Title Page

Title: College Students' Sense of Belonging: A National Perspective

Authors: Maithreyi Gopalan, [†] Shannon T. Brady, [†]

[†] Equal authorship

Corresponding Author:

Maithreyi Gopalan

Assistant Professor

Department of Education Policy Studies

The Pennsylvania State University

Email: smg632@psu.edu

Other Authors:

Shannon T. Brady

Assistant Professor

Department of Psychology

Wake Forest University

Email: bradyst@wfu.edu

College Students' Sense of Belonging: A National Perspective

Abstract

In a nationally representative sample, first-year US college students "somewhat agree", on average, that they feel like they belong at their school. However, belonging varies by key institutional and student characteristics; of note, racial-ethnic minority and first-generation students report lower belonging than peers at four-year schools, while the opposite is true at two-year schools. Further, at four-year schools, belonging predicts better persistence, engagement, and mental health, even after extensive covariate adjustment. Although descriptive, these patterns highlight the need to better measure and understand belonging and related psychological factors that may promote college students' success and well-being.

Keywords: belonging, underrepresented racial-ethnic minority students, first-generation students, college persistence, mental health, campus engagement

College Students' Sense of Belonging: A National Perspective

Students' sense of belonging has been identified as a potential lever to promote success, engagement, and well-being in college (National Academies of Sciences, Engineering, and Medicine [NAS], 2017). Yet most studies of college student belonging have used convenience samples from one or a few four-year institutions. As such, our understanding of how belonging varies across institutions and student identities and how it relates to important outcomes is sparse (Strayhorn, 2012), especially for students at two-year colleges (Strauss & Volkwein, 2004). Recently, however, a nationally representative survey of college students in the United States included a measure of belonging—allowing, for the first time, a national analysis of college belonging.

Psychologists describe belonging as a fundamental human motivation (Baumeister & Leary, 1995), a "hub" that can facilitate diverse positive outcomes (Walton & Brady, 2017). In college, feeling a sense of belonging may lead students to engage more deeply with their studies, leading to persistence and success. In both experimental (Yeager et al., 2016) and correlational (Strayhorn, 2012) studies, students who feel they belong seek out and use campus resources to a greater extent, furthering their success. In addition, belonging may buffer students from stress, improving mental health (Baumeister & Leary, 1995).

But these benefits may not be equally shared. A growing literature indicates that students from underrepresented racial-ethnic minority (URM; Black, Hispanic, and Native) and first-generation college (FG) backgrounds report lower belonging, as well as greater uncertainty about their belonging (Walton & Cohen, 2007; Strayhorn, 2012). Further, the more diverse goals, life circumstances, and student characteristics of two-year (vs. four-year) students may mean that belonging functions differently in two-year settings (Deil-Amen, 2011).

2

Therefore, we use these newly available national data to ask: do first-year college students feel like they belong at their school, and does this vary by URM status, FG status, and sex? Given considerable differences in student populations and institutional goals, are patterns similar across two-year and four-year institutions? Further, in this national sample, does first-year belonging predict subsequent persistence, use of campus services, and mental health?

Methods and Results

We used data from the Beginning Postsecondary Students Longitudinal Study, a nationally representative survey of first-time, first-year US college students in 2011-2012 (N=23,750) with a two-year follow-up. The belonging measure asked students, in the spring of their first year, to indicate their agreement with the statement, "I feel that I am a part of [SCHOOL]" (*1=Strongly disagree*, *5=Strongly agree*). A similar question, asked in the follow-up, is used for supplemental analyses of within-students changes in belonging. The Appendix provides supplemental methodological information and analyses.

First, we examined mean levels of belonging by key institutional and student characteristics. On average, students "somewhat agreed" they felt a part of their college ($M =$ 4.04 on 5-point scale, $SD =$1.10). Nevertheless, belonging varied across key dimensions (see Figure 1). Overall, students at four-year colleges reported higher belonging than students at two-year colleges. Both URM and FG students reported lower belonging than their peers (White/Asian/multiracial students and continuing-generation students, respectively)—but only at four-year colleges. At two-year colleges, the reverse was true, and women also reported higher belonging than men. There is no interaction between URM- and FG-status at either two- or four-year colleges (see Table A1).

Second, we explored associations between belonging and students' (1) persistence at any post-secondary institution after two and three years, (2) self-reported use of campus services in year three, and (3) self-reported mental health in year three. We regressed each outcome on a vector of student- and institutional-level covariates associated with college success in past research (see Table 1 note and Appendix). In the analyses for services use and mental health, we also controlled for the analogous first-year outcome. Given the descriptive findings, we conducted separate regressions for four-year and two-year colleges. Of note, the correlational nature of the data preclude causal inferences.

[Insert Figure 1 here]

At four-year colleges, belonging was positively associated with persistence, use of campus services, and mental health (ps <0.05; see Table 1). There were no significant interactions between belonging, URM-status, and FG-status, suggesting that belonging (as measured here) was equally predictive for students from different backgrounds (see Figure A1 and Discussion). However, very low belonging—which was more common among URM and FG students—appears especially pernicious, associated with considerably lower persistence (see Table A6). Results are robust to a large number of alternate models and sensitivity checks, including models that include institutional, student, and time fixed effects; institutional selectivity as a covariate or moderator; self-efficacy as a covariate; institutional expenditures as a covariate, and others (see Tables A7-A12).

[Insert Table 1 here]

In contrast, at two-year colleges, belonging was *not* significantly associated with any of the core outcomes in primary models (see Table 1). That said, in supplemental models, within-

student changes in belonging over time (first year to third year) were positively associated with all core outcomes at both two-year and four-year schools (see Table A10).

Discussion

Overall, in a national sample, most US students feel like they belong at college. Furthermore, at four-year schools, belonging is positively and robustly associated with outcomes colleges care deeply about, including persistence and mental health. Finally, across all schools, within-student increases in belonging were positively associated with improvements in these outcomes.

Yet concerningly and consistent with past research in smaller and more idiosyncratic samples, URM and FG students at four-year colleges report lower belonging than their peers. That these differences emerge across a national sample, despite suboptimal measurement of student belonging, underscores the importance of further understanding students' experiences of belonging on campus and the structural or institutional qualities that lead students, especially URM and FG students, to experience higher or lower levels of belonging.

In addition, student belonging at two-year colleges is lower than at four-year colleges and not significantly associated with our core outcomes of interest. Does this mean that belonging does not matter for two-year students? We think not. Two-year colleges and their students face greater structural challenges than their four-year peers; it may be that belonging both increases and is more associated with outcomes when structural barriers have been sufficiently addressed. Consistent with this, a recent study of an intensive advising and structural support intervention at a two-year college found impressive causal effects on academic success, accompanied by increases in belonging (Scrivener et al., 2015). Or, perhaps greater variability in student backgrounds, goals, and experiences means that general

5

institutional belonging is less important to two-year students than belonging in a course, major, or profession. Suggestively, for example, students' uncertainty about their belonging in a developmental math course was the single best predictor of course persistence (Bryk et al., 2013).

The surprising finding that URM and FG students at two-year colleges report *higher* belonging than their non-URM/FG counterparts warrants attention. Although a greater proportion of two-year (vs. four-year) students are URM and/or FG, this does not appear to explain the finding (Table A4). The pattern may be due to differences in other background/demographic factors or to the kinds of institutions students attend. More in-depth studies of belonging at two-year schools are needed to further elucidate these findings and the processes at play.

