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EdWorkingPaper No. 20-286

Examining the Relationship between Psychosocial and Academic Outcomes in Higher Education: A Descriptive Analysis

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This paper estimates the relationship between students' psychosocial and academic outcomes during their first three years enrolled at public, four-year institutions. Our sample is comprised of students from low-income backgrounds who applied for a competitive scholarship and enrolled at a four-year public institution. We follow two cohorts of entering students throughout their first three years on campus. We observe their cumulative GPA and persistence decisions each semester, and have annual measures of four psychosocial outcomes: mattering to campus, sense of belonging to campus, academic self-efficacy, and social self-efficacy. We find that psychosocial outcomes are moderately predictive of academic outcomes, with sense of belonging and academic self-efficacy emerging as most predictive of both cumulative GPA and persistence.

VERSION: September 2020

Suggested citation: Swanson, Elise, Tatiana Melguizo, and Francisco Martorell. (2020). Examining the Relationship between Psychosocial and Academic Outcomes in Higher Education: A Descriptive Analysis. (EdWorkingPaper: 20-286). Retrieved from Annenberg Institute at Brown University: https://doi.org/10.26300/fp11-2850

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We would like to thank Darnell Cole, Ronald Hallett, Matt Soldner, Mark Masterton, Evan Nielsen, Cameron McPhee, Samantha Nieman, Gwendelyn Rivera, and all the other members of the broader mixed-methods evaluation team for designing and implementing the Longitudinal Survey of Thompson Scholars, for helping us get a better understanding of the program and providing relevant feedback on previous versions of this manuscript. This study received financial support from the Susan Thompson Buffett Foundation.

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Abstract. This paper estimates the relationship between students' psychosocial and academic outcomes during their first three years enrolled at public, four-year institutions. Our sample is comprised of students from low-income backgrounds who applied for a competitive scholarship and enrolled at a four-year public institution. We follow two cohorts of entering students throughout their first three years on campus. We observe their cumulative GPA and persistence decisions each semester, and have annual measures of four psychosocial outcomes: mattering to campus, sense of belonging to campus, academic self-efficacy, and social self-efficacy. We find that psychosocial outcomes are moderately predictive of academic outcomes, with sense of belonging and academic self-efficacy emerging as most predictive of both cumulative GPA and persistence.

Keywords: Psychosocial outcomes, academic achievement, persistence, postsecondary success

Examining the Relationship between Psychosocial and Academic Outcomes in Higher Education: A Descriptive Analysis

The goal of education has been contested in the United States at least since the early 20th century, when reformers pushed to create similar educational structures and systems across the country (Tyack, 1974). Policymakers and educational leaders have argued that the purpose of education is to force assimilation among recent immigrants (Tyack, 1974), to build an informed citizenry engaged in public discourse (Gutmann, 1999), to empower individuals with the tools needed for their own flourishing and that of others (Brighouse et al., 2018), or to create social change and advance equity (hooks, 2017; McGuinn, 2017), among other goals. As conceptualizations about the purpose of education have shifted, so too have the policies shaping the practices of schools and educators. In the 1990s and early 2000s the federal government offered a series of increasingly forceful policies aimed at increasing the testing of and accountability for student achievement outcomes (McGuinn, 2017). By the mid-2010s, however, concern about the emphasis on standardized testing led to a renewed focus on non-test-based measures of performance, such as school climate, student attendance, and student psychosocial outcomes (Barone, 2017; Krachman et al., 2016). The policy pendulum swinging back and forth between an emphasis on academics and psychosocial development makes it difficult for educational leaders to make decisions about what practices and institutional-level policies to pursue. Increasingly, researchers are examining the relationship between students' psychosocial and academic outcomes in the K-12 system (e.g. Wanzer et al., 2019; Jackson, 2018; Kraft, 2017).

Although these tensions are often most visible within the K-12 system, postsecondary education is not immune from debates regarding the skills, knowledge, and experiences colleges

should provide. Increasingly, states are tying postsecondary funding to easily quantifiable outcomes, such as retention and graduation rates (Holly & Fulton, 2017), even as employers emphasize the importance of psychosocial skills (The Aspen Institute, 2019; Hart Research Associates, 2013). Given this policy backdrop, postsecondary organizations need to know whether psychosocial and academic outcomes move together (e.g. Yeager & Walton's (2011) finding that an intervention focused on belonging increases persistence) or whether growth across the two domains is unrelated. Further, universities are often organizationally and functionally split into academic and student affairs, with academic affairs primarily concerned with academic outcomes and student affairs more concerned with student development (American College Personnel Association, 2008; Kezar, 2003). This bifurcation of responsibilities may prevent students from truly reaching their potential in either domain (Nesheim et al., 2007).

In this paper, we explore whether there is a relationship between students' psychosocial and academic outcomes in their first three years of college. This descriptive work can inform postsecondary institutions working to promote student success in both psychosocial and academic domains. It also informs the debate about the extent to which positions on campus should be defined in relation to one set of outcomes or the other, or whether all university personnel should view success in both domains as within the scope of their work.

We relate four psychosocial outcomes to students' academic outcomes: mattering to campus, sense of belonging to campus, academic self-efficacy, and social self-efficacy. Belonging captures the extent to which students feel like they are a part of their institution (Inkelas et al., 2018), while mattering captures the extent to which students feel they are valued by others on campus, particularly by institutional agents, such as faculty and advisers (Rosenberg

& McCullough, 1981; Schlossberg, 1989). Academic and social self-efficacy capture the extent to which students feel they can successfully navigate the academic and social demands, respectively, of college (Bandura, 1977). We relate these constructs to students' cumulative grade point average (GPA) and persistence in the University of Nebraska system.

We hypothesize that each construct will be positively related to students' academic outcomes. Mattering could be associated with students' persistence decisions directly, as students who feel that they are valued by individuals on campus and that their success is valued by others on campus may be more likely to remain enrolled. Mattering could also relate to students' academic performance, in that students who feel they matter to their instructors may be more confident in reaching out for assistance with coursework. Belonging could relate to students' persistence decisions directly, by shaping the extent to which students feel comfortable on and want to remain at the university. Belonging could also relate to students' academic achievement by empowering students to reach out to their peers, instructors, or other support services on campus if they are struggling with a course. Students' academic self-efficacy may relate directly to their academic performance, while students' social self-efficacy may relate to their persistence decisions by facilitating students' development of a sense of belonging and mattering on campus.

This paper makes several contributions. First, rather than relying on cross-sectional data, we use longitudinal survey data as well as administrative records to examine the relationships between students' psychosocial outcomes and cumulative GPA and persistence, two traditional indicators of academic success in college. This longitudinal data allows us to examine not only cross-sectional relationships at a point in time, but also how these relationships change during a student's first 3 years on campus and how changes in the psychosocial measures relate to

changes in academic outcomes. Second, we use detailed scales of psychosocial constructs that have been validated in other samples and that exhibit strong reliability within our sample. Finally, we include a rich set of covariates that we use to control for factors that might generate spurious correlations between psychosocial outcomes and academic outcomes.

