The Effects of Growth Mindset on College Persistence and Completion

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We study the long-term effects of a psychological intervention on longitudinal academic outcomes and degree completion of college students. All freshmen at a large public university were randomized to an online growth mindset, belonging, or control group. We tracked students' academic outcomes including GPA, number of credits attempted and earned, major choices, and degree completion. We found no evidence of longitudinal academic treatment effects in the full sample. However, the mindset treatment improved term GPAs for Latinx students and the probability for Pell-eligible and Latinx students to major in selective majors. We also found no evidence of increased rates of on-time graduation, however, the treatment raised the probability to graduate with selective majors in four years, especially for Latinx students.

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Abstract

We study the long-term effects of a psychological intervention on longitudinal academic outcomes and degree completion of college students. All freshmen at a large public university were randomized to an online growth mindset, belonging, or control group. We tracked students' academic outcomes including GPA, number of credits attempted and earned, major choices, and degree completion. We found no evidence of longitudinal academic treatment effects in the full sample. However, the mindset treatment improved term GPAs for Latinx students and the probability for Pell-eligible and Latinx students to major in selective majors. We also found no evidence of increased rates of on-time graduation, however, the treatment raised the probability to graduate with selective majors in four years, especially for Latinx students.

1. Introduction

College enrollment has steadily increased over the past three decades, yet only 60% of recent undergraduate students completed a bachelor's degree within six years (McFarland et al., 2019). At the same time, time to degree completion has increased remarkably (Bound, Lovenheim, & Turner, 2012). The problem is even more critical for students from historically underrepresented groups, including first generation, economically disadvantaged, African American, and Latinx students (Arum & Roksa, 2011). In addition, college dropouts do not have substantially higher earnings than high school graduates compared to those who completed a bachelor' degree (Oreopoulos & Petronijevic, 2013).

One type of intervention that has not yet been thoroughly investigated as a large-scale approach to improving persistence and completion in college is a growth mindset intervention. Growth mindset interventions deliver the message that students' intellectual abilities are not fixed and that their abilities can grow in response to increased efforts (Dweck, 2006; Yeager & Dweck, 2012). These interventions aim to shift the way in which students attribute academic success or failure from stable factors (typically one's fixed intelligence) to more unstable factors (e.g. effort or social conditions). In other words, they aim to convince students that rather than being fixed and finite, intelligence is malleable, and one can become smarter and more successful in school by working harder (Yeager & Walton, 2011).

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Recent studies have shown positive growth mindset treatment effects on academic outcomes, especially for academically high-risk and low-SES students (Broda et al., 2018; Damgaard & Nielsen, 2018; Paunesku et al., 2015; Sisk et al., 2018; Yeager et al., 2016; Yun, Kim, Schneider, & Lee, 2020). In particular, the National Study of Learning Mindsets (NSLM) examined the effects of an online growth mindset intervention in a nationally representative sample of ninth-grade students in United States public schools and found a modest improvement of 0.04 grade points (Kim, Schneider, & Yun, 2020; Yeager et al., 2019).

In this paper we contribute to this growing literature by focusing on the longitudinal effects of a growth mindset intervention targeted toward students at a large, flagship state university. This research has two key purposes. First, we provide evidence from the random assignment of students on the longitudinal impact of the intervention on key educational outcomes including GPA and college completion. Second, we explore possible proximate outcomes (e.g., credit accumulation and major selection) and examine subgroup effects (e.g., Pell eligible students, first generation students, Latinx, and Black students) that could provide fruitful explanations for the mechanism through which these growth mindset interventions may operate.

At Michigan State University (MSU), all incoming students were invited to participate in an online survey and were randomly assigned to growth mindset, belonging, or control groups. Broda et al. (2018) show that the growth mindset intervention had a substantial short-run impact on treated Latinx students, causing a 0.4 point increase in their first year GPA and a 70% reduction in the White-Latinx GPA gap. Four years after the intervention was implemented, we seek to explore the longitudinal mindset effects on academic persistence and completion. Matching the experimental sample to the university's administrative data, we observe students' academic outcomes every semester from their first year (2014/15) until fourth year (2017/18), which provides a unique opportunity to track the dynamic evolution of the mindset effects.

Similar to Broda et al.'s (2018) initial findings, we find no evidence that the mindset treatment improved longitudinal academic outcomes in the full sample. We show that the treatment has no significant effects on GPA, cumulative GPA, credit accumulation, and graduation. However, again consistent with Broda et al.'s findings, when looking at the impact of the treatment for first generation students, Pell-eligible students, and Latinx students we find several subgroup effects, especially for Latinx students.

For first generation college students, we find no effect on graduation, cumulative or term-wise GPA. However, we do find mixed evidence on course-taking and credit accumulation, with positive effects for credits attempted, earned, and accumulated in Spring of year 1, and negative effects for credits attempted and earned in Fall of year 3. For Pell-eligible students, we find no effect on GPA across time and credit accumulation, except for positive effect on credits earned and accumulated in Fall of Year 2..

For Latinx students, we find that the original effects of the mindset intervention (see Broda et al., 2018) on cumulative GPA persisted across all eight semesters, with the magnitude of estimates ranging from a maximum of .337 GPA points in the Fall of year 1 to a minimum of .142 GPA points in Fall of year 3. At the end of the eighth term (Spring of year 4), the overall treatment effect for the mindset intervention was .201 GPA points. A similar pattern was found for semester-wise GPA, with participants in the treatment condition ending up with a higher

semester GPA in six out of eight total semesters. In terms of credit accumulation, we find no significant impacts on credits attempted in each semester, but we do find positive effects on credits earned in Fall of year 4.

Second, we find no significant effects in the full sample on college major choice. However, we find that the treatment increased the probability for Pell-eligible and Latinx students to major in business or in selective majors. The treatment effects are particularly large in students' 2nd, 3rd, and 4th academic years.

Third, we find that the treatment had no impact on the probability to graduate in four years. We also do not find any mindset treatment effects on the timing of degree completion or choice of STEM major. The mindset treatment, however, increased the likelihood to graduate with limited enrollment majors, indicating that the treatment affected the types of degrees students pursued and with which they graduated.

Fourth, consistent with subgroup effects on longitudinal academic outcomes, we find that the mindset treatment increased the probability to graduate with business majors for Latinx students by 180%. Results also indicate that first-generation and Pell-eligible students also are more likely to major in business and persist to their fourth year in college. Although the original hypotheses stated that the belonging treatment would affect students academic outcomes, this study, as well as the initial study by Broda et al. (2018), show significant effects of the mindset treatment but nothing for the belonging treatment. Here we provide possible explanations for these differential treatment effects. We conducted in-depth work on open response questions from belonging surveys and qualitative interviews with participants. Results suggest that there are multiple dimensions of belonging at MSU, for example, academic and social belonging, and that these types of belonging were not adequately captured by the belonging treatment. Thus, the belonging treatment at MSU might not have been well-tuned to specific ways in which belonging might operate at MSU, which could explain why we do not see any belonging effects. This interpretation fits with emerging literature on psychological interventions, which argues that light touch interventions, such as growth mindset or belonging, need to be tuned to the specific local context or they will fail (e.g., Walton & Brady, 2020).

Our study relates to the growing literature on low-cost interventions, which usually settles for short-run dependent measures, such as preventing summer melt, and presents the first longitudinal results that growth mindset improved academic outcomes in postsecondary education and had lasting impacts for certain subgroups. As Bailey et al. (2020) argued, it is essential for the published literature to include long-term results, significant of not, so that fadeout and persistence can be studied directly. These improved mindsets and positive impacts on field of degree may boost labor market and social outcomes (Heckman, Stixrud, & Urzua, 2006). Prior studies have shown that improved emotional skills such as growth mindset have short-run academic benefits (Kim, Schneider, & Yun, 2020; Yeager et al., 2019), however, this type of intervention has not shown persisting effects on academic outcomes (Damgaard & Nielsen, 2018; Oreopoulos & Petronijevic 2019). Heckman and Kautz (2013) documented that the lack of persisting evidence may result from intervention effects that change incentives in the short-term and only temporarily affect key behaviors.

Our results extend recent findings on the impacts of randomized psychological interventions in higher education contexts. For example, Bayer, Bhanot, Bronchetti, and O'Connell (2020) evaluated an intervention at a smaller scale in an introductory economics classroom and found that women and underrepresented racial/ethnic minority (URM) students had lower levels of relevance, belonging, and growth mindset compared to non-URM students and men. The fact that these survey measures differ by demographic subgroups supports our block randomization approach. The authors argue that interventions to increase these psychological measures may help women and URM students perform better and persist in the discipline. Our results on long-term impacts of a growth mindset intervention, particularly for Latinx students, not only support their claim but also extend the scope of outcomes and time horizon.

Through this study, we provide the first evidence that the growth mindset treatment not only boosted GPA and credits earned but also affected field of degree. We show that mindset intervention effects, if they last, do not always appear for the same outcomes (e.g. GPA) but also involve adequate progress through the college (e.g., through major plans). Estimated treatment effects are especially large for Pell-eligible, Latinx, and first-generation students, which reduced income, racial and ethnicity gaps in academic outcomes. As improved academic outcomes in college are likely to enhance labor market outcomes, these findings have practical implications for many higher education institutions. In addition, the broad range of outcomes and subgroups studied provides evidence for where future research could focus for the longitudinal effects of such interventions.

2. Spartan Persistence Project

In the Fall of 2014, MSU implemented the Spartan Persistence Project for all incoming domestic students. From May to August prior to fall matriculation, all 2014/15 admitted applicants to MSU received an email that invited then to participate in an online growth mindset survey.[2] When students signed into the survey, they were randomized into three groups: 1) growth mindset treatment; 2) belonging treatment; and 3) control. We hypothesized the intervention effects may vary by race, and therefore randomized the sample within four race strata.

Students in the growth mindset treatment group were given a brief scientific article to read about growth mindset and provided an exercise that emphasized the idea that intelligence is not fixed and that extra effort and effective strategy use on their part can translate to a growth in intelligence over time. Students in the belonging treatment group were given a series of stories taken from upperclassmen that discussed how current students overcame challenges of feeling like they did not belong at MSU and what belonging at MSU means. Key stories were then matched with the reader's identified gender and race/ethnicity.[3] Students in the control condition

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[2] The intervention was part of incoming students' admission packet, although they were not required to do it. Part of the strength of the intervention is that the take-up rate and completion rate were both very high. Among invited students, 92% of them participated in the intervention and 98% of them completed intervention. Students were considered to complete if they completed at least one of the exercises in the treatment. More details about the implementation of the intervention are available at Broda et al. (2018). Although we cannot directly measure the extent of diligence and interest, we tried to measure a proxy for engagement by applying Linguistic inquiry and Word Count (LIWC) (a program designed to count words and phrases in written products) to count the number of words that students wrote across essays. We found no engagement or differential treatment engagement effects.
[3] See Broda et al. (2018) for more detail on the specific intervention and its theoretical and conceptual grounding.

were given reflections to read from current students about more generic topics such as the weather and food on campus.

3. Data

The data for all of the analyses from the 2014/15 school year through the 2017/18 school year were merged from multiple sources. First, we obtained pre- and post- treatment survey information using Qualtrics (an online survey system) that was linked by unique student identifiers to institutional data. Survey information includes treatment status, survey start and end times, completion status, and information to identify the student including email and IP addresses.

Second, we obtained institutional data on student demographic and background characteristics, including: gender, race and ethnicity, date of birth, first generation college student status, high school name, ACT or SAT scores, and Pell eligibility.

Third, we used longitudinal, student-level, administrative data from the Office of Registrar to identify academic persistence and completion information, including: GPA, number of credits attempted and earned, and choice of major, all of which were reported at the end of each fall and spring semester. We also obtained completion status for whether students had graduated within the four-year window.

