



CTC-Indiana University Bloomington  
NSF Project:  
Executive Summary of the First Year

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The College Transition Collaborative is excited to share preliminary results of the NSF extension of the Indiana University Bloomington prematriculation social-belonging intervention. The purpose of the NSF extension project is to explore the experiences of underrepresented students in STEM (science, technology, engineering, & mathematics) settings.

## Project Objective and Significance

Increasing the pipeline of STEM-competent workers entering the labor force is imperative for the United States to remain globally competitive (NSF, 2015; National Research Council, 2012). However, many socially disadvantaged and negatively stereotyped groups “leak” from the STEM pipeline (Hill, Corbett, & St. Rose, 2010; National Science Board, 2014; Sass, 2015); these individuals tend to choose STEM majors at disproportionately lower rates, leave STEM majors at higher rates, and underperform throughout (i.e., earn lower grades than their SAT scores predict).

The CTC’s original prematriculation social-belonging intervention addressed the experience of *social identity threat*—or concerns that one’s group does not belong in a setting (e.g., Steele, Spencer, & Aronson, 2002)— among 40,000 students across 23 colleges and universities. In the NSF extension project, we are investigating the unique experience of underrepresented students pursuing STEM, as they often experience heightened identity threat for many reasons (Murphy, Steele, & Gross, 2007; Murphy & Boucher, 2017). First, STEM courses often contain more identity-threatening cues than most other college courses. For example, groups that are stigmatized in U.S. society tend to be even more numerically underrepresented in STEM (e.g., Hill et al., 2010; NSF, 2015). Second, the abilities of groups—like women—that are *not* negatively stereotyped in many other domains, *are* negatively stereotyped in many STEM disciplines (e.g., Schmader, Johns, & Forbes, 2008; Spencer, Steele, & Quinn, 1999). Third, American culture communicates strong messages about “innate” and “fixed” STEM abilities—such as logic, reasoning, and spatial abilities—all of which contribute to stereotypes that some groups (e.g., White or Asian men) are “naturally better” at STEM than others (e.g., women, Blacks, Latinos) (Emerson & Murphy, 2014, 2015; Leslie, Cimpian, Meyer, & Freeland, 2015). As such, first-year underrepresented STEM students may be particularly responsive to a belonging intervention aimed at reducing identity threat during the transition to their new STEM contexts in college.

This Executive Summary contains a first look at the outcomes and experiences of underrepresented STEM students that emerged across all CTC partner schools and specifically at IU. Please note that these results highlight only findings with p-values less than 0.12; more detailed statistics can be requested via the contact information below.

## Recap of Initial Intervention Results

Across schools, key findings from the initial prematriculation social-belonging intervention include:

- During their first year, students from disadvantaged groups (underrepresented students of color and first-generation college students) who received the intervention had higher levels of full-time completion, earned higher GPAs, and had increased rates of retention going into their second year compared to disadvantaged students in the control condition.
- During their second year, students from disadvantaged groups who received the intervention had marginally higher levels of full-time completion compared to those students in the control condition.

- Students from disadvantaged groups who received the intervention reported greater anticipated growth in belonging and higher levels of social integration in the post-intervention survey compared to disadvantaged students in the control condition.

## Summary of New Results

### Initial Patterns Observed Across Partner Schools

#### Finding for Underrepresented Students of Color:

- *Achievement Outcomes*: Across schools, underrepresented students of color who received the intervention showed improved achievement compared to students in the control condition.
  - Underrepresented students of color who received the intervention **earned more credits in STEM courses both during their first term and across their entire first year** compared to students in the control condition (3.1% and 2.7% higher, respectively; both IRRs = 1.03).
  - They also **earned more STEM credits during their first term and across their entire second year** compared to students in the control condition (4.0% and 2.3% higher, respectively; IRR = 1.04 & 1.02, respectively).
  - Those students who received the intervention **earned higher STEM GPAs during the first term of their first year**, compared to students in the control condition (0.06 GPA points higher; Beta = 0.028).
- *Psychological Outcomes*: Across schools, underrepresented students of color who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to students in the control condition (Beta = 0.142). Students in the treatment and control conditions did not differ in their social or academic integration.