Going forward, nationally representative surveys should incorporate greater theory-driven measurement of personal qualities (Duckworth & Yeager, 2015). Only a *single* nationally representative dataset measures students' belonging in college, using a *single* item. More robust measures of student belonging, of students' uncertainty about their belonging may yield important insights. Further, research should continue to explore how contextual factors—including efforts by the institution overall but also individual instructors and staff members—affect students' belonging, as well as how belonging differs across additional dimensions of student identity. Simultaneously, rigorous field experiments testing interventions to promote belonging should be carried out in varied contexts to understand average and heterogeneous causal effects of belonging on student outcomes (see also NAS, 2017). These efforts will allow practitioners and scholars to better understand—and, hopefully, enhance—all students' belonging, success, and well-being in college.
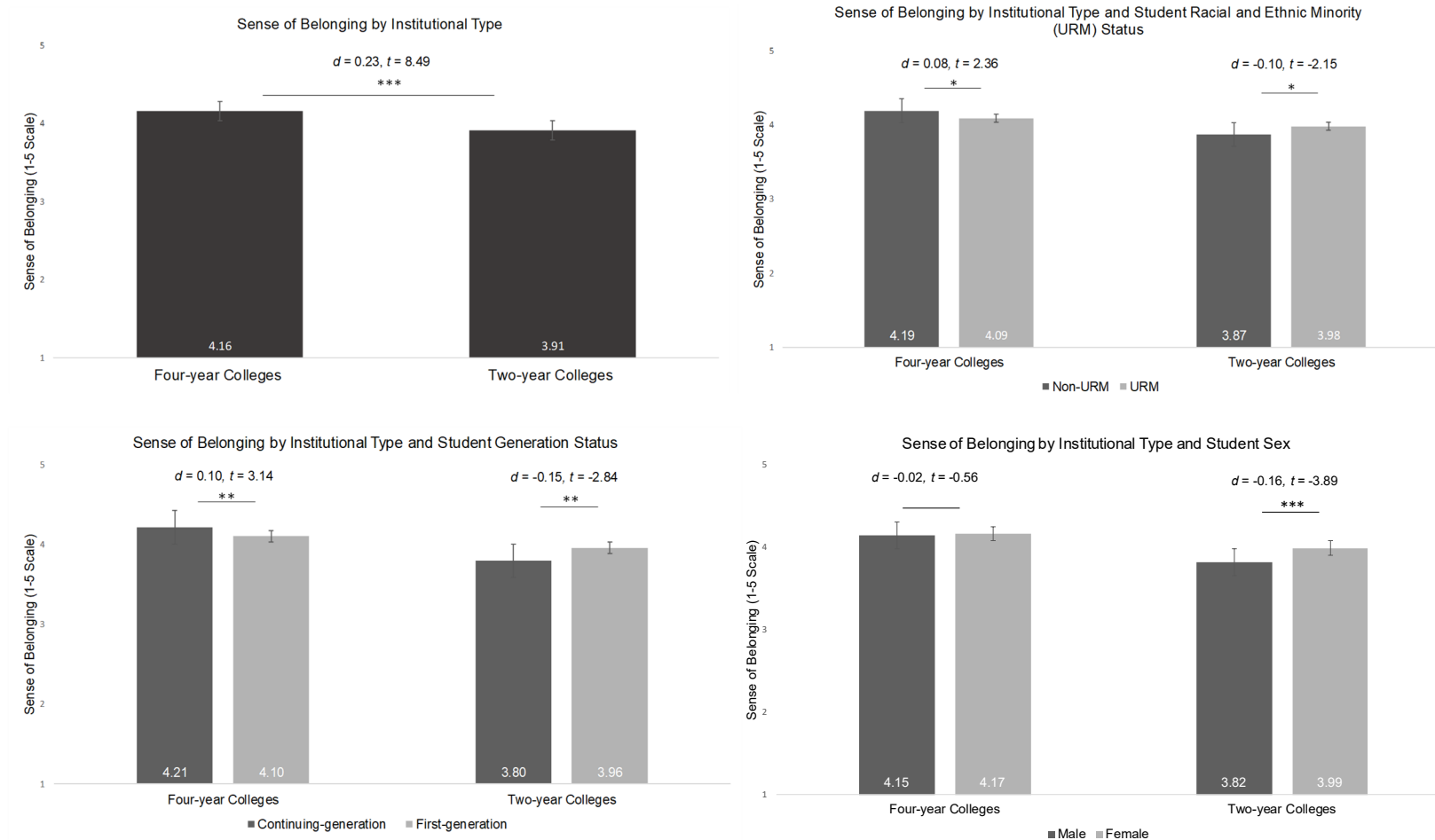
References

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal
attachments as a fundamental human motivation. *Psychological Bulletin*, *117*, 497-529.
https://doi.org/10.1037/0033-2909.117.3.497

Bryk, A. S., Yeager, D. S., Hausman, H., Muhich, J., Dolle, J. R., Grunow, A., … Gomez, L.
(2013). *Improvement research carried out through networked communities:
Accelerating learning about practices that support more productive student mindsets*.
Palo Alto, CA: Carnegie Foundation for the Improvement of Teaching. Retrieved from
https://www.carnegiefoundation.org/wp-
content/uploads/2014/09/improvement_research_NICs_bryk-yeager.pdf

Deil-Amen, R. (2011). Socio-academic integrative moments: Rethinking academic and social
integration among two-year college students in career-related programs. *The Journal of
Higher Education*, *82*, 54-91. https://doi.org/10.1080/00221546.2011.11779085

Duckworth, A. L., & Yeager, D. S. (2015). Measurement matters: Assessing personal qualities
other than cognitive ability for educational purposes. *Educational Researcher*, *44*, 237-
251.

National Academies of Sciences, Engineering, and Medicine. (2017). *Supporting
students' college success: The role of assessment of intrapersonal and interpersonal
competencies*. Washington, DC: National Academies Press.

Scrivener, S., Weiss, M. J., Ratledge, A., Rudd, T., Sommo, C., & Fresques, H. (2015).
*Doubling graduation rates: Three-year effects of CUNY's Accelerated Study in
Associate Programs (ASAP) for developmental education students*. New York, NY:
MDRC. Available from https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2571456.

Strauss, L. C., & Volkwein, J. F. (2004). Predictors of student commitment at two-year and

    four-year institutions. *The Journal of Higher Education*, *75*, 203-227.

    https://doi.org/10.1080/00221546.2004.11778903

Strayhorn, T. L. (2012). *College students' sense of belonging: A key to educational success for*

    all students. New York, NY: Routledge.

Walton, G. M., & Brady, S. T. (2017). The many questions of belonging. In A. J. Elliot, C. S.

    Dweck, & D. S. Yeager (Eds.), *Handbook of competence and motivation (2nd Edition):*

    Theory and application. New York, NY: Guilford Press.

Walton, G. M. & Cohen, G. L. (2007). A question of belonging: Race, social fit, and

    achievement. *Journal of Personality and Social Psychology, 92*, 82-96.

Yeager, D. S., Walton, G. M., Brady, S. T., Akcinar, E. N., Paunesku, D., Keane, L., … Dweck,

    C. S. (2016). Teaching a lay theory before college narrows achievement gaps at scale.

    Proceedings of the National Academy of Sciences, *113*, E3341–E3348.

    https://doi.org/10.1073/pnas.1524360113

Tables and Graphs

Sense of Belonging by Institutional Type

$d = 0.23$, $t = 8.49$
***

Four-year Colleges: 4.16
Two-year Colleges: 3.91

Sense of Belonging by Institutional Type and Student Racial and Ethnic Minority (URM) Status

$d = 0.08$, $t = 2.36$
*

$d = -0.10$, $t = -2.15$
*

Four-year Colleges: Non-URM 4.19, URM 4.09
Two-year Colleges: Non-URM 3.87, URM 3.98

■ Non-URM ■ URM

Sense of Belonging by Institutional Type and Student Generation Status

$d = 0.10$, $t = 3.14$
**

$d = -0.15$, $t = -2.84$
**

Four-year Colleges: Continuing-generation 4.21, First-generation 4.10
Two-year Colleges: Continuing-generation 3.80, First-generation 3.96

■ Continuing-generation ■ First-generation

Sense of Belonging by Institutional Type and Student Sex

$d = -0.02$, $t = -0.56$

$d = -0.16$, $t = -3.89$
***

Four-year Colleges: Male 4.15, Female 4.17
Two-year Colleges: Male 3.82, Female 3.99

■ Male ■ Female

Figure 1. Students' sense of belonging by key institutional and student characteristics. Institutional characteristics include four-year vs. two-year colleges. Student characteristics include (in order) Underrepresented Racial-ethnic Minority (URM) status, generation status, and sex. Error bars represent standard errors. All estimates are weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment.
*p < .05. **p < .01. ***p < .001.

Table 1
Coefficients and Standard Errors from Multivariate Regressions

	Four-Year Colleges					Two-Year Colleges			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	Persistence Year 2	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*		*Persistence Year 2*	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*
Sense of Belonging	0.019***	0.021***	0.014**	0.050***		0.008	-0.000	0.004	0.027
	(0.006)	(0.006)	(0.005)	(0.013)		(0.011)	(0.011)	(0.009)	(0.021)
Public/Private institution (Public=1)	0.055***	0.046***	-0.046***	0.042		0.033	0.014	0.019	0.061
	(0.014)	(0.012)	(0.011)	(0.029)		(0.056)	(0.055)	(0.061)	(0.120)
URM (Black, Hispanic, Native)	0.018	0.026	0.042**	0.070		-0.002	0.008	0.068**	0.036
	(0.013)	(0.017)	(0.013)	(0.042)		(0.028)	(0.027)	(0.023)	(0.047)
Asian	0.033	0.053*	0.051*	-0.128*		0.069	0.033	-0.044	0.135
	(0.023)	(0.024)	(0.025)	(0.058)		(0.061)	(0.061)	(0.043)	(0.105)
Two or more races	-0.005	-0.006	0.026	-0.093		0.084	0.007	0.050	0.064
	(0.026)	(0.029)	(0.019)	(0.058)		(0.050)	(0.062)	(0.057)	(0.115)
First-generation	-0.042**	-0.046*	-0.019	0.009		-0.011	-0.049	-0.027	0.048
	(0.015)	(0.018)	(0.012)	(0.026)		(0.030)	(0.031)	(0.026)	(0.049)
Sex (Female=1)	0.042***	0.042***	0.004	-0.134***		0.045	0.041	0.024	-0.180**
	(0.009)	(0.011)	(0.010)	(0.031)		(0.027)	(0.024)	(0.019)	(0.058)
High School GPA	0.042**	0.045***	0.000	0.045		-0.004	0.009	0.050*	0.072*
	(0.013)	(0.012)	(0.012)	(0.038)		(0.020)	(0.021)	(0.021)	(0.032)
First-year GPA	0.081***	0.076***	0.012	0.037		0.101***	0.098***	-0.009	0.015
	(0.011)	(0.012)	(0.008)	(0.026)		(0.012)	(0.012)	(0.015)	(0.027)
R-Squared	0.11	0.11	0.07	0.21		0.05	0.05	0.07	0.16
Number of Observations[a]	10,500	10,500	6,800	10,500		5,130	5,130	1,900	5,130

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment. To economize on space, we report on coefficients and standard errors on key variables only. All specifications above also include students' ACT/SAT scores, socioeconomic status, first-year GPA, and a measure total debt burden, as noted in main text and Appendix. We also control for self-reported first-year use of campus services and self-reported mental health in the models predicting third-year use of campus services and third-year self-reported mental health outcomes.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

*p < .05. **p < .01. ***p < .001.