We find that students' psychosocial and academic outcomes are related, even after controlling for a rich set of background characteristics and institution of enrollment. In particular, students' reported levels of sense of belonging to campus and academic self-efficacy are consistently predictive of students' cumulative GPA and persistence. Further, changes in sense of belonging predict persistence decisions, even after accounting for college GPA and semester-to-semester changes in academic achievement. Mattering and social self-efficacy are also predictive of achievement and persistent, but the associations are slightly less robust. We find no evidence of heterogeneity across subgroups defined by race/ethnicity, gender, income, prior achievement, or parental education.

Prior Literature Linking Psychosocial and Academic Outcomes

Psychosocial skills, also known as socioemotional or non-cognitive skills, refer to a range of student capabilities beyond traditional measures of academic knowledge (Duckworth & Yeager, 2015). In K-12 settings, researchers have found positive associations between psychosocial skills, including grit, conscientiousness, personality, academic mindset, self-image, and motivation and academic achievement (Wanzer et al., 2019; West et al., 2016; Zamarro et al., 2016; Durlak et al., 2011; Farrington et al., 2012; Howse et al., 2013; Oyserman et al., 2006), educational attainment, and wages (Heckman et al., 2006).

The literature in the postsecondary space is more mixed. When considering course performance, some studies document positive associations between self-efficacy, sense of

belonging, engagement, general determination, academic discipline, goal striving, commitment to college, study skills, communication skills, social activity, social connection, academic self-confidence, emotional control, utility value, need for achievement, tolerance, self-actualization, social responsibility, organization, and happiness and GPA (Brown et al., 2008; Kuh et al., 2008; Le et al., 2005; Robbins et al., 2004; Robbins et al., 2006; Harackiewicz et al., 2016; Tepper & Yourstone, 2017; Friedman & Mandel, 2011; Sparkman et al., 2012; Hartley, 2011; Walton & Cohen, 2011). In general, academic self-efficacy is most strongly related to academic achievement (Krumrei et al., 2013; Chemers et al., 2001; Zajacova et al., 2005). There is some evidence that the relationship between improved sense of belonging and academic achievement is strongest for students of color (Walton & Cohen, 2011; Shook & Clay, 2012: Yeager & Walton, 2011).

However, other work finds no association between social support, coping skills, emotional control, social self-efficacy, roommate self-efficacy, need for affiliation, need for dominance, impulse control, assertiveness, optimism, problem-solving, empathy, flexibility, and stress tolerance and GPA (DeBerard et al., 2004; Robbins et al, 2006; Vuong et al., 2010; Friedman & Mandel, 2011; Sparkman et al., 2012). Still other work indicates negative associations between social activity, need for autonomy, independence, interpersonal relationships, and spirituality and GPA (Robbins et al., 2006; Friedman & Mandel, 2011; Sparkman et al.; Hartley, 2011). The relationship between psychosocial skills and academic achievement among college students is an unsettled question, as is the question of which psychosocial outcomes are most critical for promoting achievement.

Postsecondary researchers have also investigated the link between psychosocial skills and persistence, again with mixed findings. Researchers have documented positive associations

between persistence and general determination, academic discipline, goal striving, commitment to college, study skills, communication skills, social activity, social connection, academic self-confidence, emotional control, academic goals, self-efficacy, growth mindset, and sense of belonging (Le et al., 2005; Robbins et al., 2004; Robbins et al., 2006; Wright et al., 2012; Vuong et al., 2010; Porchea et al., 2010; Yeager et al., 2016). However, other work finds no or negative relationships between persistence and social activity, emotional control, self-efficacy, social self-efficacy, need for achievement, need for affiliation, need for autonomy, need for dominance, interpersonal competence, marginality, and loneliness (Robbins et al., 2006; Elias & Loomis, 2000; Vuong et al., 2010; Friedman & Mandel, 2011; McGaha & Fitzpatrick, 2005). Again, there is evidence of heterogeneity by race/ethnicity, with evidence of a stronger link between engagement and persistence for black students (Kuh et al., 2008). Evidence from a limited number of studies suggests a positive relationship between psychosocial skills and degree attainment (Pascarella et al., 2004; Lee et al., 2008; Sparkman et al., 2012).

Research examining the relationship between academic outcomes and psychosocial skills among postsecondary students often utilizes cross-sectional, self-reported survey data. Studies that use longitudinal survey or administrative data typically include a limited set of covariates, such as ACT/SAT score and high school GPA. Additionally, many of the psychosocial constructs examined relate to students' internal traits, such as personality or intrinsic motivation, rather than constructs that reflect students' interactions with their collegiate environments, such as sense of belonging or mattering. While these more environmental psychosocial skills feature prominently in theories of college persistence (e.g. Tinto, 1993), there is limited quantitative work estimating the relationships among these constructs and students' academic outcomes. Finally, most studies employ observational methods, although Durik and Harackiewicz (2007),

Durik et al. (2015), Harackiewicz et al. (2016), Walton and Cohen (2011), and Yeager et al. (2016) are exceptions in that they experimentally evaluate the impact of interventions targeting psychosocial constructs on academic outcomes.

This study builds on the prior literature by examining the relationships between four psychosocial outcomes (mattering to campus, sense of belonging to campus, academic self-efficacy, and social self-efficacy) to two academic outcomes (cumulative GPA and persistence) over students' first three years in college.

Data and Methods

We utilize data from an evaluation of the Thompson Scholars Learning Communities (TSLC), a comprehensive college transition program implemented in the University of Nebraska system. We have survey and administrative data for students who applied for the program and entered college in 2015 or 2016. Students who apply for a scholarship from the Susan Thompson Buffett Foundation (STBF) are scored based on a variety of factors, including high school GPA, recommendations, and an essay. During the evaluation, students with the highest scores were awarded a scholarship and entrance into TSLC. Students whose scores were beyond a threshold for eligibility but were not among the top scores were placed in an experimental sample. These students were randomized into one of three treatment arms: scholarship and learning community support; scholarship only; or a control group (Angrist et al., 2016; Melguizo et al., 2019). For this analysis, which is descriptive and exploratory, we pool together all three groups in the experimental sample as well as the students who were awarded comprehensive support directly by the STBF based on their high application score.

We ask two research questions:

1) What is the relationship between students' reported psychosocial skills and cumulative GPA at the end of their first, second, and third years on campus? Do these relationships vary by student race/ethnicity, sex, prior academic achievement, first-generation status, or socioeconomic status?
2) What is the relationship between students' reported psychosocial skills and likelihood of continued enrollment throughout their first six semesters (three years) on campus? Does this relationship vary by student race/ethnicity, sex, prior academic achievement, first-generation status, or socioeconomic status?

