Asian	0.00	0.00	0.00	
Native Hawaiian/Pacific Islander	0.00	0.00	0.00	
Two-year private for-profit				
Native Hawaiian/Pacific Islander	1.01	0.00	-1.01	0.00
Multiracial	2.48	0.84	-1.64	0.34
Asian	1.42	0.84	-0.58	0.59
White	40.77	32.77	-8.00	0.80
Black/African American	14.91	12.61	-2.30	0.85
Hispanic/Latino	37.17	48.74	11.57	**1.31**
Received Pell	63.67	93.28	29.61	**1.47**
American Indian/Alaska Native	2.23	4.20	1.97	**1.88**

Note: Developmental education course enrollment was self-reported during an interview in 2012. The composition index measures if students are represented in the developmental mathematics population at the same rate they are represented in the overall student population. Ratios greater than one indicate overrepresentation. For example, 63.6 percent of students in the sample received Pell and 72.3 percent of the developmental mathematics population received Pell, indicating a ratio of 1.14 (72.3/63.6) and overrepresentation of students who received Pell in the developmental mathematics population.
Source: Author’s analysis of BPS:12/14.

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