Appendix for College Students' Sense of Belonging: A National Perspective

This appendix provides greater detail about the data, measures, and analytic approach used in the present investigation of college students' sense of belonging in a nationally representative sample. It also includes supplemental analyses.

Supplemental analyses include a variety of sensitivity checks to illustrate the robustness of our main results (i.e., the covariate-adjusted OLS estimate highlighted in Table 1 of our manuscript) to alternative model specifications as well as additional descriptive analyses to further examine interesting trends that we could not include in the main manuscript due to space constraints. We believe that the OLS model highlighted in Table 1 ("main results" for brevity) is the most parsimonious model guided by theory and past empirical work as well as a logical starting point for this descriptive exploration of college students' sense of belonging.

In alternative model specifications, we include additional student- and institutional-controls, explore interaction effects, and test alternative empirical strategies used primarily to reduce omitted variable bias through the inclusion of various fixed effects (institution-, year-, and student-fixed effects). We find that our main results are robust to these alternative modeling strategies further bolstering the hypotheses we highlight in the main manuscript. Furthermore, these supplemental analyses also help us contextualize our main results by providing potential bounds on the estimates of association between sense of belonging and key student outcomes.

1 Data

1.1 Data Source

As noted in the main text, we use data from the Beginning Postsecondary Students Longitudinal Study (BPS: 12/14). Sponsored by the National Center of Education Statistics (NCES), BPS: 12/14 follows a nationally representative sample of first-time beginning college

students who started postsecondary education in the 2011-12 academic year. Participants were surveyed initially as part of the National Postsecondary Student Aid Study (NPSAS) in 2012; they were surveyed again during the 2013-2014 academic year for the first follow-up. In addition to the student survey, the BPS: 12/14 dataset includes data from a variety of administrative databases, including the National Student Loan Data System (NSLDS), the National Student Clearinghouse (NSC), and the Central Processing System (CPS). For more information about BPS, please refer to this documentation: https://nces.ed.gov/pubs2016/2016062.pdf. In all, the BPS: 12/14 provides rich data on first-time beginning college students' postsecondary experiences and outcomes through 2013-14.

1.2 Sample

Analyses included all students in the BPS dataset who originally attended a two-year or four-year institution. This was greater than 95% of the sample. Analyses excluded students attending less-than-two-year institutions.

Basic descriptive statistics of various student and school characteristics of the sample are presented in Table A1.

[Insert Table A1 here]

2 Measures

Technical information for the BPS: 12/14 dataset is available online from the NCES website. Documentation relevant to the present study can be found here: https://nces.ed.gov/pubs2016/2016062.pdf. Additional documentation on the sample selection process and NPSAS interview documentation from which the BPS:12/14 sample is drawn from is available here: https://nces.ed.gov/pubs2014/2014182_1.pdf.

2.1 Measure of Belonging

As noted in the main text, belonging was measured with a single item on a 5-point scale. Students who were still enrolled at their original institution were presented with the statement, "I feel that I am a part of [SCHOOL]," while students not still enrolled were presented with the statement, "I felt that I was a part of [SCHOOL]" (for all students: *1=strongly disagree* to *5=strongly agree*). The belonging measure was part of the larger NPSAS survey students were invited to complete starting in February 2012 (spring of their first year of college). Students received a few reminders about the survey. All responses were collected by the end of June 2012.

A similar measure of belonging was included in the follow-up survey conducted two years later (spring 2014). As might be expected, the two measures of belonging are correlated ($r = 0.27$). For the present study, our key independent variable of interest is students' sense of belonging reported during their first year.

As we discuss in the main text, a single-item measure is less than ideal to understand the nuances and variations in students' sense of belonging along different dimensions.[1] Nevertheless, the inclusion of this measure in the latest BPS survey (referred to by the BPS as "belong") represents the first time a measure of belonging has been included in a nationally representative survey of college students in the United States. The measure is consistent with conceptualizations of belonging used in several studies exploring college students' experiences of connectedness and belonging (Wilson et al., 2015; Trujillo et al., 2015; Anderson-Butcher & Conroy, 2002).

The distributions for both the first-year and third-year belonging measures (on 5-point scales) are shown below in Table A2.

[Insert Table A2 here]

2.2 Academic Outcomes

3

The main academic outcomes of interest are students' cumulative persistence/attainment at any institution across years (through 2011-12, 2012-13, 2013-14 for first, second, and third years in college, respectively). For each year, we created indicator variables denoting students' college persistence/attainment. Students who attained a degree, a certificate, or who were still enrolled were coded as 1. Students who left without earning a degree, or those who weren't enrolled were coded as 0. Specifically, the categories "Attained a bachelor's degree", "Attained associate's degree", "Attained certificate", and "No degree still enrolled" were coded as 1; and the categories "No degree, not enrolled" and "No degree, left without return" were coded as 0.

2.3 Use of Campus Services

Students were asked about their use of various campus services at their school in 2011-12 and 2013-14. Students were presented with the following statement "During the [YEAR] school year only, which of the following school services have you used/did you use at [SCHOOL]? (Visiting, emailing, or in any way communicating with and receiving information or help from a school office or department that offers a particular service counts as use of that service.):"

(1) Academic advising

(2) Academic support services

(3) Career services

(4) Financial aid counseling services

Binary indicators for each outcome (*0=Did not use; 1=Used*) were combined into a composite measure ($\alpha = 0.45$). This outcome was measured both in students' first year and in their third year.

2.4 Mental Health

Students were asked to rate their mental health on a 5-point scale. They were asked, "In general, how is your mental health?" *(1=Excellent* to *5=Poor)*. We reverse coded the measure such that higher values indicated better mental health. This outcome was measured both in students' first year and in their third year.

2.5 Student Characteristics

In addition to the outcome variables, the present investigation used a number of variables related to student characteristics, including:

(1) Sex: Indicator variable, coded as 1, for females.[2]

(2) Race: Three indicator variables, coded as 1 each, for racial-ethnic minority status (which included Black, Hispanic, and Native Hawaiian/Other Pacific Islander, non-Hispanic; American Indian or Alaska Native, non-Hispanic), Asian, and students of two or more races.

(3) First-generation: Indicator variable, coded as 1, for students who reported that neither of their parents had a four-year college degree.[3]

(4) Prior academic performance:

1. High school GPA: In the BPS data, students' high school grade point average was reported using 8 categories (D- to D, D to C-, C- to C, C to B-, B- to B, B to A-, A- to A, and missing) along with the exact ranges of GPA within each category. We translated the categorical variable to a 4-point GPA scale (continuous scale) by imputing the mid-point of the GPA category, as provided in the documentation. For example, a GPA in the category "D- to D" was recoded as "0.7", given that the GPA in the category ranged between 0.5 and 0.9. Similarly,

"B- to B" was recoded as "2.7"; the category "B to A-" was recoded as "3.2", and so on.

2. SAT/ACT score: ACT composite score, derived from either a reported ACT score or the reported SAT combined score converted to an estimated ACT composite score, used as a continuous variable.

3. First-year cumulative GPA: cumulative GPA for students' first year of college measured on a 4-point scale and included as a continuous variable.

(5) Socioeconomic status: Socioeconomic status was computed using students' income percentile rank. The percentile rank was calculated separately for dependent students and independent students and then combined into this variable. For dependent students, parents' income was used, and for independent students, the student's own income (including spouse's income if student is married) was used for the rank calculation. In the statistical models, it was included a continuous variable.

(6) Debt burden: Debt burden was computed using a measure of students' total loans, which included all loans other than Direct PLUS loans to parents. In the statistical models, it was included a continuous variable. Analyses using alternative measures of debt burden available in the dataset—such as the *ratio of total aid to student budget* in the first year or the *aid amount exceeding federal need*—provide qualitatively similar results.

(7) Student fixed effects: In supplemental analyses, we included student fixed effects to isolate within-student variation.

(8) Age: In supplemental analyses, we included students' age as of 12/31/2011.

(9) Financial dependence: In supplemental analyses, we included students dependency status in 2011-12 as an indicator variable, coded as 1 for dependent students (dependency

classified according to the federal criteria; see here for more details: https://nces.ed.gov/datalab/powerstats/pdf/bps2014_subject.pdf).

2.6 Institutional Characteristics

The present investigation also used a number of variables related to institutional characteristics, including:

(1) Institution type: An indicator variable denoted whether the school was a two-year institution (attended by 42.9% of the sample) or a four-year institution (attended by 52.5% of the sample).

(2) Institution sector: An indicator variable denoted whether the school was public (attended by 69.8% of the sample) or private (attended by 30.2% of the sample).

(3) Institutional fixed effects: In supplemental analyses, we included institutional fixed effects—an indicator variable representing each unique institution in our sample.

(4) Institutional size: In supplemental analyses, we included the size of the school attended by students in their first year, indexed by total student enrollment.

(5) Institutional diversity: In supplemental analyses, we included percentage URM student enrollment, indexed by the percentage of undergraduates at students' first-year school who were Black, Hispanic, and/or Native.

(6) Institutional expenditure: In supplemental analyses, we included the natural log of per-full-time-equivalent (FTE)[4] expenditures at the school attended by students in their first year.

(7) Institutional expenditure on academic, institutional support, and student services: In supplemental analyses, we also include the natural log of per-FTE expenditures on

academic, institutional support, and student services at the school attended by students in their first year.