We first correlate students' psychosocial skills with traditional academic outcomes in each year. Then, we predict students' traditional academic outcomes as a function of students' psychosocial outcomes and a rich set of background characteristics. When examining the relationship between students' psychosocial outcomes and persistence, we first estimate Probit models predicting student persistence as a function of students' psychosocial outcomes and background characteristics. We then estimate survival models that pool information across students' first six semesters on campus to model students' risk of dropout as a function of students' psychosocial outcomes and background characteristics. We look at the relationship between students' reported levels of psychosocial outcomes and persistence, as well as the relative predictive power of changes in students' psychosocial outcomes and changes in cumulative GPA for persistence. Data on students' psychosocial outcomes come from a rich, longitudinal survey administered as part of the Promoting At-Promise Student Success (PASS) Project, which evaluated the TSLC program.[1] We describe the student survey in greater detail next, followed by a description of our analytic approach.

Survey Data

The research team surveyed students who applied for and were eligible for a scholarship from the STBF and enrolled at a University of Nebraska system campus in the Fall semester of 2015 or the Fall semester of 2016, as well as students who were randomized to the TSLC group and transferred into a University of Nebraska system campus after initially enrolling elsewhere as first-year students in Fall 2015 or 2016. Students are not surveyed after exiting the University of Nebraska system. Students were first surveyed in the fall of their first year, then in the spring of each academic year for up to four academic years. In this paper, we focus on students' first three years on campus, for which we have data for both cohorts of students. The original survey included scales validated in prior literature in line with TSLC's hypothesized theory of change; for example, the program was hypothesized to increase students' sense of belonging at the campus, so items from the 2015 Programme for International Student Assessment (PISA; OECD, 2017) measuring belonging were included in the original survey. After each survey administration, the psychometric properties of each scale were examined, qualitative data were reviewed, and adjustments were made to items to ensure the relevance, validity, and reliability of the scales (Cole et al., 2019). In this paper, we focus on four key psychosocial constructs: mattering to campus, sense of belonging to campus, academic self-efficacy, and social self-efficacy. The psychosocial constructs were measured using a Rasch scoring method; we standardize the logit scores for our analyses.

Mattering to Campus

Mattering to campus captures the extent to which students feel that they have developed supportive, reliable relationships with individuals on campus (Rosenberg & McCullough, 1981; Schlossberg, 1989). Kirp (2019) stresses the potentially powerful impact mattering can have on

postsecondary outcomes, arguing that interventions that improve student success "enable students to recognize that they are full-fledged members of a community that takes them seriously, as individuals" (p. 8). Mattering stresses the importance of the interpersonal, and, in particular, the extent to which students have relationships with institutional agents, including faculty, staff, and advisers, in addition to peers.

Traditionally, the onus is on students to reach out to such institutional agents and establish relationships, which may lead to inequities along lines of race/ethnicity and socioeconomic status (e.g. Jack, 2016). Our analysis is set in a context in which institutional agents are encouraged to reach out to students, potentially lessening inequities across groups. The data used in this study were collected as part of an evaluation of a comprehensive college transition program, the Thompson Scholars Learning Communities (TSLC), which provides holistic supports (in addition to a generous financial scholarship) to students from low-income backgrounds attending four-year public institutions in Nebraska. The program is intentional in its efforts to facilitate the development of relationships between students and university faculty and staff, as well as peers. Participants take small classes reserved for TSLC students, meet regularly with program staff, complete a first-year seminar course, are mentored by more senior students who previously went through TSLC, participate in various academic and social events, and have access to academic tutors. Through these structured interactions, TSLC encourages faculty and staff to be proactive in reaching out to students, engendering feelings of mattering for students from all backgrounds (Melguizo et al., 2019).

Our survey measures students' feelings of mattering to campus through eight Likert-type items. Students indicated the extent to which they felt "There are people at {MY INSTITUTION} who are generally supportive of my individual needs" and that "Other students

at {MY INSTITUTION} are happy for me when I do well on exams or projects." There were some changes to the scale over time. In the fall of 2015, students responded to six Likert-type items, each of which had a four-point scale. Following formative and qualitative analysis of that scale, two items were added and the response scale was expanded from a four-point scale to a seven-point scale (where one indicates the lowest level of mattering and seven indicates the highest level of mattering). The scale remained constant thereafter. Because of the changes to the scale over time, the construct scores were calculated using a Rasch scoring method. The construct demonstrated acceptable fit; a full discussion of goodness-of-fit statistics is available in Appendix B.

Belonging to Campus

Sense of belonging to campus captures the extent to which students identify with the institution and participate in campus life. While mattering highlights the extent to which students feel that they are valued by others on campus, sense of belonging highlights the extent to which students feel comfortable reaching out to and interacting with others on campus (Inkelas et al., 2018).

While theories of persistence emphasize the importance of integrating into the campus community (e.g. Tinto, 1993), researchers have also documented how such processes can be incredibly painful for students who feel such integration requires a renunciation of their prior experiences and identity (e.g. Lee & Kramer, 2013; Lehmann, 2013; Yosso et al., 2009). In response, researchers have transitioned from conceptualizing 'belonging' as a form of integrating into the dominant campus community and towards understanding 'belonging' as finding or creating a supportive network that acknowledges and respects students' identities. This

understanding was used when designing the survey instrument used for this study and for understanding the construct in our analysis.

Our survey measures students' sense of belonging to campus through eight Likert-type items. Students were asked to report, on a scale of one (strongly disagree) to seven (strongly agree), the extent to which they "feel like an outsider" and "feel I am a member of the {INSTITUTION} community". Similar to the mattering scale, the belonging to campus scale initially included only six items, and students responded on a four-point scale. After the survey was administered in fall 2015, two items were added and the response scale was expanded to include seven response options. Again, due to these changes in the construct over time, we calculated construct scores using a Rasch scale model. The psychometric properties of the sense of belonging to campus construct indicate it is performing well; a complete discussion of the goodness-of-fit measures is available in Appendix B.

Academic Self-Efficacy

Academic self-efficacy measures the extent to which students believe themselves to be capable of successfully completing academic tasks required of them (Bandura; 1977; Schunk, 1991; Pajares et al., 1999). This construct focuses on students' internal perceptions of themselves more than their perceptions of their relationships with or value to others. Students' expectations of success are linked to both their motivation and their outcomes (e.g. Eccles et al., 1983; Eccles & Wigfield, 2002; Jacobs et al., 2002).

On the first survey administered, in fall 2015, students responded to 11 items on a seven-point scale. In subsequent administrations, students responded to 14 items on a seven-point scale, where one represents the lowest feeling of efficacy and seven represents the highest feeling of efficacy. Example items include the extent to which students feel can "meet the academic

demands of college" and "organize my schoolwork." Because of the changes to the construct over time, scores are calculated using a Rasch scoring model. The academic self-efficacy construct exhibits strong psychometric properties; see Appendix B for more detail.