#### Findings for English-Language Learners:

- *Achievement Outcomes*: Across schools, English-language learners who received the intervention showed improved achievement compared to students in the control condition.
  - English-language learners who received the intervention **earned more STEM credits both during their first term and across their entire first year** compared to students in the control condition (6.9% and 4.7% higher, respectively; IRRs = 1.07 & 1.05).
  - They also **earned more STEM credits during their first term and across their entire second year** compared to students in the control condition (10.5% and 11.3% higher, respectively; both IRRs = 1.11).
  - Those students who received the intervention **earned higher STEM GPAs during the first term of their first year** compared to students in the control condition (0.11 GPA points; Beta = .056).
  - Follow-up analyses revealed that these effects emerged for English-language learners **even after controlling for students' race/ethnicity**. In other words, the treatment improved the achievement of English-language learners above and beyond the intervention benefits that they may have received because of their race/ethnicity.
- *Psychological Outcomes*: Across schools, English-language learners who received the intervention showed improved psychological outcomes compared to students in the control condition.
  - English-language learners who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to students in the control condition (Beta = 0.088).

- English-language learners who received the intervention also **reported higher levels of social integration** compared to students in the control condition (Beta = 0.079). In contrast, students in the treatment and control conditions did not differ in their academic integration.

#### Findings for First-Generation College Students:

- Academic Outcomes: Across schools, first-generation college students who received the intervention showed some initial improved achievement compared to students in the control condition.
  - First-generation college students who received the intervention **earned higher STEM GPAs during the first term of their first year** compared to students in the control condition (0.07 GPA points higher; Beta = .030).
  - Across their first two years, first-generation college students in the treatment and control conditions did not show any differences in the credits they earned in STEM courses.
- Psychological Outcomes: Across schools, first-generation college students who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to students in the control condition (Beta = 0.112). First-generation college students in the treatment and control conditions did not differ in their social or academic integration.

#### Findings for Students with Disabilities:

- Academic Outcomes: Across schools, students with disabilities who received the intervention did not differ in their achievement compared to students in the control condition.
  - These flat effects may be due to the relatively low sample size of this subgroup of students, as well as to the complexity inherent to the definition of “disability” (i.e., physical disability, mental illness, learning disability, etc.)
- Psychological Outcomes: Across schools, students with disabilities who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to students in the control condition (Beta = 0.125). Students with disabilities in the treatment and control conditions did not differ in their social or academic integration.

#### Findings for Women:

- Achievement Outcomes: Across schools, women’s achievement did not benefit from the intervention.
  - Women in the intervention and control conditions did not differ in the STEM credits they earned during their first year. In contrast, women who received the intervention **earned fewer STEM credits during their second year** compared to women in the control condition (1.4% lower; IRR = 0.986).
  - Women who received the intervention **earned significantly lower STEM GPAs across both their first and second years** compared to women in the control condition (0.04 & 0.05 GPA points lower, respectively; Beta = -0.021 and -0.026, respectively).
  - Follow-up analyses revealed that women did not underperform in the control condition, as typically seen in past research. Taken together, these findings suggest that, across our sample of schools, there may have been no achievement gap for the intervention to remedy.
- Psychological Outcomes: Across schools, women who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to students in the control condition (Beta = 0.132). Women in the treatment and control conditions did not differ in their reported social or academic integration.

# Social-Belonging Intervention

## Cross-School Results

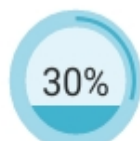


### Demographics

During the social-belonging intervention,

# 17,165

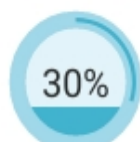
**STEM-interested students participated**



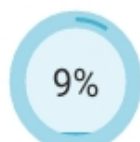
Identified as underrepresented students of color



Identified as English-language learners



Identified as first-generation students



Identified as having a disability



Identified as women

## Anticipated Growth in Belonging

Across all schools, underrepresented students of color, English-language learners, first-generation students, students with disabilities, and women all reported greater anticipated growth in belonging than those who did not receive the intervention. This shows that the intervention succeeded in changing their belonging mindset.