3 Analytic Approach

Ordinary least squares (OLS) regression was used to examine the association between belonging and student outcomes. The empirical model takes the form:

$$Outcome_i \; = \; \alpha + \beta X_i \; + \varepsilon_i$$

Where $Outcome_i$ is the outcome of student i and X_i denotes the vector of student characteristics. The above model is estimated separately for students attending four-year and two-year colleges. We use the analysis weights provided by NCES to account for students' unequal probability of selection and other weight adjustments, and report design-adjusted standard errors. Specifically, sampling weights (wta000) and associated replicate weights (wta001-wta200) were included with Stata's SVY command set, using the BRR variance estimation technique. For models with dichotomous outcome variables, the application of OLS yields coefficient estimates that may be interpreted as linear probabilities.

It is important to note that given the correlational nature of the data, we cannot make any causal claims about the belonging effects observed in Table 1. However, we provide some context to interpret the direction and magnitude of the effects we observe in our main results before describing our supplemental analyses and robustness checks. We find that at four-year colleges, a one point increase in students' sense of belonging in the first year (roughly equivalent to a standard-deviation increase) is associated with approximately a two-percentage point increase in the likelihood of a student persisting through the second and third years of college, a 1.4 point increase in use of campus services in the third year (roughly equivalent to a 0.05 standard-deviation increase in terms of a standardized measure of use of campus services across

8

the sample), and a 0.05 point increase in self-reported mental health (roughly equivalent to a 0.05 standard-deviation increase in standardized mental health measure across the sample). In contrast, at two-year colleges, we do not find any significant associations between students first-year sense of belonging and subsequent college outcomes.

4 Supplemental Analyses

4.1 Student URM and Generation-Status Intersectionality

Figure A1 characterizes students' belonging by key school and student characteristics, explored jointly. We find very similar patterns to those reported in the main text. Students who identify as URM *and* FG report lower belonging than their peers (White and continuing-generation students, respectively) in four-year colleges, with the reverse being true in two-year colleges. Of note, students who identify as *both* URM and FG report, on average, similar belonging to students who identify as *either* URM or FG. For example, when we compare the differences in self-reported belonging of URM *and* FG students with that of non-URM *and* CG students, the differences are similar to those reported in the main text when those identities are explored independently for four-year and two-year colleges, respectively ($t = 2.47$, $d = 0.13$, $p = 0.014$; $t = -2.85$, $d = -0.21$, $p = 0.005$).

[Insert Figure A1 here]

4.2 Race-, Sex-, and Generation-based Gaps in Outcomes Without Adjusting for Belonging

Table A3 presents the regression results for models with the same set of student characteristics as described earlier including demographics and prior academic performance as predictors of performance, persistence, and integration but omitting belonging as a predictor. These models provide the magnitudes of race-, sex, and generation-based gaps in academic outcomes. For example, the coefficient on URM can be interpreted as the gap in outcomes

9

between URM and white students without adjusting for belonging. Comparing these results to those in Table 1 illustrate that the magnitudes of racial-, sex-, and generation-based gaps in college outcomes are not attenuated by the inclusion of students' sense of belonging.

[Insert Table A3 here]

4.3 Belonging and Student Diversity

Do minority students report higher levels of mean belonging when they attend schools with greater minority enrollment? We do not see evidence for this in the present data, at either four-year or two-year schools. While we see greater minority student enrollments at two-year schools, on average, compared to four-year schools (*Two-year Average Minority Enrollment Mean* = 38%, *SD* = 21%, *Four-year Average Minority Enrollment Mean* = 28%, *SD* = 22%, *t* = 11.94, *p* < 0.001), we do not see patterns at either four-year or two-year schools that are consistent with the hypothesis that minority students attending institutions with greater minority (or greater low-income) enrollment will report higher mean levels of belonging.

To illustrate this, Table A4 presents mean levels of belonging at two- and four-year schools broken down by race and by institutional minority enrollment quartiles.

[Insert Table A4 here]

4.4 Analyses of Additional Outcomes

For our primary analyses, we focused on dependent measures collected in students' second and third years in order to ensure that the outcomes were determined *after* the collection of students' self-reported belonging during their first year. However, as noted previously, academic, campus services use, and mental health outcomes were also assessed during students' first year.

10

Table A5 presents the regression results for models that examine the association between students first-year belonging and the first-year college outcomes. Similar to the findings for outcomes assessed later in college, we find modest, positive associations between students' sense of belonging and the contemporaneous first-year outcomes. However, because these measures were collected concurrently, we recommend caution in interpreting these results.

[Insert Table A5 here]

4.5 Non-Linear Effects of Belonging

We also tested a few alternative specifications of the belonging measure to explore possible non-linear relationships between belonging and college success. First, we explored if there was a concave/convex relationship between belonging and second-year college persistence by including a quadratic belonging term. For example, in four-year colleges, the coefficient on the quadratic term was negative and statistically significant at the 5 percent level (β = -0.011, *SE* = 0.005, *t* = -2.42, *p* = 0.016). The effect of belonging, as measured by the linear term, was still significant and positive in these models (β = 0.095, *SE* = 0.032, *t* = 2.93, *p* = 0.004) providing suggestive evidence that at very high levels of belonging, the effects of belonging on persistence is lower. In two-year colleges, we do not observe any statistically significant effects for the quadratic or linear terms (Quadratic β = -0.009, *SE* = 0.009, *t* = -1.01, *p* = 0.314; Linear β = 0.07, *SE* = 0.061, *t* = 1.14, *p* = 0.257).

Next, we included dichotomous indicator variables, coded as 1 each, for students who "strongly disagreed", "disagreed", "neither agreed nor disagreed", "agreed", or "strongly agreed" with the statement that "I felt that I was a part of [SCHOOL]." The last category was excluded as the reference category. As shown in Table A6, we found that students who reported very low levels of belonging ("strongly disagreed") were significantly less likely to persist in four-year

11

colleges (14 percentage points lower than those who "strongly agreed"). Of note, although only a small portion of students in four-year colleges report such low levels of belonging (see Table A2), URM and FG students report this very low belonging at higher rates than their White ($\chi^2 = 15.47$, $p < 0.001$) and continuing generation peers ($\chi^2 = 8.00$, $p = 0.005$).

Together, these results show that the association between belonging and key outcomes at four-year colleges is likely more complex than simple linear models can illustrate. As we note in the main text, more robust measures are needed to continue to unpack and understand these relationships.

[Insert Table A6 here]

4.6 Sensitivity Checks

Finally, we also carried out a number of robustness checks to explore the sensitivity of the effects of students' sense of belonging on our outcomes of interest.

(1) The positive associations between students' sense of belonging in the first-year of their college and key college outcomes in four-year colleges is robust to the inclusion of students' self-reports of pre-college academic self-efficacy, measured retrospectively during their first year of college. Specifically, self-efficacy was measured at the same time as first-year belonging with the item "Before I attended [SCHOOL], I was confident I had the ability to succeed there as a student"; students responded on a 5-point scale (*1=Strongly disagree* to *5=Strongly agree*). Across outcomes in Table 1, the belonging coefficient remains significant at the 5 percent significance level; $\beta = 0.017$, $SE = 0.006$, $t = 3.06$, $p = 0.003$; $\beta = 0.021$, $SE = 0.006$, $t = 3.31$, $p = 0.001$; $\beta = 0.013$, $SE = 0.005$, $t = 2.69$, $p = 0.008$; $\beta = 0.045$, $SE = 0.013$, $t = 3.54$, $p = 0.001$.

(2) Next, we re-conducted the primary analyses with the inclusion of interactions between belonging and demographic variables to examine whether the observed relationships between belonging and each of the key outcomes varies by race, generation, or sex. For example, in models predicting second-year persistence at four-year colleges, we included interaction terms such as Belonging x URM ($\beta = 0.014$, $SE = 0.013$, $t = 1.13$, $p = 0.259$), Belonging x FG ($\beta = 0.002$, $SE = 0.016$, $t = 0.15$, $p = 0.880$), and Belonging x Sex ($\beta = 0.011$, $SE = 0.013$, $t = 0.90$, $p = 0.367$). In none of the models predicting our core outcomes were these interaction terms statistically significant at the 5 percent significance level; thus, they are not included in the models reported in Table 1.

(3) The positive associations between belonging and the key outcomes at four-year colleges are also robust to the inclusion of a measure of selectivity of the college attended by students. This selectivity measure, from the BPS dataset, is only available for four-year schools and was developed using information on the admission criteria of the college and the average pre-college academic achievement of the admitted students. Open-admission institutions that have no/minimal admission requirements were classified as one category. Non-open admission institutions were classified as "Very Selective", "Moderately Selective", or "Minimally Selective" using an index that was created from two variables: 1) the centile distribution of the percentage of students who were admitted (of those who applied); and 2) the centile distribution of the midpoint between the 25th and 75th percentile SAT/ACT combined scores reported by each institution (ACT scores were converted into SAT equivalents). Furthermore, the positive associations between belonging and student persistence are not significantly moderated by institutional selectivity. However, the positive associations between belonging and use of campus services and mental health seem to be concentrated at moderately- and very-selective

institutions. See Table A7, which illustrates these patterns across selectivity categories for four-year institutions.