For major and field of degree outcomes, we constructed two measures. First, we used the first two digits of the Classification of Instructional Programs (CIP) from Immigration and Customs Enforcement (ICE) to match all graduating majors with the CIP in order to identify STEM majors.[4] Students who had double majors in STEM (7% of the STEM sample), were coded as having two STEM majors. Second, we used institution-specific information about academic programs to identify limited enrollment majors. Limited majors have limited space for enrollment and may have additional admission requirements such as overall GPA or specific course prerequisites. In general, students need institution-specific knowledge to apply for the limited majors and must satisfy certain requirements that can be learned from individual navigation of university resources. These behaviors both are aligned with the growth mindset treatment messages, which encouraged students to seek out additional resources when needed.

3.1 Randomization

Students were randomized into a mindset treatment, belonging treatment, or control group (blocking on race/ethnicity[5]). Table 1 presents balance tests comparing the three treatment arms on time invariant and pre-treatment indicators. Overall, there is little evidence of differences

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[4] The 2-digit CIP code levels are 14 for Engineering, 26 for Biological and Biomedical Sciences, 27 for Mathematics and Statistics, and 40 for Physical Sciences. The full list of STEM majors can be found in https://www.ice.gov/sites/default/files/documents/Document/2016/stem-list.pdf.
[5] The randomization occurred at the individual level, within separate blocks according to the students' racial/ethnic group (Broda et al., 2018). The Hispanic group was treated as a race group, not as an ethnicity group, at the time of intervention randomization. Only race category was used in the randomization and gender was not part of randomization strata. As stated by Broda and colleagues, the official institutional designation for Latinx students is "Hispanic (all races)". To be consistent with the initial study, we also used the term "Latinx" in an effort to use a more inclusive group identifier.

between the mindset, belonging, and control groups. The only exception is a 2.9% difference in the proportion of Pell-eligible students in the belonging group compared to the control group. A joint orthogonality test reveals no statistically significant differences between the groups.[6]

3.2 Sample description

The size of the analytical sample matched to administrative data for the 2014/15 cohort is 6517. Table 2 presents descriptive statistics on student demographics, pre-treatment indicators, and longitudinal and completion outcomes in the analytic sample for the mindset and control conditions. In Table 2-A, we find no significant differences between the mindset and control groups on demographic makeup or pre-mindset and pre-belonging measures. In Table 2-B, we see some differences between the two groups on longitudinal outcomes. Students in the mindset treatment arm are 3-4 percentage points more likely to have a limited major than control students at the end of the second year and fourth year of college. We observe no differences in cumulative credits earned and cumulative GPA. In Table 2-C, the only observed difference is .9 percentage points lower for mindset students to graduate with a physical STEM degree than control students. As there are only 64 students in total who graduated with a degree in physical science, so we do not emphasize the differences. All other completion outcomes are not statistically significantly different between the groups.

4. Estimation

Having successfully randomized students across treatment and control groups, we next evaluated the intervention effects on academic persistence and completion by comparing outcomes between students in the treatment and control groups. We regressed outcome variables (e.g., GPA) on treatment dummies and demographic characteristics by ordinary least squares (OLS):

$$Y_{it} = \alpha + \beta_1 mind_i + \beta_2 belong_i + \delta X_i + \epsilon_{it}$$

where Y_{it} is the outcome of student i in semester t. The main outcomes of interest are end-of-semester GPA, the number of credits attempted, the number of credits earned, major choice, and degree completion. The dummy variables $mind_i$ and $belong_i$ denote whether student i is assigned to one of two treatment groups, while the omitted group is the control group. The parameter of interest is β_1, which measures the causal effect of being randomized into the growth mindset treatment groups. The vector X_i is a set of student demographic characteristics including gender, race, pre-treatment scores, Pell eligibility and first generation status, equated ACT scores, and birth year dummies.[7] Given the balance in the covariates reported in the previous section, the addition of these variables does not change the estimated coefficients. Each estimated coefficient on the $mind_i$ and $belong_i$ variables can be interpreted as the "intent-to-treat" effects of the intervention.[8] When the outcome variable is continuous, we estimate OLS

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[6] We examined attrition over time and found no evidence of differential attrition between treatment and control groups, suggesting that estimates from our longitudinal analysis are unbiased.
[7] We include the second and third order of pre-treatment scores and equated ACT scores. In other specifications, we included dummy variables for each score and found no differences in the treatment estimates.
[8] As the survey completion rate was 98 percent, the estimated effects for "treatment on the treated" (ToT) can be calculated by instrumenting for completion of the survey with dummy variables for treatment assignment. ToT estimates did not differ significantly from ITT estimates in this case.

regression models. When the outcome is a binary variable, as for a measure of whether an individual earned a bachelor's degree, the probability that the outcome variable equals 1 is estimated by logit models, and marginal effects are reported.[9] We use the robust standard errors because the clustering was not possible.

We also conduct subgroup analyses to examine heterogeneous treatment effects. We check for heterogeneity by race, Pell-grant eligibility, and first generation status. Broda et al. (2018) showed a large mindset treatment effect for Latinx students on first semester GPA of approximately 0.4 GPA points. Thus, we are particularly interested in whether Latinx effects persisted in the subsequent years and whether other subgroups benefitted from the intervention in terms of academic persistence and completion.

5. Results on Longitudinal Outcomes

Below, we present estimates for the longitudinal impacts of the mindset intervention on GPA, course credit accumulation, and major selection over the course of eight consecutive semesters. Longitudinal results are presented in the form of figures that represent the coefficient estimates for the treatment effect over time and a corresponding 95% confidence interval.[10] As described above, we present results for the full sample ("All Students"), as well as empirically-relevant subgroups where impacts may be expected due to previous research (Paunesku et al., 2015; Sis et al., 2018), including Pell-eligible students, Latinx students, and first-generation college students on multiple educationally relevant outcomes. We include the belonging treatment indicator in all-subsequent analyses but do not report the estimated coefficients for belonging. As we do not find any significant belonging treatment effects, consistent with the initial study by Broda et al. (2018), thus we focus on the mindset treatment effects instead of repeatedly stating that we do not find any significant belonging effects. Full model results, including regression tables, are available in the Online Appendix.

5.1 Impact on Cumulative GPA

Figure 1 presents the results for the impact of the mindset intervention on students' cumulative GPA. No significant effects were observed for the full sample, as well as for Pell-eligible and first-generation college students. For Latinx students, the treatment effect was found to be positive and significant across all 8 semesters, with students in the treatment group earning between .14 and .34 points higher cumulative GPA.[11] At the end of the eighth semester, the treatment effect was .30 cumulative GPA points. A similar pattern was observed for term-specific GPA, with consistent treatment effects for Latinx students and no effects for the full

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[9] We also estimated the baseline model without covariates. The introduction of covariates did not change the statistical significance of the estimates.

[10] Here we do not standardize effect sizes across outcomes as changes in standardized effect sizes over time can be misleading (Bailey et al., 2020). For example, we presented results that receiving the mindset treatment affected major choice, which in turn affects the composition of students in affected majors. As students take different sets of courses by major, grade means differ across majors and school years. If the intervention affected students' choice both in cross-sectional and longitudinal contexts, attempting to standardize GPA across different majors across time is likely to lead to biased estimates.

[11] Broda et al. (2018) documented that the program effect on the first semester GPA was 0.4. We modified sample restrictions and specifications and the point estimate was 0.34. We were able to replicate their estimates when we used the same restrictions.

sample or the other subgroups. These positive treatment effects are evidence of the persistence of treatment effects first observed for Latinx students in Broda et al. (2018). See Appendix Figure 1 and Online Appendix Tables 1 and 2 for more details on these results.

5.2 Impact on Cumulative Course Credits Earned

Figure 2 presents the results for the impact of the mindset intervention on students' cumulative credits earned over the course of the 8 semesters. No significant effects were observed for the full sample or for Pell-eligible students. For Latinx students, the treatment effect was found to be positive and significant in Fall of Year 4 only, with students in the treatment group accumulating about 5 more course credits over the 7 previous semesters. Our full-model results in the Online Appendix Tables 3 and 4 contain treatment effect estimates for course credits attempted in a given semester, as well as course credits earned. The pattern and magnitude of effects were similar for the full sample and for the subgroups.

5.3 Impact on Major Selection

Figure 3 presents the results for the impact of the mindset intervention on students' eventual enrollment in a limited-admission major. For all students, we see a small but persistent positive impact on enrollment beginning in Spring of Year 2 and continuing through Spring of Year 4. Students in the mindset treatment had between 2 and 5 percent higher likelihood of enrolling in a limited-admission major compared to students in the control condition. No effect was observed for first-generation students. For Latinx students, this treatment effect was significant in Fall of Year 3 and Spring of Year 3. The magnitude of the effect was much higher, as Latinx students in the treatment had an 18 to 20 percent higher likelihood of enrollment in limited majors compared to students in the control condition. Pell eligible students also had positive and significant treatment effects in Fall of Year 2, Spring of Year 2, and Fall of Year 3, with students in the treatment group having a likelihood of limited major enrollment that was 7 to 9 percent higher than students in the control condition. In Online Appendix Tables 5, 6 and 7, we present our full results, which include the impacts on limited-admission major enrollment, business major enrollment and STEM major enrollment. The patterns of significance and magnitude of treatment effects for business major enrollment were nearly identical to those for all limited-admission majors. We did not find any significant impacts on STEM major enrollment in the full sample or in our subgroup analyses.[12]

6. Results on Completion

In this section, we explore the growth mindset treatment effect on degree completion and field of major measured four years from the intervention. We also present heterogeneous treatment effects by subgroup, including female students, first-generation students, Pell-eligible students, and Latinx students.

6.1 Impact on Degree Completion

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[12] Note that we focus on semester specific outcomes for longitudinal measures, such as GPA at 3rd semester. Results in Online Appendix Table 8 are not sensitive to the inclusion of semester fixed effects when we use student-by-year level data.

At MSU, on average 62% of incoming students graduate in four years, and the graduation rate is lower for first-generation, Pell-eligible, and Latinx students, which are 52%, 48%, and 51% respectively. Results in Table 3 indicate that the treatment group was no more likely to obtain a degree in four years. Columns 2-5 indicate that the effect is negligible for female, first-generation, Pell-eligible, and Latinx students. We also do not find any mindset treatment effects on the timing of degree completion. Appendix Table 1 shows that there is no treatment effect on the likelihood to complete the degree within two or three years.

6.2 Impact on Field of Degree

To understand whether the mindset treatment affected which major a student completed a degree with, we next estimated separate models in which we split majors into two large categories: STEM and limited enrollment majors. Table 4 indicates that among graduates, the mindset treatment did not affect the probability of completing a college degree in STEM majors (Columns 1 and 2), however, mindset treated students were more likely to graduate with limited enrollment majors (Columns 3-6).[13] Column 3 shows that the mindset treatment increased the probability to graduate with a limited major by 3.4 percentage points, corresponding to a 6.7 percent increase. The treatment impact on the likelihood to graduate in four years with a degree in business was positive but imprecise. The point estimates for other majors including Engineering, Agriculture, Education, and Nursing were smaller and not precisely estimated.

Even though we failed to find any large significant treatment effects on field of degree, the benefit of the mindset treatment may accrue differently by subgroup. Previous analyses provided evidence that the growth mindset treatment had a positive effect on the likelihood of choosing limited enrollment majors, especially in business. Thus, we next examined whether those students who are induced to major in limited majors persisted and completed with the enrolled majors indicating a possible important effect of the mindset intervention.