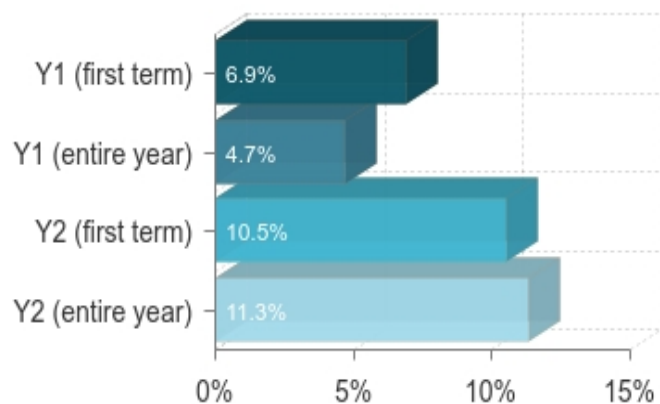


# STEM Credits

Across all schools, underrepresented students of color and English language learners who received the intervention earned more STEM credits both during their first term and across their entire first year as well as their first term and across their entire second year compared to the control condition.

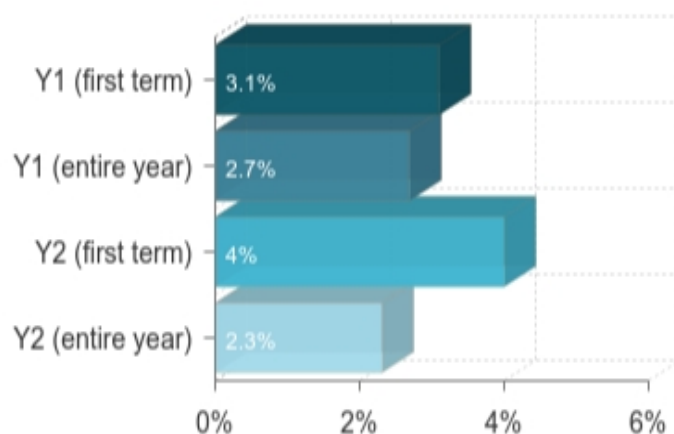
## English-Language Learners

% More STEM credits earned in intervention vs. control condition



## Underrepresented Students of Color

% More STEM credits earned in intervention vs. control condition



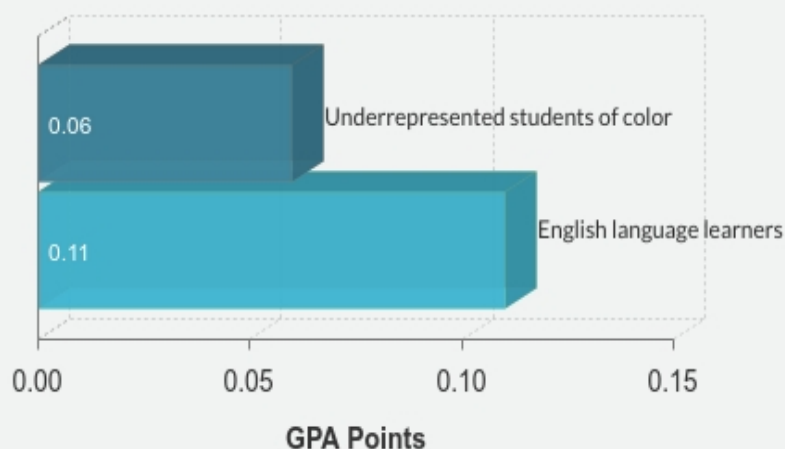
# STEM GPA



Underrepresented students of color and English-language learners who received the intervention earned higher STEM GPAs during the first term of their first year compared to the control condition.

## English-Language Learners & Underrepresented Students of Color

Additional GPA points earned in intervention vs. control condition



## Initial Patterns Observed at IU

### Finding for Underrepresented Students of Color:

- ***Achievement Outcomes:*** At IU, underrepresented students of color who received the intervention showed somewhat improved achievement compared to students in the control condition.
  - Underrepresented students of color who received the intervention **earned more STEM credits during their first year** compared to students in the control condition (14.0% higher; IRR = 1.14).
  - Yet, they **earned fewer STEM credits during their second year** compared to students in the control condition (13.5% lower; IRR = 0.87).
  - Across their first two years, underrepresented students of color in the treatment and control conditions did not differ in their STEM GPAs.
- ***Psychological Outcomes:*** At IU, underrepresented students of color who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to students in the control condition (Beta = 0.191). Students in the treatment and control conditions did not differ in their social or academic integration.