[Insert Table A7 here]

We tested for interactions between belonging and institutional selectivity variables to examine whether the links between belonging and the key outcomes at four-year colleges differ as a function of institutional selectivity. For example, we included interaction terms such as Belonging x Moderate-High Selective Indicator (*1=Yes, 0 =No*). None of these interaction terms were statistically significant at the 5 percent significance level ($\beta = 0.020$, *SE* = 0.014, *t* = 1.44, *p* = 0.150; $\beta = 0.029$, *SE* = 0.015, *t* = 1.90, *p* = 0.059; $\beta = 0.001$, *SE* = 0.011, *t* = 0.06, *p* = 0.956; $\beta = 0.016$, *SE* = 0.043, *t* = -0.38, *p* = 0.706 across four outcomes) and are thus not included in the model reported in Table A7.

(4) We also tested whether, at four-year colleges, the belonging effects on student outcomes were robust to the inclusion of:

> (a) student age and financial dependence. We find that the magnitude and statistical significance of the belonging coefficients across outcomes remain qualitatively similar with the addition of this variable (across outcomes in Table 1, $\beta = 0.021$, *SE* = 0.005, *t* = 3.82, *p* < 0.001 0; $\beta = 0.023$, *SE* = 0.005, *t* = 4.44, *p* < 0.001; $\beta = 0.013$, *SE* = 0.005, *t* = 2.81, *p* = 0.005; $\beta = 0.05$, *SE* = 0.013, *t* = 3.90, *p* < 0.001).

> (b) a variable indexing institutional size (measured as total student enrollment at students' first-year college). We find that the magnitude and statistical significance of the belonging coefficients across outcomes remain qualitatively similar with the addition of this variable (across outcomes in Table 1, $\beta = 0.019$, *SE* = 0.006, *t* = 3.36, *p* = 0.001 0; β

14

= 0.021, *SE* = 0.006, *t* = 3.60, *p* < 0.001; β = 0.014, *SE* = 0.005, *t* = 2.84, *p* = 0.006; β = 0.05, *SE* = 0.013, *t* = 3.97, *p* < 0.001).

(c) a variable indexing percentage URM student enrollment (measured as the percentage of undergraduates who are Black, Hispanic, and/or Native at students' first-year college). We find that the magnitude and statistical significance of the belonging coefficients across outcomes remain qualitatively similar with the addition of this variable (across outcomes in Table 1, β = 0.019, *SE* = 0.005, *t* = 3.38, *p* = 0.001 0; β = 0.021, *SE* = 0.006, *t* = 3.67, *p* < 0.001; β = 0.013, *SE* = 0.005, *t* = 2.81, *p* = 0.005; β = 0.05, *SE* = 0.013, *t* = 3.99, *p* < 0.001).

(d) a variable indexing the natural log of institutional expenditure per-full-time-equivalent (FTE). We find that the magnitude and statistical significance of the belonging coefficients across outcomes remain qualitatively similar with the addition of this variable (across outcomes in Table 1, β = 0.019, *SE* = 0.005, *t* = 3.58, *p* < 0.001 0; β = 0.022, *SE* = 0.006, *t* = 4.03, *p* < 0.001; β = 0.013, *SE* = 0.005, *t* = 2.48, *p* = 0.014; β = 0.043, *SE* = 0.014, *t* = 3.12, *p* = 0.002).

(e) a variable indexing the natural log of institutional expenditure for academic, institutional support, and student services per-FTE: Because the availability of campus services across institutions is not directly measured in the data set, we indirectly controlled for that using a proxy measure. The proxy measure captures if (and the intensity, if so) of the provision of these services using the institution's expenditure patterns on these items. We find that the magnitude and statistical significance of the belonging coefficients on campus use of services remain qualitatively similar with the addition of this variable (β = 0.013, *SE* = 0.005, *t* = 2.55, *p* = 0.012).

(5) Also, see Tables A8 and A9 for pair-wise correlations of all key variables used in the models.

[Insert Tables A8 and A9 here]

(6) Next, we included institutional fixed effects that control for all time-invariant institutional characteristics to control for how schools in the sample may differ in their ability to offer support services and/or proactively engage with students to promote their sense of belonging. Coefficients on the institution fixed effects indicate how the outcome measures vary with systematic features of particular institutions that are constant over time, and capture variation in student outcomes across institutions. Because institution fixed effects account for cross-institution variation in the outcomes, the coefficients on students' sense of belonging in these models are estimated using within-institution variation.

[Insert Table A10 here]

Table A10 shows that the results are qualitatively similar to the main results across the model specifications. Yet, it is important to interpret these results with caution especially in a nationally representative dataset like the BPS where only few students from the same institution are included in the sample. To illustrate: students in our sample are clustered in approximately 1,356 institutions in the first-year of college; 973 of these institutions (71.8%) have less than 20 students in the sample (a reporting guideline used by What Works Clearinghouse for valid subgroup analysis), with 537 having less than 10 students included in the sample. There are 40 institutions from which only one student is interviewed resulting in those institutions not contributing to the estimated effects, due to no within-institution variation in the measures of interest. This problem gets further exacerbated when we analyze subgroups of students (by race, generation, sex, and others), given the need for within-institution variation required for those parameters to be estimated accurately.

16

(7) Given the longitudinal nature of the data and multiple measures across two years for each student in the sample (first year and third year, as described earlier), as an alternative specification, we added student fixed effects and year fixed effects to our regression models. In these specifications, the main coefficient of interest on students' sense of belonging must be interpreted as the association between within-student change in students' sense of belonging between years one and three and the outcome variables.

For students who drop out or who have not responded to the belonging question in the third year, we impute the scale midpoint value of 3 (representing a response of "*neither agree nor disagree*" with the statement "I feel like I am a part of [SCHOOL]"). We make this conservative assumption to ensure that we can estimate the model for the persistence outcomes. Specifically, in the third year only, students who persisted in any postsecondary institution in the US have non-missing values for their sense of belonging with the institution in the third-year. For those who were not enrolled in any postsecondary institution in the third year, and therefore classified as "not persisted" (or persist = 0 in terms of our outcome of interest), we have missing values on student belonging (see BPS documentation that clarifies how respondents who were not currently enrolled in postsecondary education at the time of the interview and with no immediate plans to return, received condensed Enrollment and Education Experiences sections, which did not include the questions about belonging). In other words, because those students who don't report their sense of belonging (i.e., they legitimately skip the question because they are not enrolled in any institution) also do not persist, this results in an estimation issue in models with persistence as the dependent variable of interest.

Given the conservative nature of this assumption, and to maintain consistency, we use the imputed belonging value models to estimate the student fixed effect models across all outcomes—such as the use of campus services, and mental health. However, for those outcome variables, results are robust to alternative estimations without the use of imputed values (i.e., results on the truncated sample of students who persist and answer the questions in the third year; results available from the authors on request). In Table A11, we present the results of models that include student and time fixed effects.

[Insert Table A11 here]

In these models, we see a positive association between students' sense of belonging and all relevant outcomes in both two-year and four-year colleges. In terms of magnitude, a one-unit increase in sense of belonging, within-student, between first and third years is positively associated with roughly a three-percentage point increase in the likelihood of persistence through year three, even after controlling for all time-invariant student characteristics (through the use of student fixed effects). We observe similar positive outcomes for the other outcomes: GPA, use of campus services, and self-reported mental health.

(8) Given that we would expect GPA effects to be muted when only students who persist through 3 years are included in analyses (as in the model presented in the main text), we carry out one more robustness check. Even if we assume that a student who persists earns the lowest possible GPA in year 3 (i.e., we impute a value of GPA = 0 for those students who are missing GPA values in year 3), we observe positive effects of belonging on student's performance; as expected, these are of slightly greater magnitude than the model estimated using listwise deletion of all students who did not persist through the third year (for four-year colleges: $\beta = 0.08$, $SE = 0.015$, $t = 5.57$, $p = <0.001$; two-year colleges $\beta = 0.15$, $SE = 0.023$, $t = 6.49$, $p = <0.001$).

(9) Given the concurrent measurement of first-year GPA and first-year belonging, we take a conservative approach and include first-year GPA as a control variable in all of our main models. However, there is reason to hypothesize that feelings of low belonging in the first year may affect students' academic performance in the first year (see Table A5). Thus, one may reasonably wonder whether we have been too conservative and over-controlled for academic performance by including first-year GPA in our models. Therefore, in this final sensitivity check, we illustrate how the effects of belonging may be slightly attenuated across our models when first-year GPA is included.

[Insert Table A12 here]

In Table A12, we see a slightly stronger, positive association between students' sense of belonging and the relevant outcomes as compared to the base models (Table 1).

Notes

(1) A single-item measure of students' belonging on college campuses has several limitations including potential scale- and measurement-invariance across subgroups and/or institutional contexts (see Hopkins & King, 2010, for recommendations on how to mitigate some of these issues inherent in survey methodology). Additionally, including few more items measuring the underlying construct from validated belonging scales in large nationally representative surveys of college students will be essential to move research forward in this area. Inclusion of multiple items would also enable more rigorous analysis of measurement-invariance and scale-invariance across student and institutional characteristics in future research.

(2) In reviewing the BPS documentation (https://nces.ed.gov/pubs2016/2016062.pdf see page C4), we discovered that the BPS dataset and documentation call the variable "gender". However, the phrasing of the question itself is actually aligned with "sex" rather than "gender." Therefore, we have renamed the variable to "sex" throughout the manuscript. We thank a reviewer for calling our attention to this.