Table 5 presents the estimated treatment effects on field of degree, where each panel presents separate estimation results by corresponding subgroup. Results suggest that the treatment affected the field of major that students chose and graduated with for certain subgroups. Given that 82-88% of students persist in STEM majors during their first two years at MSU, we do not find any treatment effect on STEM majoring for any subgroup. Female students make their first appearance here as a tested subgroup given their longstanding underrepresentation in STEM majors. Our analysis suggests that they are 0.8 percentage points, or 36 percent, more likely to graduate with an Engineering major if they were exposed to the mindset intervention. Given the low number of female Engineering graduates in the control group (18 students), this estimate may be driven by a small number of random cases. Thus, we do not overemphasize the female Engineering treatment effects, however, this analysis suggests that future studies may want to focus on this as a possible important outcome of mindset-type interventions.

The point estimates for limited majors in Column 3 are larger and statistically significant for Pell-eligible (Panel C) and Latinx (Panel D) students. The mindset treatment increased limited major completion by eight percentage points for Pell-eligible and by 24 percentage points for

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[13] STEM majors include Engineering, Biological and Biomedical Sciences, Mathematics and Statistics, and Physical Sciences. Limited enrollment majors include Agriculture, Business, Education, Engineering, and Nursing. Estimation results for full STEM and Limited subfields are summarized in Appendix Table 2.

Latinx students, which corresponds to 20 percent and 72 percent increases, respectively. Given the relatively low baseline rates for Pell-eligible and Latinx students' graduation with limited majors, these effect sizes are economically significant. Estimated coefficients in Column 4 indicate that the limited major effects for Latinx students were mostly driven by Business majors. The point estimate reveals that the treated Latinx students were 180% more likely to graduate on-time with Business majors compared to control group students. Yet, we do not emphasize the Latinx Business treatment effects as there are only 4 students and the effects may have been driven by randomness. Columns 5 and 6 show that the mindset treatment had no influence on the probability to graduate with degrees in Education, Engineering, or Nursing.

Taken together with the longitudinal treatment effects for these subgroups, we find that the mindset treatment has effectively changed academic trajectories for Pell-eligible and Latinx students, and provides a possible fruitful avenue for future studies of mindset effects.

6.3 Impact on Completion including the 4th Year Information

In the previous section we presented evidence that Pell-eligible and Latinx students are more likely to switch their majors to limited majors (especially business) while enrolled.[14] However, we do not find significant positive treatment effects on field of degree. Since switching to a more competitive major may require more time to graduate, and since some pre-professional majors (such as pre-medical) are identified as limited majors, yet students cannot graduate with them, the treatment effects on field of degree in Table 5 may actually underestimate the treatment effects.

To investigate this possibility, we next included 7th and 8th semester outcomes in 2017/18 for those students who did not graduate in four years. Results, presented in Table 6, show that we do not find any STEM treatment effects. In Column 2, with a larger sample size, the mindset effects for female students on the probability either to graduate in Engineering, or be in their 4th year in Engineering while not graduating, was statistically significant at the 5% level. Though not shown here, the mindset treatment had no effect for male students on STEM majors. The treatment, however, had a negative effect on males to graduate with STEM majors in four years, implying that the marginal students who moved into STEM majors took longer to graduate but persisted. Whether these treated students are more likely to graduate in five years is left for future research.

Results in Columns 3 and 4 indicate that the mindset effect for business majors who were first-generation and/ or Pell-eligible was positive and statistically significant. This suggests that the treatment induced these students to major in Business, but they did not graduate in four years.[15] For example, mindset-treated Pell-eligible students were 39% more likely to major in business than control group students, which means that in the absence of the treatment, these students

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[14] There are multiple pathways through which the intervention increased business majors, especially for Latinx students. Further analyses show that the mindset intervention helped students persist in business majors and also caused students to switch their majors into business, particularly from other social science majors such as economics.

[15] We replicated Table 4 by including 4th year enrolled students. Estimates are quite comparable to those in Table 4 and are summarized in Appendix Table 3.

would not have enrolled in business majors.[16] Thus, the treatment seems to successfully decrease income gaps and racial gaps in business majors.

In sum, the mindset effects on the probability to major in business were positive for students in some subgroups and they persisted to their fourth year in college although they did not graduate in four years. Results suggest that the mindset treatment might have been successful in delivering messages that students can succeed in harder majors by taking more challenging courses and that the mindset treatment triggered students who were ambitious enough to enroll in selective majors and persist in college even if they struggled academically. Considering the higher potential earnings for students who study in the STEM and business fields compared to other fields (e.g., Webber, 2014), the mindset treatment may contribute to closing the earnings gap in the future.[17]

7. Robustness

As we test treatment effects on multiple outcomes across subgroups, we acknowledge the possibility that some subgroup effects on certain academic outcomes could occur by chance. The strength of this study is the use of a double-blind design, a large sample size, and a long panel to track changes in outcomes over time. We find consistent mindset effects only for Latinx students persisting over years, which is unlikely to be due to random occurrence. When we run the analyses by including interactions between treatment and ethnicity, gender, first generation, and Pell-eligibility status, we find the same consistent mindset effects only for Latinx students. There are some other subgroup effects but they are less consistent, and we view them as descriptive evidence that needs to be examined and confirmed in subsequent studies.

8. Treatment effects for Black students

The initial study by Broda et al. (2018) did not find any mindset and/or belonging effects for Black students. Nevertheless, we performed analyses on all of the outcomes for Black students. Although the interventions were designed to impact underrepresented student groups, we found persistent mindset effects only for Latinx students but not for a similarly small sample of Black students. Black students account for 8% of the sample and Latinx group account for 4% of the sample. If the mechanism in which mindset intervention works is through students' race, it could be puzzling to find differential mindset effects between Black and Latinx students. Because we think understanding patterns of no treatment effects may be just as important as understanding treatment effects, we present some explanation. Specifically, we hypothesize that treatment saturation could explain the differential mindset effects between Black and Latinx students. While there has been a long tradition of recruitment and retention programs designed for Black

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[16] We found positive mindset effects among Latinx and Pell-eligible students in Tables 5 and 6, however, it is not clear whether the mindset treatment worked through socioeconomic status or whether the estimates for Latinx and Pell-eligible are independent. In additional analyses, we restricted the sample to Latinx students and added the interaction of mindset treatment indicator and Pell-eligible indicator to the main specification where the outcome is to graduate with limited or graduate with business majors. We do not find consistent interaction effects.

[17] Results align with previous research on mindset treatments that found positive effects for low-achieving students (e.g., Yeager et al., 2019). We also examined whether the mindset treatment has any effects for high-achieving students. In particular, we restricted the sample to those who were admitted to a highly selective residential program. Results not shown here show no treatment effects on persistence, degree completion, and field of degree.

students at MSU, Latinx populations have historically been smaller and while they have shown strong growth relatively recently (Diversity Workforce Data Report, 2020)[18] supports for Latinx students have a much shorter history than those designed for their Black peers (Personal Communication, 2017).[19] Given this history, one possible explanation for these differential findings is that the mindset message for Black students is already saturated as similar messages may already be well established in existing programs at MSU. For Latinx students, these messages may not be as well established, thus, an intervention like this short survey would have a greater window for success for Latinx students at MSU.

9. Discussion

Improvement in social and emotional measures is shown to predict long-term labor market outcomes but interventions that impact these outcomes may not work consistently across heterogeneous student subgroups based on race/ethnicity, socioeconomic status, and prior experience with higher education. Further, as more of these long-term studies on low-cost interventions are undertaken, empirical evidence about possible key outcomes must be highlighted to guide the design of these future studies. This paper examines the mindset treatment effects on academic outcomes for college students and investigates the degree to which the mindset intervention affected students' academic outcome trajectories. We provide evidence that a mindset treatment at a large public university had positive and persisting effects for underrepresented students, including Latinx, Pell-eligible, and first-generation students.

For Latinx students, we find that the original effects for the mindset intervention on cumulative GPA persisted across all eight terms, with the magnitude of estimates ranging from a maximum of .337 GPA points in the Fall of year 1 to a minimum of .142 GPA points in Fall of year 3. At the end of the eighth term (Spring of year 4), the overall treatment effect for the mindset intervention was .201 GPA points. A similar pattern was found for term-wise GPA, with participants in the treatment condition ending up with a higher term GPA in 6 out of 8 total semesters. In terms of credit accumulation, we find no significant impacts on credits attempted in each term, but we do find positive effects on credits earned in Fall of year 4. These results underscore the need for additional research on why Latinx students experienced such sustained and persistent effects from this intervention, while other underrepresented groups did not.

One possible factor that may drive some of these findings is that unlike other nudge-style interventions like financial aid or college application assistance, this type of low-cost psychological intervention requires a substantial amount of time and effort from participants to be effective. These interventions may benefit from additional supports that help students nurture and sustain the short-term treatment effects. In 2017/2018, MSU adopted a special program that adds extra support for students who were predicted to have a low first-year GPA. Students were paired with a volunteer mentor who checked in at critical times of the year, provided information about institutional resources, and linked them with critical services as needed. Preliminary results indicate that the additional supports paired with the psychological interventions had positive treatment effects on first semester GPA, suggesting that mindset and belonging interventions

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[18] https://inclusion.msu.edu/_assets/documents/about/annual-reports/2018-19-Diversity-at-MSU-Student-and-Workforce-Report-Final-RevisedJune2020.pdf
[19] Personal communication with Luis Alonzo Garcia, Director of MSU Migrant Services, 2017

may benefit from additional services and follow-up. More targeted and personalized interventions that focus on the connection with students, instead of anonymous public messages, and that use institutional resources can work together with the mindset treatments to help students increase academic achievement and persistence.

While this paper examines mindset treatment effects on longitudinal academic outcomes for college students there is still much left to learn. In particular we must investigate mechanisms through which the intervention affected other outcomes. Using the first four semesters of transcript data we find that students who completed the growth mindset intervention were more likely to take challenging courses (defined as the top tenth percentile of courses with students receiving a grade of 2.0 or lower) during their first year of school. These effects are most pronounced for students from low-income backgrounds (as determined by Pell-eligibility) and Latinx students. In addition, only mindset-treated Pell-eligible students are more likely to *re*-take failed courses (defined as receiving a grade of 1.0 or lower).

These findings suggest that, consistent with prior research (e.g., Bettinger et al., 2017; Rege et al., 2020), the growth mindset intervention led to more challenge-seeking behaviors, particularly for students from lower income backgrounds. However, it does not raise students' GPA on average. It follows that GPA may be a poor indicator of the effectiveness of mindset interventions; students who take tougher courses within more challenging majors may earn lower GPAs than they would have in less challenging courses. Research has shown, however, these challenging courses are often gateways into selective majors that have been linked with long-term labor market benefits (Webber, 2014). We observed that students in the mindset treatment were more likely to enroll in a limited-admission major. Enrollment in such majors is itself a challenge-seeking behavior as admission is competitive and there can be coursework and GPA requirements for entry. Similar to the findings of Rege and colleagues (2020), the institutional context allowed students to make decisions about the challenges they sought in limited-admission majors and coursework in the semesters after receiving the mindset intervention.

In addition, results from the above suggest that when an intervention is given to a large diverse group, the likelihood of the treatment being equally effective for all participants is quite low. While it might be explicitly targeted at a particular population, it may only have an impact on a sub-population of the target group, which indicates the heterogeneity in the effects of social psychological interventions. As an exercise to identify heterogeneous treatment effects, we created predicted-GPA for the 1st fall semester using information from prior cohorts and found that lower predicted-GPA mindset treated students over-performed compared to the control group students. More rigorous research is needed to predict individuals who are most susceptible to the treatment, but like the other findings above, these key areas are highly suggestive of other areas to explore.