Social Self-Efficacy

Social self-efficacy measures the extent to which students feel they can successfully navigate social situations on campus (Friedman, 1979; Bandura, 1977). While our measures of mattering to campus, belonging to campus, and academic self-efficacy focus primarily on the extent to which students develop relationships with institutional agents, such as faculty and staff, and feel they can succeed academically, social self-efficacy emphasizes the importance of peer relationships (Inkelas et al., 2018; Kirp, 2019).

Social self-efficacy was originally measured through six Likert-type items; the construct was expanded in fall 2016 to include eight Likert-type items. Students consistently responded to these items on a seven-point scale, where one indicates the student feels they "cannot do this at all" and seven indicates the student feels they "absolutely can do this." Students reported the extent to which they felt they could "get involved in interesting activities" and "make friends you can talk about your very personal problems with." We again estimate students' social self-efficacy using a Rasch scoring method. The social self-efficacy construct functions reasonably well; goodness-of-fit measures are discussed in detail in Appendix B.

Sample Characteristics

Our survey data allow us to capture a rich, nuanced perspective on students' psychosocial development throughout their first three years on campus. We combine this information with administrative records from the STBF, University of Nebraska system, and FAFSA filings to conduct our analyses, detailed below. In all analyses, we combine observations from the 2015

and 2016 cohorts of students who applied for a scholarship from the STBF. We do not restrict our sample to students who responded consistently to each survey wave; thus, sample sizes vary over time. We do limit our sample to students with complete background information. Table 1 describes our sample for each survey wave.

<TABLE 1 HERE>

The characteristics of our analytic sample are relatively consistent over time, although the share of students of color decreases from the end of year one to the end of the years two and three, while average ACT scores, expected family contribution, and initial mattering and academic self-efficacy increase slightly as students attrit from the survey (and potentially from the university system). Our initial measures of mattering and academic self-efficacy (T0) are taken from a survey administered a few months into students' first semester.

Analytic Strategy

We pursue two distinct analytic strategies for our examination of the relationship between, first, students' psychosocial outcomes and cumulative GPA, and, second, students' psychosocial outcomes and persistence. We begin by describing our strategy for our analyses focusing on GPA and then turn to our strategy for examining persistence.

Psychosocial Outcomes and Academic Achievement

We start by examining the relationship between students' psychosocial outcomes and cumulative GPA at the end of their first, second, and third years on campus. We first calculate pairwise correlations between each psychosocial outcome of interest (mattering to campus, belonging to campus, academic self-efficacy, and social self-efficacy) and student's year one, year two, and year three cumulative GPA. When testing the significance of these correlations we apply a Bonferroni adjustment for multiple comparisons that holds the familywise error rate

constant at α=0.05. As we calculate 20 correlations each year (between each of our four psychosocial outcomes and cumulative GPA), this adjustment means that our functional alpha level for each individual correlation is .0025. We standardize logit scores for each psychosocial construct and report GPA on a continuous 4.0 scale.

We next estimate regression-adjusted correlations between our four psychosocial outcomes of interest and students' cumulative GPA at the end of their first, second, and third years on campus, respectively. Coefficients on the psychosocial outcomes can be interpreted in standard deviation units. Our preferred model is given by Equation (1):

$$Y_{it} = \beta_0 + \delta_1 PSY_{it} + \gamma \boldsymbol{X_i} + \boldsymbol{\tau_i} + \varepsilon_i$$

In Equation (1), Y_{it} is, in turn, student *i*'s cumulative GPA at each *t* (end of their first, second, and third year on campus). β_0 is an intercept. δ_1 is our coefficient of interest, and captures the association between each psychosocial construct and students' academic achievement at each time point. $\boldsymbol{X_i}$ is a vector of student background characteristics, including race/ethnicity, sex, high school GPA, ACT score, expected family contribution, first-generation status, TSLC treatment status (must-fund, randomized to TSLC, randomized to COS, or randomized to control), and initial levels of the four psychosocial constructs of interest. $\boldsymbol{\tau_i}$ is a vector of fixed effects indicating student *i*'s initial campus of enrollment and their cohort of enrollment (2015 or 2016). ε_i is a stochastic error term. We also estimate models in which we include all four psychosocial constructs simultaneously, to see which is most predictive of achievement, net of the others. These results are presented in Appendix A. We explored heterogeneity across subgroups defined by race/ethnicity (students of color and white students), gender (female and male students), parental education (first generation and continuing generation students), family resources (zero expected family contribution, below-median expected family

contribution, and above-median expected family contribution), and prior academic achievement (below- and above-median high school GPA as well as below- and above-median ACT score). We found no consistent pattern of differences across these subgroups; results are available upon request.

Psychosocial Outcomes and Persistence

We examine the relationship between students' self-reported psychosocial outcomes and persistence by estimating a series of Probit models as shown in Equation (2):

$$\Pr(Y_{it} = 1|X) = \Phi(\beta_0 + \delta PSY_{it-1} + \gamma X_i + \tau_i + \varepsilon_i)$$

In Equation (2), we focus on whether or not student *i* remains enrolled at the start of their second and third years on campus (full results for each semester are available upon request). We include a measure of students' psychosocial outcomes from the semester prior to whether the student is perceived as persisting or not (PSY_{it-1}). More concretely, when we examine whether or not a student persists into their third semester (the start of their second year) we include measures of students' mattering to campus, belonging to campus, academic self-efficacy, and social self-efficacy, respectively, from students' second semester (the end of their first year). We again include a rich set of student background characteristics and include a vector of initial campus of enrollment and cohort fixed effects to account for campus and cohort specific shocks. After examining the relationship between students' reported levels of psychosocial outcomes and persistence, we explore the relative power of changes in psychosocial outcomes and GPA for predicting persistence. To do this, we difference measures of psychosocial outcomes and GPA. For example, when looking at whether or not a student persists through their second year, we look at the change in mattering from the beginning of their first year to the end of their first year, as well as the change in GPA from their first to second semester. We report marginal effects for

all Probit models, so results can be interpreted as percentage points. We have standardized the logit scores for the psychosocial constructs, so these can be interpreted in standard deviation units.

Lastly, we estimate a survival model that pools together information on students' psychosocial outcomes across all three years and persistence decisions across all six semesters of their first three years on campus. This model includes the same variables as Equation (2), but instead of estimating separate Probit models for each time point, it estimates a proportional hazard mode in which students' survival (e.g. not dropping out) is expressed as a function of time and their characteristics, including their psychosocial outcomes. In our data, we observe individual students multiple times (up to six times if they persist through the end of their third year). To account for this, we cluster our standard errors by individual. We report hazard ratios for this analysis. Hazard ratios greater than 1 indicate higher levels of that variable are associated with an increased risk of drop-out, while hazard ratios less than 1 indicate higher levels of that variable are associated with a decreased risk of drop-out (and, by definition, an increased likelihood of persistence). Again, psychosocial constructs can be interpreted in standard deviation units.