(3) While we adopted a common definition of first-generation college student status used in the literature for our analysis (i.e., neither parent had a four-year college degree), our results are robust to alternative definitions of first-generation status (i.e., (a) that neither parent earned a two-year degree or higher; (b) and that neither parent participated in any post-secondary college). For example, when alternative first-generation definition (a) is used, the results for the outcomes in Table 1 remain quite similar, $\beta = 0.021$, $SE = 0.005$, $t = 3.83$, $p = 0.001\ 0$; $\beta = 0.023$, $SE = 0.005$, $t = 4.36$, $p < 0.001$; $\beta = 0.014$, $SE = 0.005$, $t = 2.87$, $p = 0.005$; $\beta = 0.05$, $SE = 0.013$, $t = 3.92$, $p < 0.001$. When alternative first-generation definition (b) is used the results for the outcomes in Table 1 remain quite similar, $\beta = 0.021$, $SE = 0.005$, $t = 3.84$, $p < 0.001$; $\beta = 0.023$,

SE = 0.005, *t* = 4.38, *p* < 0.001; *β* = 0.014, *SE* = 0.005, *t* = 2.86, *p* = 0.005; *β* = 0.05, *SE* = 0.013, *t* = 3.93, *p* < 0.001.

(4) Per-FTE expenditure information at the institution-level are not available directly in the BPS dataset. Therefore, using the Integrated Postsecondary Education Data System [IPEDS] institution identifier, we merged relevant information from the Delta Cost Project (https://nces.ed.gov/ipeds/deltacostproject/; AY 2011-12) with our analytical sample. We follow IES guidelines for calculating FTE enrollments and use that figure to calculate all expenditure values per-FTE at the institution-level. FTE enrollments are derived from the enrollment by race/ethnicity section of the fall IPEDS enrollment survey. The FTE of an institution's part-time enrollment is estimated by multiplying part-time enrollment by factors that vary by control and level of institution and level of student; the estimated FTE of part-time enrollment is then added to the full-time enrollment of the institution. This formula is used by the U.S. Department of Education to produce the FTE enrollment data published annually in the Digest of Education Statistics. Please refer to documentation here: https://nces.ed.gov/ipeds/deltacostproject/download/DCP_Data_File_Documentation_1987_2012.pdf for further details.

References

Anderson-Butcher, D., & Conroy, D. E. (2002). Factorial and criterion validity of scores of a measure of belonging in youth development programs. *Educational and Psychological Measurement*, *62*, 857-876.

Hopkins, D., & King, G. (2010). Improving anchoring vignettes: Designing surveys to correct interpersonal incomparability. *Public Opinion Quarterly*, *74(2)*, 201–222.

Trujillo, G., Aguinaldo, P. G., Anderson, C., Bustamante, J., Gelsinger, D. R., Pastor, M. J., ... & Riggs, B. (2015). Near-peer STEM mentoring offers unexpected benefits for mentors from traditionally underrepresented backgrounds. *Perspectives on Undergraduate Research and Mentoring*, *4*.

Wilson, D., Jones, D., Bocell, F., Crawford, J., Kim, M. J., Veilleux, N., ... & Plett, M. (2015). Belonging and academic engagement among undergraduate STEM students: A multi-institutional study. *Research in Higher Education*, *56*, 750-776.

Tables and Graphs
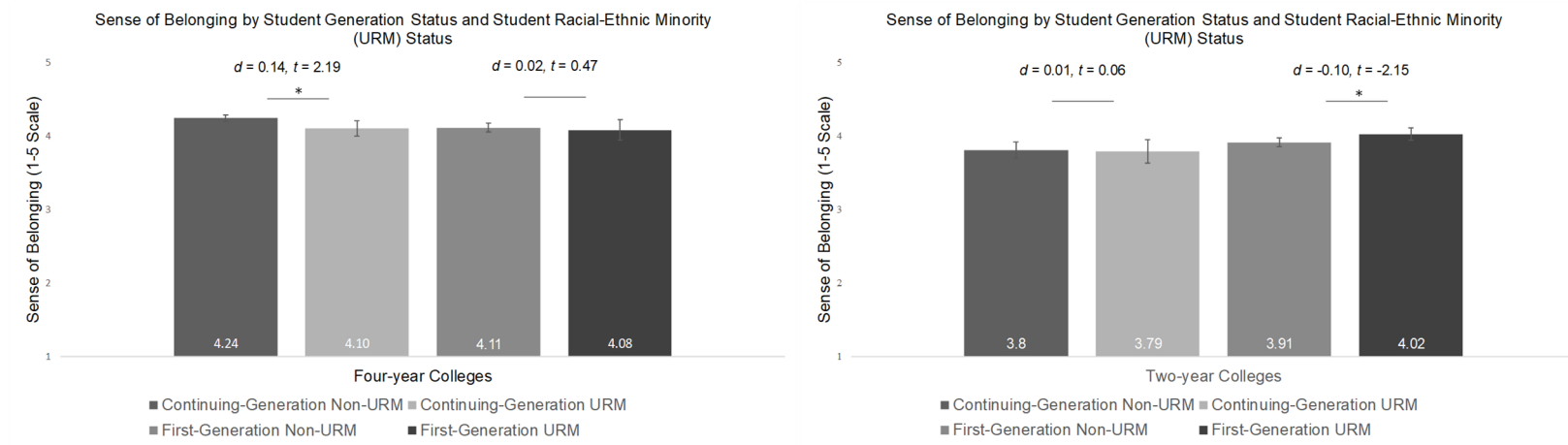
Figure A1. Students' sense of belonging by student generation status and Underrepresented Racial-ethnic Minority (URM) status explored jointly. Error bars represent standard errors. Sample size rounded to the nearest 10 as per dataset guidelines. All estimates are weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment.
*p < .05. **p < .01. ***p < .001.

Table A1
Descriptive Statistics of Key Variables

Key Characteristics	Four-Year Colleges			Two-Year Colleges		
	M (95% CI)	*SD*	*N*	*M*	*SD*	*N*
Sense of Belonging	4.16 (4.12-4.21)	1.10	14,250	3.91 (3.88-3.95)	1.07	9,500
Academic Outcomes						
First year GPA	2.98 (2.96-3.01)	0.84	13,740	2.86 (2.82-2.90)	0.88	8,870
Third year GPA (Estimated)	3.18 (3.16-3.19)	0.60	12,420	3.07 (3.04-3.10)	0.63	6,970
First Year Cumulative Persistence	0.93 (0.92-0.94)	0.27	14,250	0.77 (0.75-0.80)	0.39	9,500
Second Year Cumulative Persistence	0.82 (0.81-0.83)	0.40	14,250	0.58 (0.55-0.61)	0.47	9,500
Third Year Cumulative Persistence	0.80 (0.79-0.81)	0.42	14,250	0.57 (0.54-0.60)	0.47	9,500
Other Outcomes						
First Year Use of Campus Services	0.48 (0.47-0.49)	0.27	14,250	0.36 (0.35-0.37)	0.25	9,500
First Year Mental Health	4.13 (4.09-4.16)	0.99	14,250	4.07 (4.04-4.11)	0.92	9,500
Third Year Use of Campus Services	0.46 (4.32-4.38)	0.27	7,950	0.39 (0.35-0.37)	0.27	3,150
Third Year Mental Health	3.97 (3.93-4.00)	1.04	14,250	3.97 (3.93-4.01)	0.94	9,500
Student and School Characteristics						
First-generation	0.47 (0.46-0.49)	0.52	13,740	0.73 (0.72-0.75)	0.42	8,980
Black or African American	0.14 (0.12-0.15)	0.36	14,250	0.14 (0.13-0.16)	0.32	9,500
Hispanic	0.14 (0.13-0.15)	0.36	14,250	0.25 (0.23-0.26)	0.36	9,500
Native American/Pacific Islander	0.01 (0.01-0.02)	0.11	14,250	0.02 (0.01-0.02)	0.11	9,500
Asian	0.07 (0.06-0.08)	0.26	14,250	0.04 (0.04-0.05)	0.19	9,500
White	0.61 (0.59-0.62)	0.51	14,250	0.52 (0.50-0.54)	0.47	9,500
Two or more races	0.04 (0.03-0.04)	0.20	14,250	0.03 (0.03-0.04)	0.03	5,780
Composite ACT/SAT score	1060 (1051-1068)	198	11,110	925 (181-916)	181	11,110
High School GPA	3.17 (3.15-3.18)	0.60	13,010	2.80 (2.78-2.83)	0.63	8,450
Socioeconomic Status (Income Percentile Rank)	55 (54-56)	31	14,250	45 (43-46)	31	9,500
Debt Burden (Total Federal Loans)	4,053 (3,930-4,176)	4,765	14,250	1,361 (1,265-1,457)	2,697	9,500
Public Institution	0.59 (0.57-0.61)	0.51	14,250	0.89 (0.88-0.91)	0.29	9,500

Note. All estimates are weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment. Sample size rounded to the nearest 10 as per dataset guidelines.

Table A2

Distribution of Students' Sense of Belonging on 5-point Scale

"I feel like I am a part of [SCHOOL]"	Four-Year Colleges		Two-Year Colleges	
	N	*Percent*	*N*	*Percent*
First year Sense of Belonging				
Strongly Disagree	520	3.65	470	4.97
Somewhat Disagree	700	4.95	560	5.95
Neither Disagree nor Agree	1,800	12.67	2,030	21.41
Somewhat Agree	4,150	29.15	2,660	28.01
Strongly Agree	7,060	49.59	3,770	39.65
Third year Sense of Belonging				
Strongly Disagree	300	4.08	120	4.87
Somewhat Disagree	480	6.56	190	7.78
Neither Disagree nor Agree	1,070	14.51	530	21.69
Somewhat Agree	2,040	27.70	660	26.64
Strongly Agree	3,460	47.15	960	39.03

Note. All estimates are weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) used in above tabulations. Sample size rounded to the nearest 10 as per dataset guidelines.