Given that nearly 20% of students who enter MSU do not graduate within 6 years, investigating whether the mindset treatment helped students to graduate either on-time or within 5 years has a huge policy implication, especially for students who are induced to enroll in limited enrollment majors and persisted through their 4th year. As what students study in college matters more than where they study (Hasting, Neilson, & Zimmerman, 2014), it will be critical to track whether these underrepresented students are successful in graduating with selective majors and also persist into corresponding occupations.

Acknowledgement

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Figure 1. Longitudinal Estimates for Impact of SPP Mindset Intervention on Cumulative GPA.
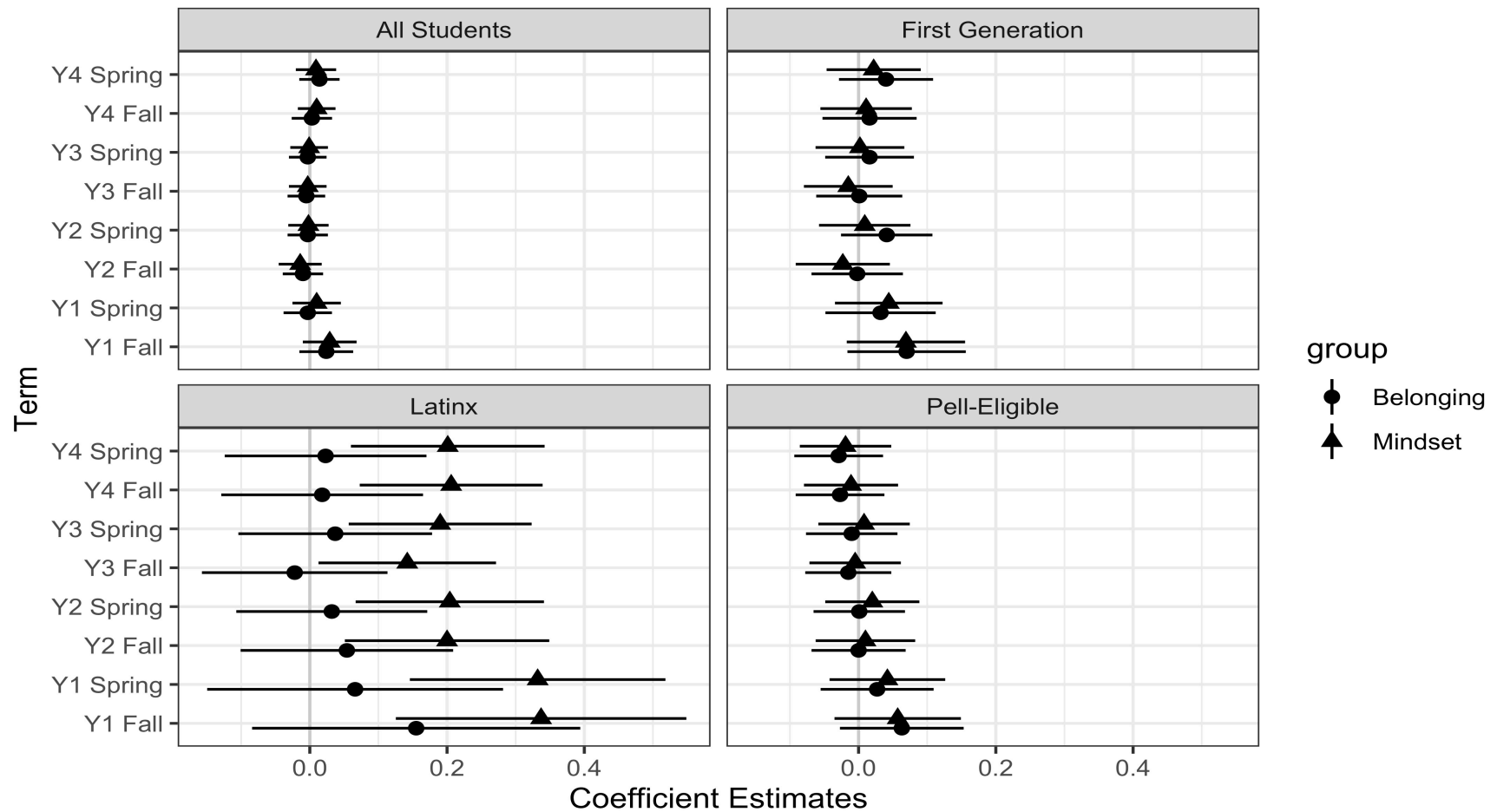
Notes: Dots represent point estimates, and black bars represent the upper and lower limits of a 95% confidence interval. Circle dots represent belonging estimates and triangle dots represent mindset estimates.

Figure 2. Longitudinal Estimates for Impact of SPP Mindset Intervention on Cumulative Course Credits Earned.
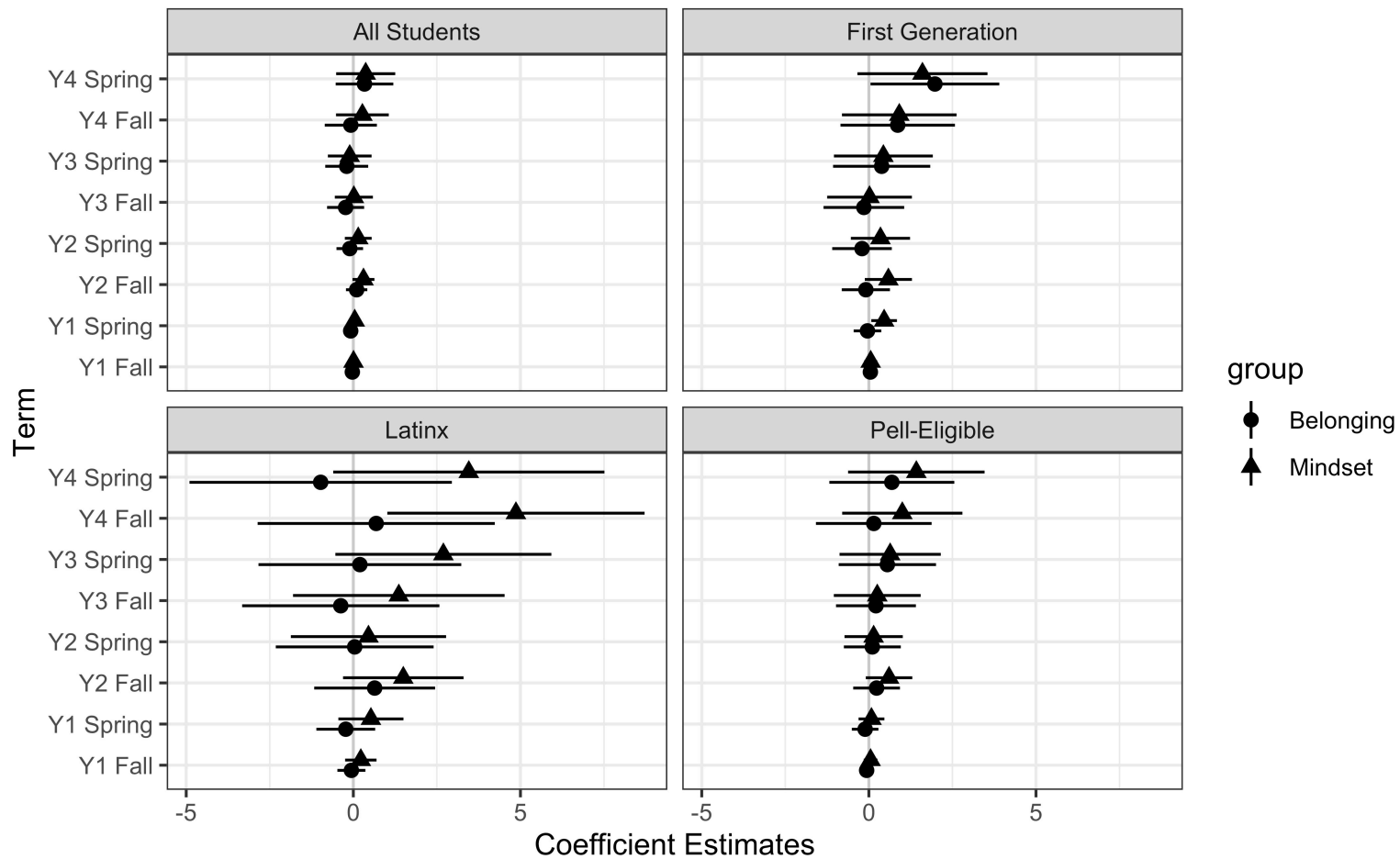
Notes: Dots represent point estimates, and black bars represent the upper and lower limits of a 95% confidence interval. Circle dots represent belonging estimates and triangle dots represent mindset estimates.

Figure 3. Longitudinal Estimates for Impact of SPP Mindset Intervention on Limited-Admission Major Enrollment.
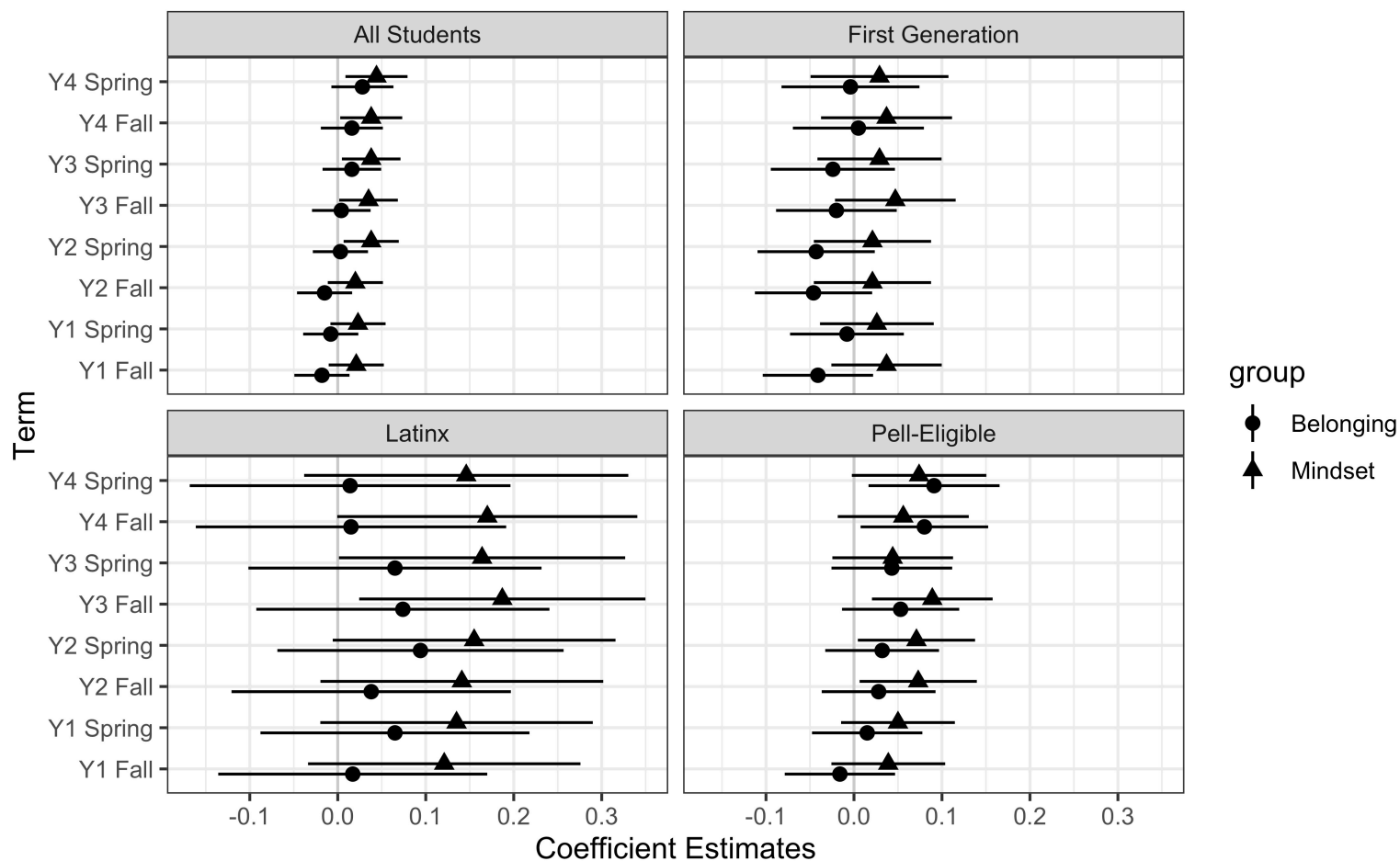
Notes: Dots represent point estimates, and black bars represent the upper and lower limits of a 95% confidence interval. Circle dots represent belonging estimates and triangle dots represent mindset estimates.