Results

Cumulative GPA

Table 2 presents the pairwise correlations between students' sense of mattering to campus, sense of belonging to campus, social self-efficacy, and academic self-efficacy with their cumulative GPA at the end of their first, second, and third years. All correlations are significant at the .01 level after applying the Bonferroni adjustment for multiple comparisons.

<TABLE 2 HERE>

We find positive correlations between students' sense of belonging to campus, mattering to campus, academic self-efficacy, social self-efficacy, and cumulative GPA at each time point. While these correlations are significant, they are small to moderately sized, around 0.14 to 0.31 at each time point. These correlations provide suggestive evidence that these four psychosocial outcomes are indeed related to students' postsecondary academic achievement, although these relationships may not be as strong as prior theory would suggest. Full year-by-year correlation matrices are available in Appendix A.

We are also interested in the predictive power of students' psychosocial skills on academic outcomes holding constant student background characteristics. Table 3 presents the results from Equation (1).

<TABLE 3 HERE>

There are positive and significant associations between each psychosocial construct of interest and students' cumulative GPA at each of the three time points we examine. The strongest relationship is between academic self-efficacy and cumulative GPA. At end the end of each year, a one standard deviation increase in academic self-efficacy is associated with an increase in GPA of 0.18, 0.12, and 0.08 points, respectively; these relationships are all significant at the .01 level. Higher levels of belonging to campus are also positively associated with academic achievement at the end of students' first, second, and third years on campus. Specifically, an increase in belonging to campus predicting a 0.12, 0.08, and 0.08 point increase in GPA, respectively; all relationships are significant at the .01 level. Higher reported levels of social self-efficacy are associated with 0.11, 0.06, and 0.07 point increases in GPA in years one through three, respectively ($p<.01$). Finally, one standard deviation increases in mattering are associated with

increases in cumulative GPA of 0.09, 0.03, and 0.05 points, respectively, during students' first three years on campus ($p<.01$).

In models including all four psychosocial constructs simultaneously, academic self-efficacy and sense of belonging to campus are consistently significant predictors of cumulative GPA in years one through three (see Appendix A for full results). Mattering to campus is not significantly related to cumulative GPA in either year one or year three, and is negatively associated with cumulative GPA in year two. Social self-efficacy is not significantly related to first-year cumulative GPA in year one, and is negatively associated with second- and third- year cumulative GPA. However, the high correlations between the psychosocial constructs may lead to issues of multicollinearity, making it difficult to disentangle the relationships among the psychosocial and academic outcomes. For example, mattering and belonging are correlated at about 0.6 each year, social self-efficacy and belonging are correlated at about 0.7 each year, and mattering and social self-efficacy are correlated at about 0.6 each year.

Our regression results give additional support to the relationships suggested by the raw correlations: students' psychosocial outcomes are significantly related to their academic achievement. In particular, students' academic self-efficacy and sense of belonging are tightly connected to their academic performance.

Persistence

We first present the results of our Probit models looking at the extent to which students' psychosocial outcomes predict their likelihood of persisting into their second and third years, respectively. The marginal effects from these models are shown in Table 4.

<TABLE 4 HERE>

The four psychosocial constructs are generally positively and significantly predictive of persistence into students' second and third years. Higher reported levels of academic self-efficacy, sense of belonging to campus, and social self-efficacy are all associated with about a 3 percentage point increase in the likelihood a student will be enrolled in their first semester of their second year on campus; these estimates are all significant at the 0.01 level. A one standard deviation increase in mattering to campus in students' first year is associated with a 1.6 percentage point increase in the likelihood of returning for a second year ($p<.05$).

A one standard deviation increase in academic self-efficacy at the end of students' second year is associated with a 1.8 percentage point increase in the likelihood of returning for a fifth semester ($p<.01$). Belonging and social self-efficacy are also positively associated with the likelihood of returning for a third year; point estimates are 1.6 and 1.2 percentage points, respectively ($p<.05$). Second year mattering to campus is not significantly related to the likelihood of returning for a third year.

In models including all four psychosocial constructs simultaneously (shown in Appendix A), both academic self-efficacy and sense of belonging to campus are significant predictors of second- and third- year persistence. A one standard deviation increase in academic self-efficacy and sense of belonging in students' first year is associated with a 1.8 and 2.0 percentage point increase in the likelihood of returning in semester three, respectively ($p<.05$). Similarly, one standard deviation increases in academic self-efficacy and belonging in year two are associated with 1.6 and 1.7 percentage point increases in the likelihood of persistence into year three, respectively ($p<.05$). After controlling for sense of belonging and academic self-efficacy, neither mattering to campus nor social self-efficacy is a significant predictor of persistence to year two or three.

We were also interested in exploring the relative predictive power of changes in psychosocial outcomes and cumulative GPA. Such an analysis may help institutions refine early warning systems that typically only focus on academic indicators. Table 5 presents the marginal effects from Probit models expressing the likelihood of persistence as a function of changes in both a single psychosocial construct of interest (mattering to campus, belonging to campus, academic self-efficacy, and social self-efficacy, respectively) and a change in cumulative GPA.

<TABLE 5 HERE>

As shown in Table 5, changes in cumulative GPA are consistently predictive of persistence decisions, and the relationship between changes in academic performance and persistence is stronger than the relationship between changes in psychosocial outcomes and persistence. However, changes in psychosocial outcomes do have some predictive power after accounting for changes in GPA. Specifically, changes in students' belonging to campus and social self-efficacy during their first year are significantly related to the likelihood that students will persist into their second year, such that students whose affiliation to the institution and confidence in social settings are more likely to remain enrolled (point estimate around 1 percentage point; $\alpha = .1$). Similarly, as students' sense of belonging to the campus increases in their second year, they are more likely to persist into their third year (1.4 percentage points; $\alpha = .05$).

Finally, we estimate a survival model showing the relationship between students' psychosocial outcomes and persistence over the course of students' first six semesters on campus. In this analysis, unlike in the Probits above, the outcome is whether or not the student drops out at a given point in time, so hazard ratios less than 1 indicate a higher likelihood of persistence (lower likelihood of dropout). Table 6 presents these results.