### Findings for English-Language Learners:

- ***Achievement Outcomes:*** At IU, English-language learners who received the intervention showed improved achievement compared to students in the control condition.
  - English-language learners who received the intervention **earned more STEM credits both during their first term and across their entire first year** compared to students in the control condition (26.0% and 30.0% higher, respectively; IRRs = 1.26 & 1.30, respectively).
  - They also **earned more STEM credits during the first term of their second year** compared to students in the control condition (26.0% higher; IRR = 1.26).
  - Across their first two years, English-language learners in the treatment and control conditions did not differ in their STEM GPAs.
- ***Psychological Outcomes:*** At IU, English-language learners who received the intervention did not differ in their psychological outcomes compared to students in the control condition.

### Findings for First-Generation College Students:

- ***Academic Outcomes:*** At IU, first-generation college students who received the intervention showed improved achievement compared to students in the control condition.
  - First-generation college students who received the intervention **earned more STEM credits both during their first term and across their entire first year** compared to students in the control condition (17.5% and 16.8% higher, respectively; IRRs = 1.18 & 1.17, respectively).
  - They also **earned more STEM credits during their first term and across their entire second year** compared to students in the control condition (33.8% and 16.0% higher, respectively; IRRs = 1.34 & 1.16, respectively).
  - Across their first two years, first-generation college students in the treatment and control conditions did not differ in their STEM GPAs.
- ***Psychological Outcomes:*** At IU, first-generation college students who received the intervention did not differ in their psychological outcomes compared to students in the control condition.



### Findings for Students with Disabilities:

- Academic Outcomes: At IU, students with disabilities who received the intervention did not differ in their achievement compared to students in the control condition.
  - As mentioned above, these flat effects may be due to the complexity inherent to the definition of “disability” (i.e., physical disability, mental illness, learning disability, etc.)
- Psychological Outcomes: At IU, students with disabilities who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to students in the control condition (Beta = 0.184). Students in the treatment and control condition did not differ in their social or academic integration.

### Findings for Women:

- Achievement Outcomes: At IU, women’s achievement did not benefit from the intervention.
  - Women who received the intervention **earned fewer STEM credits during their second year** compared to women in the control condition (7.1% lower; IRR = 0.93).
  - Across their first two years, women in the treatment and control conditions did differ in their STEM GPAs.
- Psychological Outcomes: At IU, women who received the intervention showed improved psychological outcomes compared to women in the control condition.
  - Women who received the intervention **reported significantly greater anticipated growth in belonging** in the post-intervention survey compared to women in the control condition (Beta = 0.185).
  - They also **reported higher levels of social integration** compared to women in the control condition (Beta = 0.120). Women in the treatment and control conditions did not differ in their academic integration.