Table A3

Coefficients and Standard Errors from Multivariate Regressions (Unadjusted for Sense of Belonging)

	Four-Year Colleges					Two-Year Colleges			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	Persistence Year 2	Persistence Year 3	Use of Campus Services Year 3	Self-reported Mental Health Year 3		Persistence Year 2	Persistence Year 3	Use of Campus Services Year 3	Self-reported Mental Health Year 3
Public/Private (Public=1)	0.053***	0.044***	-0.055***	0.076		0.030	0.014	0.034	0.067
	(0.014)	(0.012)	(0.011)	(0.040)		(0.056)	(0.055)	(0.062)	(0.120)
URM (Black, Hispanic, Native)	0.017	0.026	0.051***	0.130*		-0.003	0.008	0.070**	0.100
	(0.013)	(0.017)	(0.013)	(0.051)		(0.028)	(0.027)	(0.023)	(0.051)
Asian	0.033	0.053*	0.059*	-0.228***		0.070	0.033	-0.026	0.110
	(0.023)	(0.023)	(0.024)	(0.064)		(0.060)	(0.061)	(0.040)	(0.106)
Two or more races	-0.005	-0.005	0.032	-0.084		0.084	0.007	0.037	0.102
	(0.026)	(0.029)	(0.020)	(0.066)		(0.050)	(0.062)	(0.062)	(0.114)
First-generation	-0.043**	-0.047*	-0.020	0.009		-0.010	-0.049	-0.023	0.016
	(0.015)	(0.019)	(0.012)	(0.032)		(0.030)	(0.031)	(0.027)	(0.055)
Sex (Female=1)	0.042***	0.041***	0.007	-0.211***		0.046	0.041	0.031	-0.209**
	(0.009)	(0.011)	(0.010)	(0.030)		(0.027)	(0.024)	(0.020)	(0.065)
High School GPA	0.043**	0.048***	0.011	0.120**		-0.004	0.009	0.046*	0.113**
	(0.013)	(0.012)	(0.013)	(0.044)		(0.020)	(0.021)	(0.020)	(0.037)
R-Squared	0.10	0.10	0.03	0.03		0.05	0.05	0.04	0.03
Number of Observations[a]	10,500	10,500	6,800	10,500		5,130	5,130	1,900	5,130

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment. To economize on space, we report on coefficients and standard errors on key variables only. All specifications include students' ACT/SAT scores, socioeconomic status, first-year GPA, and a measure total debt burden, as noted in main text and Appendix. We also control for self-reported first-year use of campus services and first-year self-reported mental health in the models predicting third-year use of campus services and third-year self-reported mental health outcomes.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

*p < .05. **p < .01. ***p < .001.

Table A4
Belonging and Institutional Student Diversity

	Four-Year Colleges					Two-Year Colleges			
	Mean Levels of Belonging					Mean Levels of Belonging			
	All Students (N)b	*White Students (N)b*	*Asian Students (N)b*	*Minority Students (N)b*		*All Students (N)b*	*White Students (N)b*	*Asian Students (N)b*	*Minority Students (N)b*
0 – 25 percent Minority Enrollment	4.21	4.24	4.24	4.06		3.92	3.88	4.16	4.08
	(6,840)	(5,060)	(340)	(1,170)		(3,430)	(5,060)	(60)	(700)
25-50 percent Minority Enrollment	4.11	4.08	4.12	4.13		3.91	3.84	4.11	3.98
	(4,600)	(2,320)	(260)	(1,810)		(3,320)	(2,320)	(110)	(1,400)
25-50 percent Minority Enrollment	4.07	3.94	4.13	4.11		3.87	3.87	3.58	3.91
	(2,240)	(550)	(110)	(1,500)		(2,000)	(550)	(135)	(1,310)
25-50 percent Minority Enrollment	4.05	4.32	3.47	4.05		3.97	3.82	3.89	3.99
	(560)	(40)	(10)	(490)		(730)	(40)	(40)	(610)
All Institutions	4.16	4.19	4.17	4.09		3.91	3.87	3.94	3.98
Number of Observations [a]	14,250	7,960	720	4,970		9,500	4,810	340	4,030

Note. The mean levels of belonging reported by students disaggregated by the institutional-level student diversity quartiles (expressed in terms of percent minority enrollment) is shown across the rows. The number of students in each cell is shown in parentheses below. All estimates are weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment.

[a,b] Sample size rounded to the nearest 10 as per dataset guidelines.

Table A5

Coefficients and Standard Errors from Multivariate Regressions of Early College Outcomes

	Four-Year Colleges					Two-Year Colleges			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	GPA Year 1	*Persistence Year 1*	*Use of Campus Services Year 1*	*Self-reported Mental Health Year 1*		*GPA Year 1*	*Persistence Year 1*	*Use of Campus Services Year 1*	*Self-reported Mental Health Year 1*
Sense of Belonging	0.063**	0.014***	0.023***	0.164***		0.038	0.019	0.009	0.041
	(0.022)	(0.004)	(0.003)	(0.016)		(0.020)	(0.010)	(0.006)	(0.026)
Public/Private (Public=1)	-0.117***	0.015	-0.027***	0.089*		-0.442***	0.051	0.031	0.032
	(0.026)	(0.008)	(0.008)	(0.041)		(0.102)	(0.055)	(0.023)	(0.080)
URM (Black, Hispanic, Native)	-0.146***	0.018	0.042***	0.121***		-0.123*	0.036	0.015	0.160**
	(0.040)	(0.013)	(0.009)	(0.036)		(0.052)	(0.023)	(0.014)	(0.054)
Asian	0.052	0.012	0.052***	-0.220***		0.223*	0.025	0.069	-0.071
	(0.042)	(0.015)	(0.014)	(0.058)		(0.106)	(0.053)	(0.041)	(0.134)
Two or more races	-0.105	-0.030	0.021	-0.005		-0.009	0.002	-0.039	0.068
	(0.070)	(0.022)	(0.017)	(0.073)		(0.123)	(0.048)	(0.039)	(0.149)
First-generation	-0.062	-0.030**	-0.005	-0.010		-0.074	-0.014	0.009	-0.103
	(0.034)	(0.011)	(0.008)	(0.034)		(0.048)	(0.024)	(0.012)	(0.055)
Sex (Female=1)	0.120***	0.037***	0.027***	-0.159***		0.078	0.059**	0.026*	-0.083
	(0.026)	(0.008)	(0.008)	(0.026)		(0.054)	(0.022)	(0.012)	(0.047)
High School GPA	0.386***	0.021*	0.040***	0.169***		0.304***	-0.000	0.009	0.126***
	(0.030)	(0.009)	(0.007)	(0.027)		(0.037)	(0.016)	(0.010)	(0.036)
R-Squared	0.19	0.04	0.05	0.06		0.09	0.02	0.04	0.03
Number of Observations [a]	10,500	10,800	10,800	10,800		5,130	5,490	5,490	5,490

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment. To economize on space, we report on coefficients and standard errors on key variables only. All specifications also include students' ACT/SAT scores, socioeconomic status, and a measure total debt burden, as noted in the main text and Appendix.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

*p < .05. **p < .01. ***p < .001.

Table A6

Coefficients and Standard Errors from Multivariate Regressions Exploring Alternate Specification of Belonging

	Four-Year Colleges					Two-Year Colleges			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	Persistence Year 2	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*		*Persistence Year 2*	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*
Low Sense of Belonging ("Strongly disagreed" with statement "I feel like I am a part of [school]"=1)	-0.140***	-0.132**	-0.040	-0.126		-0.056	-0.005	0.029	-0.138
	(0.036)	(0.041)	(0.026)	(0.076)		(0.064)	(0.058)	(0.040)	(0.126)
Public/Private (Public=1)	0.053***	0.045***	-0.046***	0.044		0.028	0.008	0.026	0.059
	(0.014)	(0.011)	(0.011)	(0.029)		(0.055)	(0.054)	(0.062)	(0.117)
URM (Black, Hispanic, Native)	0.017	0.025	0.043**	0.072		-0.000	0.010	0.068**	0.037
	(0.013)	(0.017)	(0.013)	(0.043)		(0.028)	(0.027)	(0.023)	(0.048)
Asian	0.032	0.053*	0.052*	-0.128*		0.069	0.031	-0.046	0.137
	(0.023)	(0.024)	(0.025)	(0.058)		(0.062)	(0.061)	(0.041)	(0.107)
Two or more races	-0.005	-0.005	0.024	-0.093		0.085	0.012	0.049	0.061
	(0.025)	(0.029)	(0.019)	(0.058)		(0.051)	(0.062)	(0.059)	(0.115)
First-generation	-0.043**	-0.047**	-0.019	0.011		-0.013	-0.052	-0.026	0.048
	(0.015)	(0.018)	(0.012)	(0.026)		(0.029)	(0.030)	(0.026)	(0.048)
Sex (Female=1)	0.041***	0.041***	0.003	-0.133***		0.045	0.042	0.023	-0.182**
	(0.009)	(0.011)	(0.010)	(0.031)		(0.027)	(0.024)	(0.019)	(0.057)
High School GPA	0.042**	0.046***	-0.001	0.044		-0.003	0.010	0.048*	0.072*
	(0.013)	(0.012)	(0.012)	(0.038)		(0.020)	(0.021)	(0.020)	(0.032)
R-Squared	0.11	0.11	0.07	0.21		0.05	0.05	0.08	0.16
Number of Observations [a]	10,500	10,500	6,800	10,500		5,130	5,130	1,920	5,130

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment. To economize on space, we report on coefficients and standard errors on key variables only. All specifications include students' ACT/SAT scores, socioeconomic status, first-year GPA, and a measure total debt burden, as noted in main text and Appendix. Students who reported a high Sense of Belonging ("Strongly agreed" with statement "I feel like I am a part of [school]" = 1) formed the reference category for our main independent variable of interest. We also control for self-reported first-year

use of campus services and first-year self-reported mental health in the models predicting third-year use of campus services and third-year self-reported mental health outcomes.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

*p < .05. **p < .01. ***p < .001.