<TABLE 6 HERE>

Consistent with the results of the individual Probits and the multivariate regressions, higher levels of each psychosocial construct predict a lower likelihood of dropout (and therefore a higher likelihood of persistence) across students' first six semester. Each psychosocial outcome is significantly related at the .01 level with a lower likelihood of dropout. An increase in mattering is associated with about an 18 percent reduction in the likelihood of dropout, while higher levels of belonging, academic self-efficacy, and social self-efficacy are associated with 33, 36, and 33 percent, respectively, decreases in the likelihood of dropout ($p<.01$). In models including all four psychosocial constructs simultaneously, only sense of belonging to campus and academic self-efficacy are significantly related to a decreased likelihood of dropout (26 and 29 percent, respectively; $p<.05$ and $p<.01$, respectively). This indicates that, while all four psychosocial outcomes may be associated with student success, belonging to campus and academic self-efficacy are the most robust psychosocial predictors of student persistence.

Conclusion

Our work provides institutions of higher education additional evidence on the relationship between psychosocial skills, which are valued by employers and are related to richer on-campus experiences, and traditional academic outcomes, which are increasingly prioritized by states subsidizing the cost of college. Our results suggest that psychosocial outcomes, particularly academic self-efficacy and sense of belonging, are positively correlated with students' cumulative GPA and persistence, even after controlling for students' background characteristics. While belonging and academic self-efficacy are most strongly predictive of students' academic outcomes, we caution against the conclusion that mattering and social self-efficacy are unimportant. Both mattering and social self-efficacy are independently predictive of

academic outcomes (when not controlling for other psychosocial outcomes) and capture important dimensions of the collegiate experience. Continued exploration of these outcomes is needed.

While our results are descriptive, they suggest that efforts to improve students' subjective experiences and psychosocial outcomes during their initial years on campus may also help universities move towards goals of increased achievement and retention. Future work should continue examining psychosocial outcomes and work to identify the causal relationship between psychosocial and long-term academic outcomes, such as persistence and graduation.

All students in our sample have an expected family contribution of $10,000 or less; additionally, about two-thirds of our sample are first-generation students. Our results are therefore most generalizable to these two at-promise[2] student groups who are typically less well served by postsecondary institutions. Universities interested in increasing the achievement and persistence of low-income and first-generation students should pay particular attention to the extent to which they are creating inclusive, welcoming spaces that support students' holistic development as scholars and individuals.

While this study demonstrated that psychosocial outcomes are correlated with academic achievement and postsecondary persistence, our results also suggest that these domains are not fully overlapping. Universities cannot focus exclusively on promoting either psychosocial outcomes or academic outcomes and expect that both goals will be reached. Instead, in order to fully support students, all institutional units need to balance their support for both academic success and psychosocial development. This may be promoted by encouraging greater collaboration between academic and student affairs (Nesheim et al., 2007; American College Personnel Association, 2008; Kezar, 2003), focusing on instructional practices and curricular

design (Yeager et al., 2016; Kirp, 2019; Tough, 2019; Baldwin, 2020), reshaping campus culture (Brown McNair et al., 2016; Jayakumar & Museus, 2012), or by developing new approaches and interventions. Future research should continue to examine how universities can promote both academic and psychosocial outcomes.

We find that, even after accounting for students' level of achievement and semester-to-semester change in achievement, changes in belonging independently predict the likelihood that students will persist into their second and third years on campus. We focus on students' first three years in college, an important time in which to understand correlates of student persistence. For example, among the national cohort of full-time students entering four-year public universities in 2015 (the same time as our first cohort of students), slightly over 79 percent of students were retained at their institution in the following year (National Student Clearinghouse, 2019). By exploring ways to improve students' early experiences in college, institutions may be able to ultimately increase graduation rates.

Our work suggests that universities may want to assess students' psychosocial outcomes each year or semester to identify students who may need additional support. Surveys administered nationally, such as the National Survey of Student Engagement from Indiana University or the Your First College Year survey from the University of California Los Angeles, could also add items to measure and differentiate between these four constructs; individual institutions could also develop surveys to measure these constructs. Such data would allow institutional research offices to provide key data to both academic and student affairs offices to allocate scare staff time to students most in need of support. Universities are increasingly analyzing student transcript data to look for early warning signs related to passing gatekeeper courses or low grades in order to provide additional support and promote student success.

Similarly, universities could examine trends in students' psychosocial outcomes to identify students who do not feel like they are part of a community and reach out to identify ways in which the university can become more inclusive and welcoming. Improving students' psychosocial outcomes is possible, particularly when students receive comprehensive support from an intensive, asset-based, and individualized intervention (e.g. Melguizo et al., 2019). More work is needed to understand how campus-wide interventions and assessment of psychosocial levels are related to student outcomes and psychosocial growth.

Our work focuses on the relationship between students' academic and psychosocial outcomes while they are enrolled in a postsecondary institution. However, students' psychosocial outcomes could also be related to their longer-term economic and personal outcomes, such as employment, wages, civic engagement, and quality of life. Future work should examine these relationships to better understand the importance of psychosocial outcomes for individuals and communities.

Notes

[1]For more information about the PASS Project, please visit: http://pullias.usc.edu/tslc/.

[2] "At-promise" is an asset-based term that refers to students who are less likely to attend a four-year college or university and who are more likely to be marginalized at predominantly white, middle class institutions, including students of color, first-generation students, students from low-income families, and students with low prior achievement. Swadener, B. B., & Lubeck, S. (Eds.). (1995). *Children and families "at promise": Deconstructing the discourse of risk*. SUNY Press.

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Tables

Table 1

Selected Sample Characteristics

Survey Respondents	N	% Students of Color	Avg. ACT Score	Avg. EFC	Avg. T0 Mattering (1-7)	Avg. T0 Acad. Self-Efficacy (1-7)
T0 and T1	1,702	40.48%	23.01	$2727.44	4.72	3.80
T0 and T2	1,454	38.38%	23.25	$2804.63	4.73	3.83
T0 and T3	1,212	38.86%	23.48	$2888.74	4.74	3.82

Note. Sample limited to students with complete demographic information, enrollment information, and a recorded GPA.