Table 1. Balance tests

	(1) Mindset	(2) Belonging	(3) Control	(4) Overall	(5) (1) vs. (2)	(6) (1) vs. (3)	(7) (2) vs. (3)	(8) Joint Orthogonality Test
Female	0.541	0.549	0.532	0.541	-0.008	0.010	0.018	0.504
	(0.011)	(0.011)	(0.011)	(0.006)	(0.015)	(0.015)	(0.015)	
White	0.788	0.780	0.783	0.784	0.008	0.005	-0.003	0.810
	(0.009)	(0.009)	(0.009)	(0.005)	(0.012)	(0.012)	(0.012)	
Black	0.072	0.080	0.073	0.075	-0.008	-0.001	0.007	0.539
	(0.006)	(0.006)	(0.006)	(0.003)	(0.008)	(0.008)	(0.008)	
Latinx	0.045	0.043	0.045	0.044	0.001	0.000	-0.001	0.963
	(0.004)	(0.004)	(0.004)	(0.003)	(0.006)	(0.006)	(0.006)	
Asian	0.048	0.051	0.051	0.050	-0.003	-0.003	0.000	0.901
	(0.005)	(0.005)	(0.005)	(0.003)	(0.007)	(0.007)	(0.007)	
Other Race	0.043	0.041	0.043	0.042	0.002	0.000	-0.002	0.903
	(0.004)	(0.004)	(0.004)	(0.002)	(0.006)	(0.006)	(0.006)	
First Generation	0.240	0.238	0.241	0.239	0.002	-0.001	-0.003	0.977
	(0.009)	(0.009)	(0.009)	(0.005)	(0.013)	(0.013)	(0.013)	
Pell	0.243	0.260	0.231	0.245	-0.016	0.013	0.029**	0.080
	(0.009)	(0.009)	(0.009)	(0.005)	(0.013)	(0.013)	(0.013)	
Out-of-state	0.132	0.126	0.135	0.131	0.006	-0.003	-0.009	0.695
	(0.008)	(0.007)	(0.008)	(0.004)	(0.011)	(0.011)	(0.011)	
ACT or Equivalent	25.588	25.663	25.561	25.604	-0.075	0.027	0.102	0.660
	(0.083)	(0.083)	(0.081)	(0.048)	(0.117)	(0.116)	(0.116)	
Pre-belonging	3.894	3.875	3.871	3.880	0.020	0.023	0.003	0.591
	(0.017)	(0.017)	(0.017)	(0.010)	(0.024)	(0.024)	(0.024)	
Pre-mindset	4.738	4.774	4.769	4.761	-0.036	-0.030	0.006	0.331
	(0.018)	(0.019)	(0.018)	(0.011)	(0.026)	(0.026)	(0.026)	
N	2148	2197	2213	6558				

Notes: Joint orthogonality test presents p-values for tests of equality of means across mindset, belonging, and control groups. Standard errors are in parenthesis. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$.

Table 2-A. Descriptive statistics: Demographics and Survey Measures

	(1) Total	(2) Mindset	(3) Belonging	(4) Control	(5) Mindset Belonging Difference	(6) Mindset Control Difference	(7) Belonging Control Difference
Female	0.541	0.541	0.549	0.532	-0.008	0.010	0.018
	(0.006)	(0.011)	(0.011)	(0.011)	(0.015)	(0.015)	(0.015)
White	0.784	0.788	0.780	0.783	0.008	0.005	-0.003
	(0.005)	(0.009)	(0.009)	(0.009)	(0.012)	(0.012)	(0.012)
Black	0.075	0.072	0.080	0.073	-0.008	-0.001	0.007
	(0.003)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)	(0.008)
Latinx	0.044	0.045	0.043	0.045	0.001	0.000	-0.001
	(0.003)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
Asian	0.050	0.048	0.051	0.051	-0.003	-0.003	0.000
	(0.003)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Other race	0.042	0.043	0.041	0.043	0.002	0.000	-0.002
	(0.002)	(0.004)	(0.004)	(0.004)	(0.006)	(0.006)	(0.006)
First Generation	0.239	0.240	0.238	0.241	0.002	-0.001	-0.003
	(0.005)	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.013)
Pell-eligible	0.245	0.243	0.260	0.231	-0.016	0.013	0.029**
	(0.005)	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.013)
Out of State	0.131	0.132	0.126	0.135	0.006	-0.003	-0.009
	(0.004)	(0.008)	(0.007)	(0.008)	(0.011)	(0.011)	(0.011)
ACT	25.604	25.588	25.663	25.561	-0.075	0.027	0.102
	(0.048)	(0.083)	(0.083)	(0.081)	(0.117)	(0.116)	(0.116)
Pre-mindset	4.761	4.738	4.774	4.769	-0.036	-0.030	0.006
	(0.011)	(0.018)	(0.019)	(0.018)	(0.026)	(0.026)	(0.026)
Pre-belong	3.880	3.894	3.875	3.871	0.020	0.023	0.003
	(0.010)	(0.017)	(0.017)	(0.017)	(0.024)	(0.024)	(0.024)
N	6558	2148	2197	2213			

Notes: Difference columns present difference in means between corresponding groups. Standard errors are in parenthesis.
$*p < 0.10$. $**p < 0.05$. $***p < 0.01$.

Table 2-B. Descriptive statistics: Longitudinal Outcomes

	(1) Total	(2) Mindset	(3) Belonging	(4) Control	(5) Mindset Belonging Difference	(6) Mindset Control Difference	(7) Belonging Control Difference
Cumulative Number of Credits Year 1	26.715	26.807	26.630	26.711	0.177*	0.096	-0.081
	(0.041)	(0.068)	(0.073)	(0.074)	(0.100)	(0.100)	(0.104)
Cumulative Number of Credits Year 2	54.656	54.837	54.511	54.623	0.325	0.214	-0.112
	(0.089)	(0.156)	(0.156)	(0.149)	(0.220)	(0.216)	(0.215)
Cumulative Number of Credits Year 3	83.237	83.269	83.144	83.297	0.124	-0.029	-0.153
	(0.143)	(0.253)	(0.245)	(0.247)	(0.353)	(0.354)	(0.348)
Cumulative Number of Credits Year 4	110.354	110.513	110.549	110.008	-0.037	0.505	0.542
	(0.193)	(0.337)	(0.320)	(0.345)	(0.465)	(0.482)	(0.471)
Cumulative GPA Year 1	3.190	3.200	3.187	3.183	0.013	0.017	0.004
	(0.008)	(0.014)	(0.015)	(0.015)	(0.020)	(0.020)	(0.021)
Cumulative GPA Year 2	3.268	3.269	3.267	3.267	0.001	0.001	0.000
	(0.007)	(0.012)	(0.012)	(0.012)	(0.017)	(0.017)	(0.017)
Cumulative GPA Year 3	3.306	3.307	3.306	3.305	0.001	0.002	0.000
	(0.007)	(0.011)	(0.011)	(0.011)	(0.016)	(0.016)	(0.016)
Cumulative GPA Year 4	3.331	3.330	3.343	3.320	-0.012	0.011	0.023
	(0.007)	(0.011)	(0.011)	(0.011)	(0.016)	(0.016)	(0.016)
Limited Majors Year 1	0.502	0.520	0.485	0.501	0.035**	0.018	-0.016
	(0.006)	(0.011)	(0.011)	(0.011)	(0.015)	(0.015)	(0.015)
Limited Majors Year 2	0.488	0.512	0.474	0.479	0.039**	0.033**	-0.006
	(0.006)	(0.011)	(0.011)	(0.011)	(0.016)	(0.016)	(0.016)
Limited Majors Year 3	0.479	0.498	0.473	0.467	0.024	0.031*	0.007
	(0.007)	(0.012)	(0.012)	(0.012)	(0.017)	(0.016)	(0.016)
Limited Majors Year 4	0.475	0.494	0.476	0.455	0.017	0.039**	0.022
	(0.007)	(0.013)	(0.013)	(0.012)	(0.018)	(0.018)	(0.018)
N	6558	2148	2197	2213			

Notes: Difference columns present difference in means between corresponding groups. Standard errors are in parenthesis.
*$p < 0.10$. **$p < 0.05$. ***$p < 0.01$.

Table 2-C. Descriptive statistics: Completion Outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
					Mindset	Mindset	Belonging
	Total	Mindset	Belonging	Control	Belonging	Control	Control
					Difference	Difference	Difference
Graduate in 4 years	0.621	0.622	0.615	0.625	0.008	-0.003	-0.010
	(0.006)	(0.010)	(0.010)	(0.010)	(0.015)	(0.015)	(0.015)
Graduate in 4 years with							
STEM majors	0.333	0.331	0.328	0.340	0.003	-0.009	-0.012
	(0.007)	(0.013)	(0.013)	(0.013)	(0.018)	(0.018)	(0.018)
Limited majors	0.516	0.539	0.500	0.510	0.039**	0.030	-0.009
	(0.008)	(0.014)	(0.014)	(0.013)	(0.019)	(0.019)	(0.019)
Engineering (STEM)	0.081	0.083	0.081	0.080	0.002	0.003	0.000
	(0.004)	(0.008)	(0.007)	(0.007)	(0.011)	(0.011)	(0.010)
Biological Sciences (STEM)	0.144	0.138	0.150	0.143	-0.011	-0.005	0.006
	(0.005)	(0.009)	(0.010)	(0.009)	(0.014)	(0.013)	(0.014)
Physical Sciences (STEM)	0.016	0.010	0.019	0.019	-0.010**	-0.009**	0.000
	(0.002)	(0.003)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
Mathematics and Statistics (STEM)	0.009	0.008	0.008	0.009	0.000	-0.001	-0.001
	(0.001)	(0.002)	(0.002)	(0.003)	(0.003)	(0.004)	(0.004)
Agriculture (Limited)	0.039	0.043	0.039	0.034	0.003	0.009	0.005
	(0.003)	(0.006)	(0.005)	(0.005)	(0.008)	(0.007)	(0.007)
Business (Limited)	0.202	0.218	0.191	0.197	0.027*	0.020	-0.006
	(0.006)	(0.011)	(0.011)	(0.011)	(0.016)	(0.016)	(0.015)
Education (Limited)	0.088	0.088	0.084	0.093	0.005	-0.005	-0.010
	(0.004)	(0.008)	(0.008)	(0.008)	(0.011)	(0.011)	(0.011)
Nursing and Veterinary (Limited)	0.033	0.034	0.035	0.030	0.000	0.004	0.004
	(0.003)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.007)
Double Majors	0.019	0.019	0.022	0.017	-0.004	0.001	0.005
	(0.002)	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.005)
N	6558	2148	2197	2213			

Notes: Difference columns present difference in means between corresponding groups. Standard errors are in parenthesis. The number of observations with graduating majors includes students who graduated in 4 years. *$p < 0.10$. **$p < 0.05$. ***$p < 0.01$.