Table A7

Belonging Effects not Moderated by Institutional Selectivity

	Four-Year Colleges: *Very and Moderately Selective*					Four-Year Colleges: *Minimally Selective and Open Admissions*			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	Persistence Year 2	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*		*Persistence Year 2*	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*
Sense of Belonging	0.014**	0.015***	0.014*	0.048***		0.030*	0.040**	0.015	0.056
	(0.005)	(0.005)	(0.005)	(0.015)		(0.013)	(0.014)	(0.010)	(0.033)
Public/Private institution (Public=1)	0.032***	0.028***	-0.041***	0.019		0.084	0.052	-0.084**	0.147**
	(0.010)	(0.011)	(0.010)	(0.034)		(0.046)	(0.044)	(0.031)	(0.050)
URM (Black, Hispanic, Native)	0.016	0.031*	0.056***	0.064		0.027	0.028	-0.002	0.097
	(0.014)	(0.017)	(0.017)	(0.042)		(0.033)	(0.041)	(0.036)	(0.071)
Asian	0.008	0.024	0.051	-0.149*		0.068	0.111	0.061	0.085
	(0.023)	(0.024)	(0.027)	(0.061)		(0.122)	(0.070)	(0.063)	(0.190)
Two or more races	0.003	0.002	0.035	-0.117		-0.025	-0.026	-0.027	-0.011
	(0.025)	(0.028)	(0.020)	(0.068)		(0.068)	(0.070)	(0.052)	(0.127)
First-generation	-0.031**	-0.030	-0.018	0.012		-0.017	-0.038	-0.025	0.022
	(0.013)	(0.016)	(0.013)	(0.033)		(0.051)	(0.044)	(0.028)	(0.056)
Sex (Female=1)	0.037***	0.030*	-0.005	-0.146***		0.035	0.051	0.036	-0.088
	(0.011)	(0.012)	(0.013)	(0.035)		(0.028)	(0.031)	(0.028)	(0.051)
High School GPA	0.025	0.026	0.005	0.082		0.037	0.039	-0.027	-0.037
	(0.015)	(0.017)	(0.013)	(0.046)		(0.031)	(0.032)	(0.026)	(0.045)
R-Squared	0.08	0.07	0.08	0.22		0.10	0.10	0.06	0.19
Number of Observations [a]	6,490	6,490	5,080	6,490		4,010	4,010	1,730	4,010

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and bootstrap variance estimation using replicate weights (WTA001-WTA200) to adjust for poststratification weight adjustment. To economize on space, we report on coefficients and standard errors on key variables only. All specifications include students' ACT/SAT scores, socioeconomic status, first-year GPA, and a measure total debt burden, as noted in main text and Appendix. We also control for self-reported first-year use of campus services and self-reported mental health in the models predicting third-year use of campus services and third-year self-reported mental health outcomes.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

*p < .05. **p < .01. ***p < .001.

Table A8

Pair-wise Correlations across Covariates – Four Year Colleges

	1	2	3	4	5	6	7	8	9	10	11	12
1. Sense of Belonging	1.00											
2. Public/Private institution (Public=1)	-0.08	1.00										
3. URM (Black, Hispanic, Native)	-0.01	-0.06	1.00									
4. Asian	0.01	-0.08	0.14	1.00								
5. Two or more races	0.06	-0.18	0.05	0.19	1.00							
6. First-generation	0.01	-0.49	0.07	0.14	0.19	1.00						
7. Sex (Female=1)	0.13	-0.18	-0.01	0.01	0.06	0.01	1.00					
8. High School GPA	-0.33	0.02	-0.06	-0.03	-0.04	-0.15	-0.10	1.00				
9. First year GPA	0.23	-0.45	0.08	0.22	0.20	0.44	0.03	-0.44	1.00			
10. Composite ACT/SAT score	0.02	0.07	0.28	-0.22	-0.15	0.07	0.18	-0.47	-0.10	1.00		
11. Socioeconomic Status (Income Percentile Rank)	-0.02	-0.32	0.31	0.29	0.13	0.55	0.18	0.05	0.25	-0.06	1.00	
12. Debt Burden (Total Federal Loans)	-0.15	0.09	0.28	0.12	-0.19	-0.17	-0.02	0.27	-0.10	0.02	0.13	1.00

Table A9

Pair-wise Correlations across Covariates – Two Year Colleges

	1	2	3	4	5	6	7	8	9	10	11	12
1. Sense of Belonging	1.00											
2. Public/Private institution (Public=1)	0.14	1.00										
3. URM (Black, Hispanic, Native)	-0.06	0.05	1.00									
4. Asian	0.30	0.16	0.14	1.00								
5. Two or more races	0.36	0.10	0.13	0.10	1.00							
6. First-generation	-0.01	-0.15	0.01	0.04	-0.08	1.00						
7. Sex (Female=1)	-0.03	0.09	-0.10	0.00	-0.17	-0.06	1.00					
8. High School GPA	0.10	0.01	0.02	0.14	0.33	-0.18	-0.17	1.00				
9. First year GPA	-0.15	-0.08	0.12	-0.04	0.05	-0.12	-0.17	-0.03	1.00			
10. Composite ACT/SAT score	0.10	0.12	0.20	-0.14	0.04	-0.02	0.02	-0.30	-0.05	1.00		
11. Socioeconomic Status (Income Percentile Rank)	0.02	-0.22	0.19	-0.07	-0.10	0.32	-0.08	0.00	-0.09	-0.29	1.00	
12. Debt Burden (Total Federal Loans)	0.07	0.48	0.15	0.16	0.07	-0.15	-0.11	-0.16	0.19	0.04	0.01	1.00

Table A10

Models with Institutional Fixed Effects Included

	Four-Year Colleges					Two-Year Colleges			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	Persistence Year 2	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*		*Persistence Year 2*	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*
Sense of Belonging	0.017***	0.017***	0.014**	0.049***		0.008	0.0003	0.001	0.024
	(0.005)	(0.005)	(0.005)	(0.012)		(0.011)	(0.011)	(0.011)	(0.020)
Number of Observations (Student-Years)[a]	10,500	10,500	6,800	10,500		5,130	5,130	1,900	5,130

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) used to adjust for poststratification. Robust standard errors (clustered at the institution-level) reported in parentheses. To economize on space, we report on coefficients and standard errors on key variable only. All specifications include institution fixed effects and the other covariates, as noted in main text and Appendix.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

p < .05. **p* < .01. ***p* < .001.

Table A11

Models with Student Fixed Effects and Time Fixed Effects Included

	Four-Year Colleges					Two-Year Colleges			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	GPA	Persistence	Use of Campus Services	Self-reported Mental Health		GPA	Persistence	Use of Campus Services	Self-reported Mental Health
Sense of Belonging	0.033***	0.037***	0.021***	0.044***		0.044**	0.039**	0.035***	0.032*
	(0.009)	(0.004)	(0.004)	(0.011)		(0.016)	(0.005)	(0.007)	(0.013)
Number of Observations (Student-Years)[a]	26,160	28,490	22,190	28,490		15,840	19,000	12,640	19,000

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and robust standard errors used to adjust for poststratification. To economize on space, we report on coefficients and standard errors on key variable only. All specifications include students fixed effects and year fixed effects, as noted in main text and Appendix.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

*p < .05. **p < .01. ***p < .001.

Table A12
Models Excluding Students' First-year GPA

	Four-Year Colleges					Two-Year Colleges			
	Academic Outcomes		Other Outcomes			Academic Outcomes		Other Outcomes	
	Persistence Year 2	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*		*Persistence Year 2*	*Persistence Year 3*	*Use of Campus Services Year 3*	*Self-reported Mental Health Year 3*
Sense of Belonging	0.028***	0.031***	0.014**	0.053***		0.024*	0.015	0.003	0.033±
	(0.006)	(0.006)	(0.004)	(0.012)		(0.010)	(0.011)	(0.009)	(0.023)
Number of Observations [a]	10,800	10,800	6,900	10,800		5,490	5,490	2,010	5,490

Note. Standard errors in parentheses. All estimates are unstandardized but weighted to adjust for the BPS: 12/14 complex survey design: Analysis weight (WTA000) and robust standard errors used to adjust for poststratification. To economize on space, we report on coefficients and standard errors on key variable only. All specifications include other student and institutional characteristics, as noted in main text and Appendix.

[a] Sample size rounded to the nearest 10 as per dataset guidelines.

± $p < .10$. *$p < .05$. **$p < .01$. ***$p < .001$.