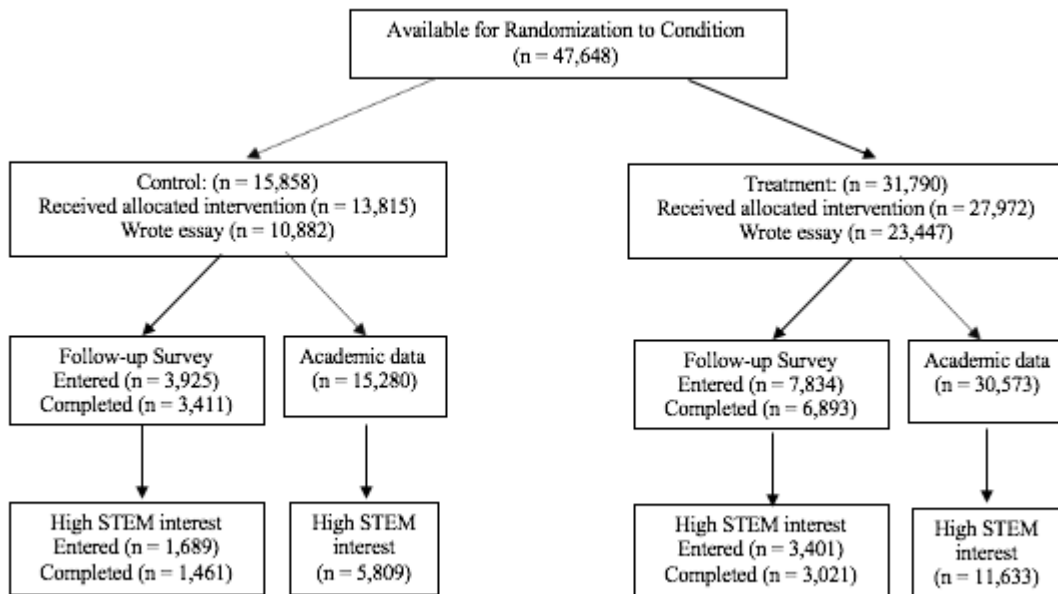
## In Closing

Thank you for your partnership, and everything that IU has done to make this collaborative work possible. We deeply appreciate your commitment to our shared goal of creating more equitable learning environments where all students can thrive.

As we continue with the analyses included in the NSF extension of the CTC belonging project, we look forward to providing IU and our CTC partner schools with more detailed results of our work. If you have any questions about this executive summary or the larger project, please contact the research team at [nsf@ctcteam.org](mailto:nsf@ctcteam.org).

## Summary Tables

### Across partner schools, student participation in various elements of intervention



**Across partner schools, participation broken down by underrepresented identities**

*Results presented as: total participants, control condition / treatment conditions*

	Total Participants	Underrep. Students of Color	English-Language Learners	First-Gen. College Students	Students with Disabilities	Women
<u>All students</u> (academic data)	45,036 15,023 / 30,013	16,010 5,288 / 10,722	5,434 1,860 / 3,574	12,648 4,207 / 8,441	3,872 1,292 / 2,580	26,253 8,734 / 17,519
<u>All students</u> (follow-up survey)	11,014 3,643 / 7,371	3,783 1,266 / 2,517	1,289 430 / 859	3,607 1,169 / 2,438	1,106 382 / 724	7,192 2,380 / 4812
<u>STEM-interested students</u> (academic data)	17,165 5,719 / 11,446	5,066 1,642 / 3,424	2,770 949 / 1,821	5,134 1,698 / 3,436	1,616 548 / 1,068	8,896 2,930 / 5,966
<u>STEM-interested students</u> (follow-up survey)	4,763 1,560 / 3,203	1,516 506 / 1,010	665 224 / 441	1,575 499 / 1,076	454 166 / 288	2,820 927 / 1,893

**At IU, participation broken down by underrepresented identities**

*Results presented as: total participants, control condition / treatment conditions*

	Total Participants	Underrep. Students of Color	English-Language Learners	First-Gen. College Students	Students with Disabilities	Women
<u>All students</u> (academic data)	4,078 1,345 / 2,733	762 228 / 534	129 51 / 78	569 175 / 394	301 101 / 200	2,392 772 / 1,620
<u>All students</u> (follow-up survey)	963 315 / 648	182 53 / 129	37** 17 / 20	181 58 / 123	99 29 / 70	659 212 / 447
<u>STEM-interested students</u> (academic data)	1,040 350 / 690	203 60 / 143	62** 21 / 41	176 55 / 121	114 41 / 73	584 192 / 392
<u>STEM-interested students</u> (follow-up survey)	339 113 / 226	81** 24 / 57	21** 9 / 12	81 26 / 55	33** 10 / 23	231 76 / 155

*Note: Results marked with \*\* should be interpreted with caution due to their low sample sizes (at least one cell has 25 or fewer students).*