Table 3. Estimated Mindset and Belong Treatment Effects on Degree Completion

	(1) All Sample	(2) Female	(3) First Generation	(4) Pell-eligible	(5) Latinx
Mindset	-0.004	-0.004	0.021	-0.004	0.104
	(0.015)	(0.020)	(0.035)	(0.035)	(0.088)
Belong	-0.007	-0.009	-0.013	0.003	-0.068
	(0.015)	(0.020)	(0.034)	(0.034)	(0.085)
Control Mean	0.623	0.684	0.518	0.478	0.505
N	6517	3523	1557	1592	289

Notes. Each column is estimated separately by logit and marginal effects are reported. Dependent variable is a measure of whether an individual earned a bachelor's degree in four years. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.
[+]$p < 0.10$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Table 4. Estimated Mindset and Belong Treatment Effects on Field of Degree

	(1) STEM	(2) STEM Engineering	(3) Limited	(4) Limited Business	(5) Limited Education	(6) Limited Nursing
Mindset	-0.010	0.002	0.034^{+}	0.022	-0.004	0.004
	(0.019)	(0.007)	(0.020)	(0.015)	(0.009)	(0.006)
Belong	-0.019	-0.002	-0.004	-0.000	-0.007	0.004
	(0.019)	(0.007)	(0.020)	(0.015)	(0.009)	(0.006)
Control Mean	0.341	0.081	0.510	0.197	0.093	0.030
N	4044	4044	4044	4044	4044	4044

Notes. Each column is estimated separately by logit and marginal effects are reported. Dependent variable is a measure whether an individual earned a bachelor degree in corresponding majors. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.
$^{+}p < 0.10$. $*p < 0.05$. $**p < 0.01$. $***p < 0.001$.

Table 5. Heterogeneous Mindset Treatment Effects on Field of Degree (Graduates)

	(1) STEM	(2) STEM Engineering	(3) Limited	(4) Limited Business	(5) Limited Education	(6) Limited Nursing
Panel A: Female (N=2382)						
Mindset	0.023	0.008^{+}	0.022	0.026	-0.016	0.002
	(0.024)	(0.005)	(0.025)	(0.018)	(0.015)	(0.009)
Belonging	0.002	0.008	-0.021	-0.008	-0.013	0.002
	(0.023)	(0.005)	(0.025)	(0.018)	(0.015)	(0.009)
Control Mean	0.289	0.022	0.463	0.163	0.133	0.039
Panel B: First Generation (N=808)						
Mindset	-0.017	0.005	0.050	0.048	-0.005	0.007
	(0.041)	(0.014)	(0.044)	(0.030)	(0.020)	(0.014)
Belonging	0.009	-0.024	-0.055	0.002	-0.003	0.006
	(0.040)	(0.015)	(0.044)	(0.032)	(0.020)	(0.013)
Control Mean	0.325	0.090	0.471	0.157	0.095	0.033
Panel C: Pell-eligible (N=780)						
Mindset	-0.011	0.003	0.080^{+}	0.048	-0.010	0.019^{+}
	(0.041)	(0.012)	(0.046)	(0.029)	(0.023)	(0.010)
Belonging	-0.100^{*}	-0.010	0.019	0.014	0.000	0.019^{+}
	(0.041)	(0.012)	(0.045)	(0.030)	(0.021)	(0.010)
Control Mean	0.342	0.071	0.395	0.119	0.082	0.015
Panel D: Latinx (N=149)						
Mindset	-0.062	0.028	0.244^{*}	0.153^{**}	0.003	0.001
	(0.099)	(0.024)	(0.112)	(0.059)	(0.016)	(0.001)
Belonging	0.094	0.046	0.025	-0.025	-0.005	0.000
	(0.097)	(0.031)	(0.113)	(0.082)	(0.020)	(0.001)
Control Mean	0.280	0.028	0.340	0.085	0.080	0.000

Notes. Each column is estimated separately by logit and marginal effects are reported. Dependent variable is a measure whether an individual earned a bachelor degree in corresponding majors. Panels A-D restrict the sample to the corresponding subgroup who graduated in four years. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.
$^{+}p < 0.10.$ $^{*}p < 0.05.$ $^{**}p < 0.01.$ $^{***}p < 0.001.$

Table 6. Heterogeneous Mindset Treatment Effects on Field of Degree (including 4th year enrolled students)

	(1) STEM	(2) STEM Engineering	(3) Limited	(4) Limited Business	(5) Limited Education	(6) Limited Nursing
Panel A: Female (N=3523)						
Mindset	0.008	0.013*	0.024	0.019	-0.012	0.005
	(0.019)	(0.006)	(0.020)	(0.012)	(0.011)	(0.007)
Belonging	0.001	0.015*	-0.011	-0.005	-0.012	0.002
	(0.018)	(0.006)	(0.020)	(0.013)	(0.011)	(0.007)
Control Mean	0.272	0.032	0.380	0.120	0.106	0.034
Panel B: First Generation (N=1557)						
Mindset	-0.002	0.006	0.039	0.031$^+$	-0.003	0.004
	(0.028)	(0.011)	(0.030)	(0.017)	(0.013)	(0.006)
Belonging	0.012	0.001	-0.020	0.000	-0.009	0.004
	(0.027)	(0.011)	(0.030)	(0.018)	(0.013)	(0.006)
Control Mean	0.284	0.080	0.340	0.095	0.070	0.022
Panel C: Pell-eligible (N=1592)						
Mindset	0.017	0.014	0.068*	0.027$^+$	-0.001	0.012$^+$
	(0.028)	(0.011)	(0.030)	(0.015)	(0.013)	(0.007)
Belonging	0.001	0.023*	0.050+	0.011	-0.012	0.013*
	(0.027)	(0.010)	(0.029)	(0.016)	(0.013)	(0.006)
Control Mean	0.268	0.061	0.285	0.069	0.067	0.010
Panel D: Latinx (N=289)						
Mindset	-0.034	0.015	0.159*	0.074*	0.003	0.008
	(0.068)	(0.032)	(0.073)	(0.032)	(0.008)	(0.009)
Belonging	0.058	0.036	-0.001	-0.035	-0.002	0.002
	(0.067)	(0.031)	(0.073)	(0.040)	(0.010)	(0.008)
Control Mean	0.280	0.021	0.340	0.080	0.080	0.000

Notes. Each column is estimated separately by logit and marginal effects are reported. Dependent variable is a measure whether an individual earned a bachelor degree in corresponding majors. Panels A-D restrict the sample to the corresponding subgroup who either graduated in four years or persisted to 4th year. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.
$^+p < 0.10$. $^*p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Appendix Figure 1. Longitudinal Estimates for Impact of SPP Mindset Intervention on Term GPA.
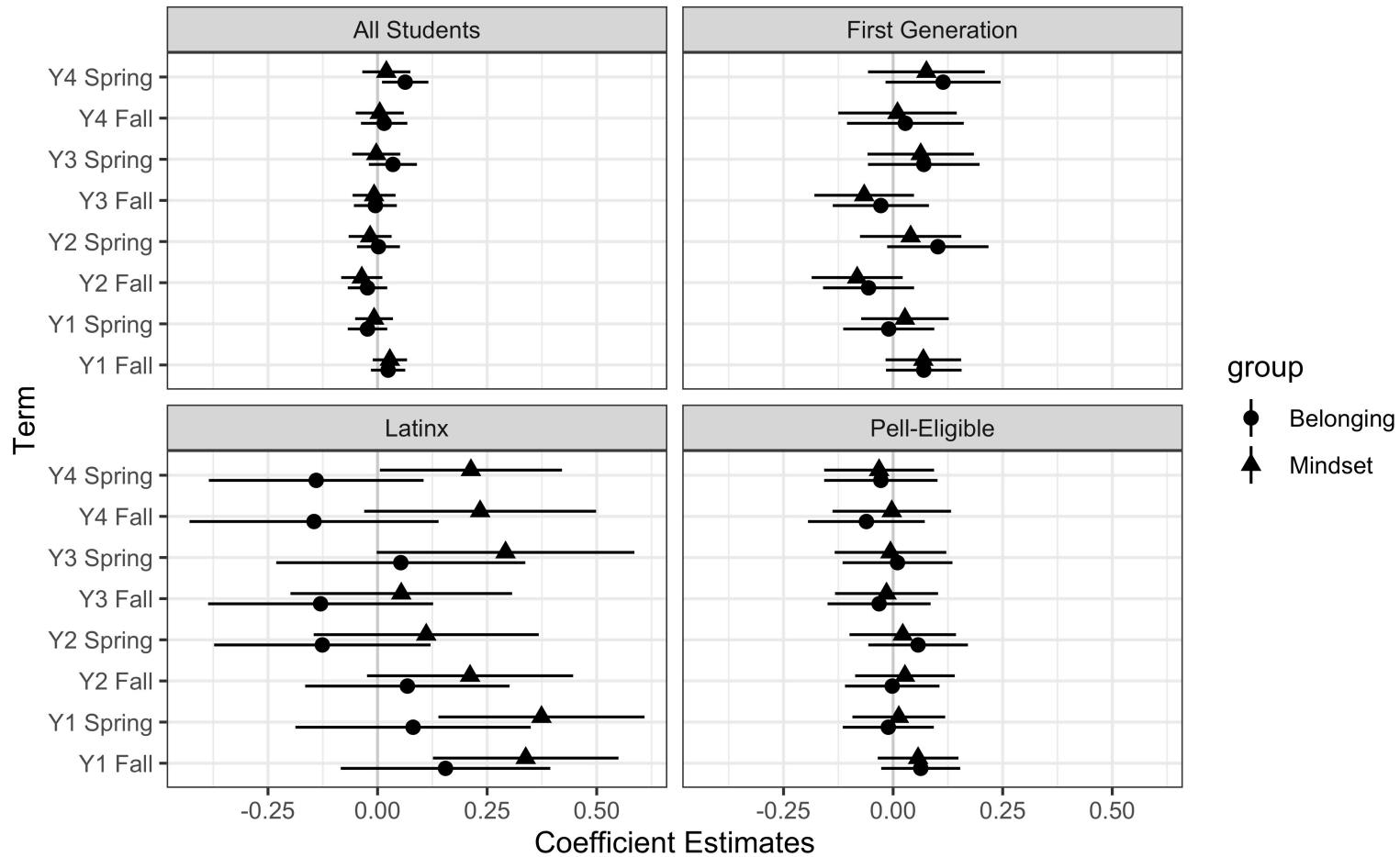
Notes: Dots represent point estimates, and black bars represent the upper and lower limits of a 95% confidence interval. Circle dots represent belonging estimates and triangle dots represent mindset estimates.