Table 2

Pairwise Correlations between Psychosocial Outcomes and Cumulative GPA

	Year 1 GPA	Year 2 GPA	Year 3 GPA
Mattering to Campus	0.178***	0.140***	0.157***
Belonging to Campus	0.183***	0.166***	0.194***
Academic Self-Efficacy	0.311***	0.298***	0.251***
Social Self-Efficacy	0.215***	0.165***	0.187***

Note. Pairwise correlations adjusted for multiple comparisons. Sample restricted to students with a recorded GPA in each year of interest. Year 1 observations = 1944; year 2 observations = 1678; year 3 observations = 1405.
*p<.05, **p<.01, ***p<.001

Table 3

Multivariate Regressions with one Psychosocial Construct of Interest

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Mattering to Campus			Belonging to Campus			Academic Self-Efficacy			Social Self-Efficacy		
	Year 1 GPA	Year 2 GPA	Year 3 GPA	Year 1 GPA	Year 2 GPA	Year 3 GPA	Year 1 GPA	Year 2 GPA	Year 3 GPA	Year 1 GPA	Year 2 GPA	Year 3 GPA
Same Yr. MAT	0.086***	0.030***	0.048***									
	(0.017)	(0.012)	(0.012)									
Same Yr. SOB				0.119***	0.080***	0.079***						
				(0.018)	(0.012)	(0.012)						
Same Yr. ASE							0.175***	0.119***	0.078***			
							(0.016)	(0.011)	(0.012)			
Same Yr. SSE										0.114***	0.058***	0.066***
										(0.017)	(0.012)	(0.013)
Observations	1,702	1,454	1,212	1,702	1,454	1,212	1,702	1,454	1,212	1,702	1,454	1,212
R-squared	0.344	0.353	0.341	0.349	0.367	0.354	0.379	0.397	0.356	0.350	0.360	0.347

Note. Models control for race/ethnicity, sex, high school GPA, ACT score, expected family contribution, first-generation status, treatment status, initial level of the psychosocial outcome of interest, initial campus of enrollment, and cohort. MAT: Mattering to campus; SOB: Sense of belonging to campus; ASE: Academic self-efficacy; SSE: Social self-efficacy.

*p<.1, **p<.05, ***p<.01

Table 4

Probit Models with Single Psychosocial Construct of Interest

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Mattering to Campus		Belonging to Campus		Academic Self-Efficacy		Social Self-Efficacy	
	Start of Year 2	Start of Year 3	Start of Year 2	Start of Year 3	Start of Year 2	Start of Year 3	Start of Year 2	Start of Year 3
Prior Yr. MAT	0.016**	0.004						
	(0.007)	(0.006)						
Prior Yr. SOB			0.034***	0.016**				
			(0.007)	(0.006)				
Prior Yr. ASE					0.032***	0.018***		
					(0.008)	(0.006)		
Prior Yr. SSE							0.033***	0.012**
							(0.008)	(0.006)
Observations	1,702	1,454	1,702	1,454	1,702	1,454	1,702	1,454

Note. Models control for race/ethnicity, sex, high school GPA, ACT score, expected family contribution, first-generation status, treatment status, initial level of the psychosocial outcome of interest, initial campus of enrollment, and cohort. MAT: Mattering to campus; SOB: Sense of belonging to campus; ASE: Academic self-efficacy; SSE: Social self-efficacy.
Marginal effects shown.
*p<.1, **p<.05, ***p<.01

Table 5

Marginal Effects, Changes in Psychosocial Outcomes, GPA and Persistence

	Persist to Year 2				Persist to Year 3			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MAT, T0 to T1	0.000							
	(0.005)							
BEL, T0 to T1		0.010*						
		(0.006)						
ASE, T0 to T1			-0.002					
			(0.005)					
SSE, T0 to T1				0.011*				
				(0.006)				
CGPA, S1 to S2	0.107***	0.105***	0.108***	0.103***				
	(0.011)	(0.011)	(0.012)	(0.011)				
MAT, T3 to T4					0.003			
					(0.006)			
BEL, T3 to T4						0.014**		
						(0.006)		
ASE, T3 to T4							0.001	
							(0.006)	
SSE, T3 to T4								0.007
								(0.006)
CGPA, S3 to S4					0.143***	0.138***	0.142***	0.142***
					(0.026)	(0.026)	(0.027)	(0.026)
Observations	1,701	1,701	1,701	1,701	1,399	1,399	1,399	1,399

Note. MAT: Mattering to campus. BEL: Belonging to campus. ASE: Academic self-efficacy. SSE: Social self-efficacy. CGPA: Cumulative GPA. T0: Beginning of semester one; T1: End of semester two; T3: End of semester four; T4: End of semester six. S1: Semester one; S2: Semester two; S3: Semester three; S4: Semester four. Models control for treatment status, sex, race/ethnicity, EFC, ACT score, high school GPA, first-generation status, initial campus of enrollment, cohort, levels of psychosocial outcomes, and cumulative GPA. Standard errors in parentheses.

*** p<.01, ** p<.05, * p<.1

Table 6

Relative Risk of Dropout, Single Psychosocial Construct of Interest

	(1) Hazard Ratio	(2) Hazard Ratio	(3) Hazard Ratio	(4) Hazard Ratio
Mattering	0.816***			
	(0.061)			
Belonging		0.666***		
		(0.062)		
Academic Self-Efficacy			0.640***	
			(0.058)	
Social Self-Efficacy				0.670***
				(0.067)
Observations	7,536	7,536	7,536	7,536

Note. Models control for race/ethnicity, sex, high school GPA, ACT score, expected family contribution, first-generation status, treatment status, initial level of the psychosocial outcome of interest, initial campus of enrollment, and cohort. Standard errors clustered by student (N=1,902).
*p<.1, **p<.05, ***p<.01

Appendix A

Table A.1

Year-by-Year Correlation Matrices

	Mattering	Belonging	Academic Self-Efficacy	Social Self-Efficacy	Cumulative GPA
Year One					
Mattering	1.000	0.587***	0.435***	0.556***	**0.178*** **
Belonging	0.587***	1.000	0.434***	0.715***	**0.183*** **
Academic Self-Efficacy	0.435***	0.434***	1.000	0.586***	**0.311*** **
Social Self-Efficacy	0.556***	0.715***	0.586***	1.000	**0.215*** **
Cumulative GPA	0.178***	0.183***	0.311***	0.215***	1.000
Year Two					
	Mattering	Belonging	Academic Self-Efficacy	Social Self-Efficacy	Cumulative GPA
Mattering	1.000	0.631***	0.499***	0.629***	**0.140*** **
Belonging	0.631***	1.000	0.502***	0.735***	**0.166*** **
Academic Self-Efficacy	0.499***	0.502***	1.000	0.609***	**0.298*** **
Social Self-Efficacy	0.629***	0.735***	0.609***	1.000	**0.165*** **
Cumulative GPA	0.140***	0.166***	0.298***	0.165***	1.000
Year Three					
	Mattering	Belonging	Academic Self-Efficacy	Social Self-Efficacy	Cumulative GPA
Mattering	1.000	0.615***	0.549***	0.626***	**0.157*** **
Belonging	0.615***	1.000	0.600***	0.727***	**0.194*** **
Academic Self-Efficacy	0.549***	0.600***	1.000	0.802***	**0.251*** **
Social Self-Efficacy	0.626***	0.727***	0.802***	1.000	**0.187*** **
Cumulative GPA	0.157***	0.194***	0.251***	0.187***	1.000

Note. All correlations significant at the .001 level after implementing the Bonferroni adjustment for multiple comparisons (within each year). Sample restricted to students with a recorded GPA in each year of interest. Year 1 observations = 1944; year 2 observations = 1678; year 3 observations = 1405.
*p<.05, **p<.01, ***p<.001