**Results across schools, broken down by underrepresented identities**

	Underrep. Students of Color	English- Language Learners	First-Gen. College Students	Students with Disabilities	Women
<b>During the <u>FIRST YEAR</u>, did the intervention...</b>					
...increase STEM credits earned during the first term?	<b>Yes, by 3.1% (1.03)</b>	<b>Yes, by 6.9% (1.07)</b>	No significant effect	No significant effect	No significant effect
...increase STEM credits earned during the full year?	<b>Yes, by 2.7% (1.03)</b>	<b>Yes, by 4.7% (1.05)</b>	No significant effect	No significant effect	No significant effect
...increase STEM GPA during the first term?	<b>Yes, by 0.06 points (0.028)</b>	<b>Yes, by 0.11 points (0.056)</b>	<b>Yes, by 0.07 points (0.030)</b>	No significant effect	No significant effect
...increase STEM GPA during the full year?	No significant effect	No significant effect	No significant effect	No significant effect	<b>No, dropped 0.04 points (-0.021)</b>
<b>During the <u>SECOND YEAR</u>, did the intervention...</b>					
...increase STEM credits earned during the first term?	<b>Yes, by 4.0% (1.04)</b>	<b>Yes, by 10.5% (1.11)</b>	No significant effect	No significant effect	No significant effect
...increase STEM credits earned during the full year?	<b>Yes, by 2.3% (1.02)</b>	<b>Yes, by 11.3% (1.11)</b>	No significant effect	No significant effect	<b>No, dropped 1.4% (0.986)</b>
...increase STEM GPA during the first term?	No significant effect				
...increase STEM GPA during the full year?	No significant effect	No significant effect	No significant effect	No significant effect	<b>No, dropped 0.05 points (-0.026)</b>
<b>Psychological Outcomes</b>					
Did the intervention shape anticipated growth in belonging?	<b>Yes (0.142)</b>	<b>Yes (0.088)</b>	<b>Yes (0.112)</b>	<b>Yes (0.125)</b>	<b>Yes (0.132)</b>
Did the intervention shape social integration?	No significant effect	<b>Yes (0.079)</b>	No significant effect	No significant effect	No significant effect
Did the intervention shape academic integration?	No significant effect				

**Results for IU only, broken down by underrepresented identities**

	Underrep. Students of Color	English-Language Learners	First-Gen. College Students	Students with Disabilities	Women
<b>During the <u>FIRST YEAR</u>, did the intervention...</b>					
...increase STEM credits earned during the first term?	No significant effect	<b>Yes, by 26.0% (1.26)**</b>	<b>Yes, by 17.5% (1.18)</b>	No significant effect	No significant effect
...increase STEM credits earned during the full year?	<b>Yes, by 14.0% (1.14)</b>	<b>Yes, by 30.0% (1.30)**</b>	<b>Yes, by 16.8% (1.17)</b>	No significant effect	No significant effect
...increase STEM GPA during the first term?	No significant effect				
...increase STEM GPA during the full year?	No significant effect				
<b>During the <u>SECOND YEAR</u>, did the intervention...</b>					
...increase STEM credits earned during the first term?	No significant effect	<b>Yes, by 26.0% (1.26)**</b>	<b>Yes, by 33.8% (1.34)</b>	No significant effect	No significant effect
...increase STEM credits earned during the full year?	<b>No, dropped 13.5% (0.865)</b>	No significant effect	<b>Yes, by 16.0% (1.16)</b>	No significant effect	<b>No, dropped 7.1% (0.929)</b>
...increase STEM GPA during the first term?	No significant effect				
...increase STEM GPA during the full year?	No significant effect				
<b>Psychological Outcomes</b>					
Did the intervention shape anticipated growth in belonging?	<b>Yes (0.191)**</b>	No significant effect	No significant effect	<b>Yes (0.184)**</b>	<b>Yes (0.185)</b>
Did the intervention shape social integration?	No significant effect	No significant effect	No significant effect	No significant effect	<b>Yes (0.120)</b>
Did the intervention shape academic integration?	No significant effect				

*Note: For both tables, all results reported with  $p < .12$ . For credits earned outcomes, results reported indicate percent rate change (with incidence rate ratios in parentheses). For GPA outcomes, results reported indicate raw GPA points (with standardized betas in parentheses). For psychological outcomes, results reported reflect standardized betas.*

*Results marked with \*\* should be interpreted with caution due to their low sample sizes (at least one cell has 25 or fewer people).*

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