Appendix Table 1. Estimated Mindset Treatment Effects on Degree Completion Timing

	(1) Graduate 1yr later	(2) Graduate 2yrs later	(3) Graduate 3yrs later
Panel A: All Sample			
Mindset	0.000	-0.005	0.008
	(0.000)	(0.004)	(0.016)
Belonging	0.001	0.001	-0.015
	(0.000)	(0.004)	(0.016)
Control Mean			
N	6517	6517	6517
Panel B: Female			
Mindset	0.001	-0.008	0.004
	(0.001)	(0.006)	(0.022)
Belonging	0.001	-0.002	-0.018
	(0.001)	(0.006)	(0.022)
Control Mean	0.022	0.083	0.580
N	3222	3523	3523
Panel C: First Generation			
Mindset	-0.000	-0.008	0.042
	(0.001)	(0.009)	(0.031)
Belonging	0.000	-0.011	0.004
	(0.001)	(0.009)	(0.032)
Control Mean	0.037	0.115	0.369
N	1416	1557	1557
Panel D: Pell-eligible			
Mindset	-0.000	0.000	0.006
	(0.004)	(0.013)	(0.032)
Belonging	-0.003	0.010	-0.001
	(0.004)	(0.013)	(0.031)
Control Mean	0.029	0.087	0.375
N	1592	1592	1592
Panel E: Latinx			
Mindset	0.001	0.000	0.089
	(0.001)	(0.021)	(0.079)
Belonging	0.000	-0.002	-0.032
	(0.001)	(0.020)	(0.076)
Control Mean	0.032	0.075	0.404
N	262	262	289

Notes. Each column in each panel is estimated separately by logit and marginal effects are reported. Dependent variable is a measure whether an individual earned a bachelor degree in specified years. Panel A includes all students. Panels B, C, D, and E use corresponding subgroup. Each regression includes gender, black, Latinx, Asian, other

race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.
$^+p < 0.10$. $*p < 0.05$. $**p < 0.01$. $***p < 0.001$.

Appendix Table 2. Estimated Mindset and Belong Treatment Effects on Field of Degree

	(1) STEM Engineering	(2) STEM Bio	(3) STEM Physics	(4) STEM Math	(5) Limited Agriculture	(6) Limited Business	(7) Limited Education	(8) Limited Engineering	(9) Limited Nursing
Mindset	0.002	-0.005	-0.006^{+}	-0.001	0.008	0.022	-0.004	0.002	0.004
	(0.007)	(0.013)	(0.003)	(0.002)	(0.007)	(0.015)	(0.009)	(0.007)	(0.006)
Belong	-0.002	0.003	0.000	-0.002	0.005	-0.000	-0.007	-0.002	0.004
	(0.007)	(0.012)	(0.003)	(0.002)	(0.007)	(0.015)	(0.009)	(0.007)	(0.006)
Control Mean	0.081	0.143	0.019	0.010	0.034	0.197	0.093	0.082	0.030
N	4044	4044	4044	4044	4044	4044	4044	4044	4044

Notes. Each column is estimated separately by logit and marginal effects are reported. Dependent variable is a measure whether an individual earned a bachelor degree in corresponding majors. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.
$^{+}p < 0.10$. $*p < 0.05$. $**p < 0.01$. $***p < 0.001$.

Appendix Table 3. Estimated Mindset and Belong Treatment Effects on Field of Degree (including 4th year enrolled students)

	(1) STEM	(2) STEM Engineering	(3) Limited	(4) Limited Agriculture	(5) Limited Business	(6) Limited Education	(7) Limited Nursing
Mindset	-0.006	0.004	0.030$^+$	0.009$^+$	0.016	-0.004	0.005
	(0.014)	(0.007)	(0.015)	(0.005)	(0.010)	(0.006)	(0.004)
Belong	-0.006	0.007	0.002	0.004	-0.000	-0.009	0.004
	(0.014)	(0.007)	(0.015)	(0.005)	(0.010)	(0.006)	(0.004)
Control Mean	0.327	0.100	0.425	0.032	0.141	0.075	0.024
N	6517	1348	6517	6517	6517	6517	6517

Notes. Each column is estimated separately by logit and marginal effects are reported. Dependent variable is a measure whether an individual earned a bachelor degree in corresponding majors. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.

$^+p < 0.10$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$

Online Appendix Table 1. Longitudinal Estimates for Impact of SPP Mindset Intervention on Cumulative GPA.

	(1) Fall 1	(2) Spring 1	(3) Fall 2	(4) Spring 2	(5) Fall 3	(6) Spring 3	(7) Fall 4	(8) Spring 4
Panel A: Full Sample								
Mind	0.029	0.010	-0.014	-0.002	-0.003	-0.001	0.010	0.009
	(0.020)	(0.018)	(0.016)	(0.015)	(0.014)	(0.014)	(0.014)	(0.015)
Belong	0.024	-0.003	-0.010	-0.003	-0.005	-0.003	0.003	0.014
	(0.020)	(0.018)	(0.015)	(0.015)	(0.014)	(0.014)	(0.015)	(0.015)
N	6453	6330	6041	5906	5625	5439	4978	4684
Panel B: First Generation								
Mind	0.069	0.044	-0.023	0.009	-0.015	0.002	0.011	0.022
	(0.044)	(0.040)	(0.035)	(0.034)	(0.033)	(0.033)	(0.034)	(0.035)
Belong	0.070	0.032	-0.002	0.041	0.001	0.016	0.016	0.040
	(0.044)	(0.041)	(0.034)	(0.034)	(0.032)	(0.033)	(0.035)	(0.035)
N	1541	1492	1401	1354	1261	1200	1054	976
Panel C: Latinx								
Mind	0.337**	0.332***	0.200**	0.204**	0.142*	0.190**	0.206**	0.201**
	(0.108)	(0.095)	(0.076)	(0.070)	(0.066)	(0.068)	(0.068)	(0.072)
Belong	0.155	0.066	0.054	0.032	-0.022	0.037	0.018	0.023
	(0.122)	(0.110)	(0.079)	(0.071)	(0.069)	(0.072)	(0.075)	(0.075)
N	283	273	257	249	234	227	202	188
Panel D: Pell-Eligible								
Mind	0.057	0.042	0.010	0.020	-0.005	0.008	-0.011	-0.019
	(0.047)	(0.043)	(0.037)	(0.035)	(0.034)	(0.034)	(0.035)	(0.034)
Belong	0.063	0.027	-0.000	0.001	-0.015	-0.010	-0.027	-0.029
	(0.046)	(0.042)	(0.035)	(0.034)	(0.032)	(0.034)	(0.033)	(0.033)
N	1570	1531	1425	1374	1296	1241	1106	1037

Notes. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. $^{+}p < 0.10$. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Online Appendix Table 2. Longitudinal Estimates for Impact of SPP Mindset Intervention on Term GPA.

	(1) Fall 1	(2) Spring 1	(3) Fall 2	(4) Spring 2	(5) Fall 3	(6) Spring 3	(7) Fall 4	(8) Spring 4
Panel A: Full Sample								
Mind	0.028	-0.008	-0.036	-0.017	-0.008	-0.003	0.005	0.020
	(0.020)	(0.022)	(0.024)	(0.025)	(0.025)	(0.028)	(0.028)	(0.028)
Belong	0.024	-0.023	-0.023	0.002	-0.005	0.035	0.015	0.063*
	(0.020)	(0.023)	(0.023)	(0.025)	(0.025)	(0.028)	(0.027)	(0.027)
N	6453	6330	6041	5906	5625	5439	4978	4684
Panel B: First Generation								
Mind	0.069	0.027	-0.082	0.040	-0.066	0.063	0.010	0.076
	(0.044)	(0.051)	(0.053)	(0.059)	(0.058)	(0.062)	(0.069)	(0.068)
Belong	0.070	-0.010	-0.056	0.102$^+$	-0.028	0.070	0.028	0.114$^+$
	(0.044)	(0.053)	(0.053)	(0.059)	(0.056)	(0.065)	(0.068)	(0.067)
N	1541	1492	1401	1354	1261	1200	1054	976
Panel C: Latinx								
Mind	0.338**	0.374**	0.211$^+$	0.111	0.054	0.292$^+$	0.234$^+$	0.213*
	(0.108)	(0.120)	(0.120)	(0.131)	(0.129)	(0.150)	(0.135)	(0.106)
Belong	0.155	0.081	0.068	-0.126	-0.130	0.053	-0.145	-0.140
	(0.122)	(0.137)	(0.119)	(0.126)	(0.131)	(0.145)	(0.145)	(0.125)
N	283	273	257	249	234	227	202	188
Panel D: Pell-Eligible								
Mind	0.057	0.013	0.027	0.022	-0.015	-0.006	-0.003	-0.032
	(0.047)	(0.054)	(0.058)	(0.062)	(0.060)	(0.065)	(0.069)	(0.064)
Belong	0.063	-0.011	-0.002	0.057	-0.032	0.010	-0.061	-0.028
	(0.046)	(0.053)	(0.055)	(0.058)	(0.060)	(0.064)	(0.068)	(0.066)
N	1570	1531	1425	1374	1296	1241	1106	1037

Notes. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. $^+p < 0.10$. $^*p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Online Appendix Table 3. Longitudinal Estimates for Impact of SPP Mindset Intervention on Cumulative Course Credits Earned.

	(1) Fall 1	(2) Spring 1	(3) Fall 2	(4) Spring 2	(5) Fall 3	(6) Spring 3	(7) Fall 4	(8) Spring 4
Panel A: Full Sample								
Mind	0.006	0.042	0.304[+]	0.147	0.016	-0.108	0.271	0.370
	(0.050)	(0.093)	(0.167)	(0.205)	(0.291)	(0.334)	(0.403)	(0.451)
Belong	-0.030	-0.079	0.099	-0.106	-0.231	-0.198	-0.075	0.334
	(0.050)	(0.093)	(0.163)	(0.203)	(0.283)	(0.328)	(0.398)	(0.440)
N	6453	6330	6041	5906	5625	5439	4978	4684
Panel B: First Generation								
Mind	0.055	0.456[*]	0.584	0.347	0.020	0.434	0.910	1.603
	(0.101)	(0.196)	(0.360)	(0.452)	(0.647)	(0.755)	(0.875)	(0.993)
Belong	0.045	-0.042	-0.090	-0.205	-0.150	0.383	0.863	1.976[*]
	(0.106)	(0.211)	(0.368)	(0.455)	(0.616)	(0.742)	(0.874)	(0.983)
N	1541	1492	1401	1354	1261	1200	1054	976
Panel C: Latinx								
Mind	0.224	0.526	1.495	0.453	1.361	2.694	4.865[*]	3.455[+]
	(0.240)	(0.497)	(0.920)	(1.185)	(1.615)	(1.649)	(1.964)	(2.070)
Belong	-0.058	-0.226	0.638	0.041	-0.376	0.196	0.684	-0.977
	(0.214)	(0.449)	(0.923)	(1.205)	(1.506)	(1.548)	(1.810)	(2.003)
N	283	273	257	249	234	227	202	188
Panel D: Pell-Eligible								
Mind	0.051	0.078	0.604[+]	0.143	0.251	0.637	1.000	1.420
	(0.105)	(0.197)	(0.355)	(0.445)	(0.663)	(0.773)	(0.918)	(1.042)
Belong	-0.067	-0.112	0.231	0.104	0.212	0.553	0.147	0.687
	(0.106)	(0.203)	(0.357)	(0.435)	(0.610)	(0.743)	(0.883)	(0.954)
N	1570	1531	1425	1374	1296	1241	1106	1037

Notes. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. [+]$p < 0.10$. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Online Appendix Table 4. Longitudinal Estimates for Impact of SPP Mindset Intervention on Course Credits Attempted.