Table A.2

Regression-Adjusted Correlations between Psychosocial Outcomes and Cumulative GPA

	(1) Year 1 GPA	(2) Year 2 GPA	(3) Year 3 GPA
T1 Mattering to Campus	0.006		
	(0.020)		
T1 Belonging to Campus	0.055**		
	(0.024)		
T1 Academic Self-Efficacy	0.159***		
	(0.020)		
T1 Social Self-Efficacy	-0.008		
	(0.024)		
T2 Mattering to Campus		-0.041***	
		(0.015)	
T2 Belonging to Campus		0.066***	
		(0.017)	
T2 Academic Self-Efficacy		0.133***	
		(0.014)	
T2 Social Self-Efficacy		-0.040**	
		(0.017)	
T3 Mattering to Campus			-0.003
			(0.016)
T3 Belonging to Campus			0.072***
			(0.017)
T3 Academic Self-Efficacy			0.092***
			(0.019)
T3 Social Self-Efficacy			-0.055**
			(0.022)
Observations	1,702	1,454	1,212
R-squared	0.384	0.409	0.374

Note. Models control for race/ethnicity, sex, high school GPA, ACT score, expected family contribution, first-generation status, treatment status, initial levels of psychosocial outcomes, campus fixed effects, and cohort fixed effects. Standard errors in parenthesis

*p<.1, **p<.05, ***p<.01

Table A.3

Marginal Effects, Relationship of Psychosocial Outcomes and Persistence

	(1) Year 2 Persistence	(2) Year 3 Persistence
T1 Mattering to Campus	-0.003	
	(0.008)	
T1 Belonging to Campus	0.020**	
	(0.010)	
T1 Academic Self-Efficacy	0.018**	
	(0.009)	
T1 Social Self-Efficacy	0.012	
	(0.011)	
T2 Mattering to Campus		-0.011
		(0.007)
T2 Belonging to Campus		0.017**
		(0.009)
T2 Academic Self-Efficacy		0.016**
		(0.008)
T2 Social Self-Efficacy		-0.003
		(0.008)
Observations	1,702	1,454

Note. Models control for race/ethnicity, sex, high school GPA, ACT score, expected family contribution, first-generation status, treatment status, initial levels of psychosocial outcomes, campus fixed effects, and cohort fixed effects. Sample restricted to students with complete demographic information, enrollment information, and a recorded GPA for the semester prior to the persistence outcome (e.g. second semester GPA for persistence into year 2). Standard errors in parenthesis

*p<.1, **p<.05, ***p<.01

Table A.4

Survival Analysis, Relationship of Psychosocial Outcomes and Persistence

	Hazard Ratio
Mattering to Campus	1.126
	(0.103)
Belonging to Campus	0.740**
	(0.105)
Academic Self-Efficacy	0.707***
	(0.081)
Social Self-Efficacy	0.961
	(0.140)
Observations	7,536

Note. Models include race/ethnicity, sex, high school GPA, ACT score, first generation status, expected family contribution, treatment status, and initial campus of enrollment. Persistence measured by semester (up to six semesters). Standard errors clustered by individual (N=1,902)
*p<.1, **p<.05, ***p<.01

Appendix B

Goodness-of-Fit of Psychosocial Constructs

We use the Rasch scoring method to estimate our four psychosocial outcomes of interest. Below, we discuss the soundness of each construct within our sample.

Mattering to Campus

To evaluate the soundness of the construct, we examined item difficulty, construct reliability, construct dimensionality, item fit, average person ability by response category, rating scale thresholds, and differential item functioning. Item difficulties in the mattering to campus scale ranged from -0.56 to 0.93, with negative values indicating the items are easier than average to endorse and positive values indicating the items are more difficult to agree with (Bond & Fox, 2007). The Rasch reliability coefficient is 0.85 on a scale of 0 to 1, indicating reasonable construct reliability (Bond & Fox, 2007). The scale accounts for 56.3% of the variance in the data, indicating the construct is unidimensional (Reckase, 1979). Mean square error statistics, which capture the extent to which each item represents the underlying construct, range from 0.69 to 1.59; generally, error statistics between 0.60 and 1.40 indicate good fit for Likert-type scales (Linacre & Wright, 1994; Bond & Fox, 2007). However, since only one item exhibits a larger-than-desired outfit mean square error, the construct as a whole is still performing reasonably well. Average person ability measures indicate that, on average, students with higher ability agree with higher response categories, indicating proper ordering of the response categories. Andrich threshold peaks are ordered and at least one logit apart. There is no evidence of differential item functioning by cohort or survey wave.

Sense of Belonging to Campus

Item difficulties range from -0.53 to 0.46, with negative values indicating the items are easier than average to endorse and positive values indicating the items are more difficult to agree with (Bond & Fox, 2007). The Rasch reliability of the construct is 0.84, suggesting reasonable reliability (Bond & Fox, 2007). The scale accounts for 53.2% of the variance in the data, indicating the construct is unidimensional (Reckase, 1979). Mean square error statistics range from 0.82 to 1.13, indicating good fit for Liker-type items (Linacre & Wright, 1994; Bond & Fox, 2007). Again, we see the expected relationship between average person ability and increasingly positive response categories, indicating the construct is appropriately differentiating between students with varying levels of belonging to campus. Andrich threshold peaks are properly ordered and at least one logit apart. We find no evidence of differential item functioning by cohort or survey wave.

Academic Self-Efficacy

Item difficulties range from -0.62 to 0.80, with negative values indicating the items are easier than average to endorse and positive values indicating the items are more difficult to agree with (Bond & Fox, 2007). The Rasch reliability coefficient is 0.88, indicating reasonable reliability (Bond & Fox, 2007). The scale accounts for 55.0% of the variance in the data, suggesting the construct is unidimensional (Reckase, 1979). Item mean square error statistics range from 0.80 to 1.36, where mean square error statistics between 0.60 and 1.40 indicating the items represent the underlying construct (Linacre & Wright, 1994).

Social Self-Efficacy

Item difficulties range from -0.34 to 0.75, with negative values indicating the items are easier than average to endorse and positive values indicating the items are more difficult to agree with

(Bond & Fox, 2007). The Rasch reliability is 0.80, suggesting reasonable reliability (Bond & Fox, 2007). Item mean square error statistics range from 0.70 to 1.56. Linacre and Wright (1994) suggest mean square error statistics from 0.60 to 1.40 indicate a good fit between the items and underlying construct; as only one item falls outside this range, the construct as a whole is still performing reasonably well in our context. We find a positive relationship between average person ability and increasingly positive response categories. Andrich thresholds are ordered; however, not all peaks are at least one logit apart, indicating students may not be fully differentiating between points on the response scale (e.g. the difference between a 2 and 3 is not well-delineated). We find no evidence of differential item functioning by cohort or survey wave.