	(1) Fall 1	(2) Spring 1	(3) Fall 2	(4) Spring 2	(5) Fall 3	(6) Spring 3	(7) Fall 4	(8) Spring 4
Panel A: Full Sample								
Mind	0.018	0.016	0.070	-0.012	-0.101	0.017	0.012	0.118
	(0.044)	(0.059)	(0.066)	(0.077)	(0.077)	(0.092)	(0.091)	(0.104)
Belong	-0.021	-0.040	0.071	-0.064	-0.072	0.073	0.075	0.171^{+}
	(0.045)	(0.059)	(0.066)	(0.075)	(0.074)	(0.091)	(0.089)	(0.103)
N	6453	6330	6041	5906	5625	5439	4978	4684
Panel B: First Generation								
Mind	0.039	0.263*	0.123	0.038	-0.368*	-0.151	0.186	0.165
	(0.091)	(0.127)	(0.137)	(0.161)	(0.162)	(0.183)	(0.177)	(0.215)
Belong	0.018	-0.047	-0.161	0.010	-0.172	-0.092	0.183	0.070
	(0.096)	(0.136)	(0.149)	(0.158)	(0.150)	(0.175)	(0.188)	(0.211)
N	1541	1492	1401	1354	1261	1200	1054	976
Panel C: Latinx								
Mind	0.105	0.077	0.257	-0.588	-0.400	0.564	0.572	0.124
	(0.213)	(0.305)	(0.304)	(0.363)	(0.331)	(0.342)	(0.378)	(0.457)
Belong	-0.123	-0.110	0.344	-0.535	0.005	0.155	0.422	-0.989*
	(0.201)	(0.273)	(0.298)	(0.349)	(0.305)	(0.331)	(0.452)	(0.501)
N	283	273	257	249	234	227	202	188
Panel D: Pell-Eligible								
Mind	0.077	0.007	0.196	0.025	0.031	-0.015	0.212	0.301
	(0.093)	(0.123)	(0.146)	(0.164)	(0.162)	(0.184)	(0.173)	(0.210)
Belong	-0.093	-0.026	0.151	0.138	0.085	0.172	-0.035	0.295
	(0.095)	(0.124)	(0.151)	(0.161)	(0.156)	(0.175)	(0.183)	(0.204)
N	1570	1531	1425	1374	1296	1241	1106	1037

Notes. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. $^{+}p < 0.10$. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Online Appendix Table 5. Longitudinal Estimates for Impact of SPP Mindset Intervention on Limited-Admission Major Enrollment.

	(1) Fall 1	(2) Spring 1	(3) Fall 2	(4) Spring 2	(5) Fall 3	(6) Spring 3	(7) Fall 4	(8) Spring 4
Panel A: Full Sample								
Mind	0.021	0.023	0.020	0.038*	0.035*	0.038*	0.038*	0.044*
	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)
Belong	-0.018	-0.008	-0.015	0.003	0.004	0.016	0.016	0.028
	(0.016)	(0.016)	(0.016)	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)
N	6452	6329	6041	5906	5625	5439	4978	4684
Panel B: First Generation								
Mind	0.037	0.026	0.021	0.021	0.047	0.029	0.037	0.029
	(0.032)	(0.033)	(0.034)	(0.034)	(0.035)	(0.036)	(0.038)	(0.040)
Belong	-0.041	-0.008	-0.046	-0.043	-0.020	-0.024	0.005	-0.004
	(0.032)	(0.033)	(0.034)	(0.034)	(0.035)	(0.036)	(0.038)	(0.040)
N	1541	1492	1401	1354	1261	1200	1054	976
Panel C: Latinx								
Mind	0.121	0.135$^+$	0.141$^+$	0.155$^+$	0.187*	0.164*	0.170$^+$	0.146
	(0.079)	(0.079)	(0.082)	(0.082)	(0.083)	(0.083)	(0.087)	(0.094)
Belong	0.017	0.065	0.038	0.094	0.074	0.065	0.015	0.014
	(0.078)	(0.078)	(0.081)	(0.083)	(0.085)	(0.085)	(0.090)	(0.093)
N	283	273	257	249	234	227	202	188
Panel D: Pell-Eligible								
Mind	0.039	0.050	0.073*	0.071*	0.089*	0.044	0.056	0.074$^+$
	(0.033)	(0.033)	(0.034)	(0.034)	(0.035)	(0.035)	(0.038)	(0.039)
Belong	-0.016	0.015	0.028	0.032	0.053	0.043	0.080*	0.091*
	(0.032)	(0.032)	(0.033)	(0.033)	(0.034)	(0.035)	(0.037)	(0.038)
N	1570	1531	1425	1374	1296	1241	1106	1037

Notes. Each regression is estimated separately by logit and marginal effects are reported. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. $^+p <$ 0.10. $^*p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Online Appendix Table 6. Longitudinal Estimates for Impact of SPP Mindset Intervention on Business Major Enrollment

	(1) Fall 1	(2) Spring 1	(3) Fall 2	(4) Spring 2	(5) Fall 3	(6) Spring 3	(7) Fall 4	(8) Spring 4
Panel A: Full Sample								
Mind	0.006	0.011	0.015	0.009	0.002	0.002	0.009	0.010
	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)
Belong	-0.004	-0.000	0.006	0.006	-0.006	-0.001	-0.001	0.004
	(0.010)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
N	6452	6329	6041	5906	5625	5439	4978	4684
Panel B: First Generation								
Mind	-0.004	-0.005	0.010	0.005	0.006	-0.001	0.017	0.007
	(0.018)	(0.019)	(0.020)	(0.020)	(0.019)	(0.019)	(0.021)	(0.022)
Belong	-0.024	-0.033^{+}	-0.015	-0.011	-0.024	-0.020	-0.007	-0.020
	(0.019)	(0.020)	(0.021)	(0.020)	(0.020)	(0.020)	(0.023)	(0.023)
N	1541	1492	1401	1354	1261	1200	1054	976
Panel C: Latinx								
Mind	0.063^{+}	0.054	0.089^{*}	0.073^{+}	0.064^{+}	0.025	0.067^{+}	0.100^{*}
	(0.035)	(0.038)	(0.043)	(0.039)	(0.038)	(0.029)	(0.037)	(0.044)
Belong	-0.064	-0.045	-0.002	-0.012	-0.052	-0.058	-0.080	-0.032
	(0.045)	(0.046)	(0.049)	(0.046)	(0.050)	(0.038)	(0.050)	(0.050)
N	283	273	257	249	234	227	202	184
Panel D: Pell-Eligible								
Mind	0.010	0.015	0.040^{*}	0.032^{+}	0.030^{+}	0.020	0.029	0.030
	(0.016)	(0.018)	(0.018)	(0.018)	(0.016)	(0.016)	(0.019)	(0.021)
Belong	0.005	0.014	0.024	0.021	0.020	0.014	0.021	0.016
	(0.016)	(0.017)	(0.019)	(0.018)	(0.017)	(0.017)	(0.020)	(0.021)
N	1570	1531	1425	1374	1296	1241	1048	969

Notes. Each regression is estimated separately by logit and marginal effects are reported. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. $^{+}p < 0.10$. $^{*}p < 0.05$. $^{**}p < 0.01$. $^{***}p < 0.001$.

Online Appendix Table 7. Longitudinal Estimates for Impact of SPP Mindset Intervention on STEM Major Enrollment

	(1) Fall 1	(2) Spring 1	(3) Fall 2	(4) Spring 2	(5) Fall 3	(6) Spring 3	(7) Fall 4	(8) Spring 4
Panel A: Full Sample								
Mind	-0.012	-0.009	-0.004	-0.007	-0.009	-0.001	-0.006	-0.005
	(0.014)	(0.015)	(0.016)	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)
Belong	0.008	0.005	0.003	-0.002	-0.001	0.004	0.001	0.000
	(0.014)	(0.015)	(0.016)	(0.016)	(0.016)	(0.017)	(0.017)	(0.018)
N	6452	6329	6041	5906	5625	5439	4978	4684
Panel B: First Generation								
Mind	0.002	0.002	0.014	-0.022	-0.014	-0.003	0.001	0.006
	(0.028)	(0.030)	(0.032)	(0.033)	(0.035)	(0.036)	(0.038)	(0.040)
Belong	0.019	0.027	0.061[+]	0.016	0.022	0.033	0.034	0.034
	(0.028)	(0.030)	(0.031)	(0.033)	(0.034)	(0.035)	(0.038)	(0.039)
N	1541	1492	1401	1354	1261	1200	1054	976
Panel C: Latinx								
Mind	0.016	0.001	-0.046	-0.044	-0.048	-0.013	-0.006	-0.061
	(0.069)	(0.070)	(0.074)	(0.078)	(0.083)	(0.083)	(0.088)	(0.093)
Belong	0.162[*]	0.110	0.164[*]	0.163[*]	0.183[*]	0.150[+]	0.165[+]	0.123
	(0.069)	(0.069)	(0.077)	(0.080)	(0.085)	(0.087)	(0.091)	(0.094)
N	283	273	257	249	234	227	202	184
Panel D: Pell-Eligible								
Mind	-0.007	-0.008	-0.011	0.017	0.008	0.025	0.030	0.015
	(0.028)	(0.029)	(0.031)	(0.033)	(0.034)	(0.035)	(0.038)	(0.040)
Belong	-0.013	-0.019	0.007	-0.001	-0.001	0.005	0.011	0.017
	(0.027)	(0.028)	(0.030)	(0.032)	(0.034)	(0.034)	(0.037)	(0.038)
N	1570	1531	1425	1374	1296	1241	1048	969

Notes. Each regression is estimated separately by logit and marginal effects are reported. Each regression includes gender, black, Latinx, Asian, other race, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. [+]$p <$ 0.10. *$p < 0.05$. **$p < 0.01$. ***$p < 0.001$.

Online Appendix Table 8. Estimated Mindset and Belong Treatment effects with Semester Fixed Effects

	(1) Full Sample	(2) Full Sample	(3) Latinx	(4) Latinx	(5) Pell	(6) Pell
Panel A: Term GPA						
Mindset	-0.002	-0.003	0.236***	0.235***	0.014	0.012
	(0.009)	(0.009)	(0.044)	(0.044)	(0.021)	(0.021)
Belong	0.009	0.010	-0.011	-0.010	0.004	0.003
	(0.009)	(0.009)	(0.047)	(0.047)	(0.021)	(0.020)
Panel B: Cumulative GPA						
Mindset	0.006	0.006	0.238***	0.237***	0.017	0.015
	(0.006)	(0.006)	(0.028)	(0.028)	(0.014)	(0.013)
Belong	0.003	0.004	0.051	0.052$^+$	0.005	0.004
	(0.006)	(0.006)	(0.031)	(0.031)	(0.013)	(0.013)
Panel C: Limited major						
Mindset	0.028***	0.028***	0.124***	0.124***	0.051***	0.052***
	(0.006)	(0.006)	(0.027)	(0.027)	(0.011)	(0.011)
Belong	0.002	0.002	0.016	0.016	0.036**	0.037***
	(0.005)	(0.005)	(0.026)	(0.026)	(0.011)	(0.011)
Panel D: Business major						
Mindset	0.005	0.005	0.060***	0.060***	0.022***	0.022***
	(0.003)	(0.003)	(0.016)	(0.016)	(0.006)	(0.006)
Belong	-0.005	-0.005	-0.030*	-0.030*	-0.001	-0.000
	(0.003)	(0.003)	(0.012)	(0.012)	(0.005)	(0.005)
Semester FE		O		O		O
N	46,923	46,923	1,986	1,986	11,035	11,035

Notes. Dependent variable is term GPA in Panel A, cumulative GPA in Panel B, a measure whether an individual is enrolled in a limited-enrollment major in Panel C, and a measure whether an individual is enrolled in a business major in Panel D. Columns 1 and 2 use all pooled sample. Columns 3 and 4 restrict the analysis to Latinx students. Columns 5 and 6 restrict the sample to Pell-eligible students. Estimates in Panels C and D are estimated separately by logit and marginal effects are reported. Each regression includes gender, race and ethnicity indicators, pre-treatment scores, Pell eligibility and first-generation status, equated ACT scores, and age dummies. Robust standard errors are in the parenthesis.
$^+p < 0.10$. $*p < 0.05$. $**p < 0.01$. $***p < 0.001$.