Supplemental Material

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SUPPLEMENT

This document contains supplementary material for the manuscript entitled "Evaluating

Psychosocial Mechanisms Underlying STEM Persistence in Undergraduates: Evidence of Impact

from a Six-Day Pre-College Engagement STEM Academy Program". Below is a list of materials

with respective page numbers.

Eligibility and Recruitment

Potential STEM Academy (SA) participants included all admitted FTIC students with a quantitative math SAT score of under 650 who were enrolled in a College of Arts and Sciences STEM major (Biology and Chemistry Department majors, Physics, Math, Statistics, and Geosciences). Students entering College of Engineering majors were not included in the recruitmentsince several engagement programs already exist for these students. For 2015, approximately 1,200 students who met the above criteria were invited to apply to the program with an email notification from admissions. Potential students were also recruited during several admitted student events held on campus during the Spring of 2015, and a letter and postcard about the program was also sent to the homes of eligible students. Applications were collected via a secure online portal managed by the SA Director. The application is shown in Table S1. Applicants were evaluated on a rolling basis, and students were provisionally accepted to the SA program by the SA Director. Note that the SA program was not designed to recruit a high-achievingor "honors" level cohort. Thus, Admission was primarily based on the sophistication of the personal statement, the student's understanding of the scope of the program and entry in pre-calculus since the "honors" population generally entered in calculus. Since a maximum of 120 students could participate, official admission was offered to students only after they had formally made a deposit to attend the university, register for an orientation session, and made a deposit for residential housing (for those students who were going to live on campus). It was not required that students lived on campus, and the first cohort had 12 students who commuted to the program each day. Scholars also could apply for one of 40 available slots in the SA Living Learning Community (LLC) that provided additional opportunities for engagement and community building throughout the Fall/Spring semesters of their first year.

General SA Program Structure

The majority of SA programming occurs through small break out groups of no more than 24 students. This number aligns with the capacity of the teaching labs. Each group of 24 students that are mentored by one STEM Ph.D. student (who typically has reached doctoral candidacy)and three undergraduate peers. Thus, the student/mentor ratio is 6:1, allowing for smaller break outs within the group of 24. The 2015 cohort was set to 120 and thus had five groups of 24. Graduate and undergraduate peer mentors are recruited and trained as discussed in the next section. Scholars are placed into their respective break out groups based on the research focus area of the graduate mentor that they rank when applying to the program. However, the groups are also set to balance genderand the student's majors.

SA Program Staffing

The SA staffing utilizes faculty, administrative staff, graduate students and peer mentors to deliver the program. Only graduate students and peer mentors receive compensation for their time, but also benefit from the opportunity and the credentialing of skills that it provides. All other SA participants provide assistance and programing in association with their current duties and in small (1-2 hour blocks). The program contains numerous "short" modules that are typically aligned with the expertise of the individual who is facilitating the activity. Thus, in many cases, there is no significant preparation outside of what an individual will do through their already assigned duties; however, they are provided a "guide"to assist in the development of new programming. Below are the general positions, duties and costs for SA Staff. Table 2S summarizes the staffing costs. Note, these are reflective of our university and individual grant funding; amounts may vary widely if adapted to other contexts.

SA Graduate Mentors (Compensation $3,000/mentor for ~ 30hrs training over Fall/Spring/Summer and full time effort (40+ hrs) during the week-long SA program). One SA Grad Mentor is needed for every 24 SA students in the program (ex. 120 students is 5 groups of 24 and will need 5 grad mentors). The SA Grad mentors provide mentorship to a group of 24 SA students and facilitate several program modules in a small group setting during the SA program (see the overview table S3). Typically, mentors are senior level Ph.D. students who have reached candidacy and are committed to high-level undergraduate teaching and to learning innovative pedagogy. Having senior level students also allows them to better utilize their career and research experiences in their mentoring. It is important that the majority of SA Grad Mentors are active researchers in a STEM discipline that is aligned with the SA students' degree programs,as they will need to provide an opportunity for the SA students to observe/participate in elements of their research during the SA program. This also allows for the SA Grad Mentor to bring some of undergraduate researchers who may be working with them into the SA program as peer mentors. Mentors are selected following an application, interview and letter of support from their major professor articulating their support of the mentor's commitment to the 30 hrs. of training and weeklong SA program. The support from the major professor is one of the most critical aspects of acceptance since the student's desire to learn and perform in the SA program cannot occur if they are worried about missing lab/research time due to their participation. A reason the training is spread over several semesters is to make it more acceptable to research faculty who often view any time outside of research as a distraction.

SA Undergraduate Peer Mentors (Compensation $450/mentor for training and full time effort (40+ hrs) during the week-long SA program). Three Undergraduate (UG) Peer Mentors are needed for every 24 SA Scholars in the program (ex. 120 Scholars is 5 groups of 24 and will

need 15 peer mentors). The UG Peer Mentors provide assistance to the SA Grad Mentor and mentorship of and engagement with the SA students. In the first iterations of the SA program, SA UG Peer Mentors have come from several different populations: 1) SA Scholars from the previous SA program; 2) undergraduate researchers who already work with the SA Grad Mentors or 3) peer mentors who come from academic courses (ex. Chemistry I, Math) or tutors from the Academic Success Center. Best practices would be to have 2 UG Peers from the previous SA and 1 UG researcher per SA Grad Mentor. This alignment provides the Grad Mentor with at least one student that they know and have worked with and others who are familiar with the program. All potential UG Peers must apply to the program and undergo an interview. They also must commit to several training modules and have evidence that they are highly engaged.

Program Time Lines and Program Content.

To provide a transition to the university, the SA program was schedule the week prior to the start of the Fall semester. Students who would be residing on campus were allowed to move into their assigned residences on the Sunday with classes starting a week later. Since the general student body moves in after this point, the early move in fees and first three days of meals were subsidized by the SA (those not residing on campus, about 15% of the cohort, were also provided meals for the first three days of the program). All SA students attended the required university first-year orientation session during the summer that included a meeting with the SA Director, who provided an overview of the program and answered questions. All SA students were also enrolled in a secure SA Canvas organization that provided resource information, schedules, and assignments (see below) designed to encourage introductions and interactions prior to campus arrival.

The overarching goal of the SA was to increase retention and engagement in STEM disciplines, primarily by targeting and promoting adaptive inter- and intra-individual level processes. Specifically, the program elements were developed to build a connection to the university, facilitate collaboration with peers who have purposely chosen a STEM discipline, provide hands on access to STEM curricular elements and lab exercises, promote practice in writing, provide opportunities for engagement with successful graduate students and peer undergraduates and promote strategic planning about their entry to a research university. The SA program includes 19 different modules delivered in three daily sessions (morning, afternoon, evening). The learning outcomes for each SA module are detailed in Table S3. Each program session contained engaging individual and group action exercises, writing, research design, or hands-on lab or math exercises that were relevant to STEM disciplines. Eleven of the modules were facilitated by the graduate and peer mentors to their individual groups, and the other sessions were facilitated by the SA Director, faculty, resource unit Directors or staff. The evening sessions were less formal to allow the group to engage in team building exercises, journaling about their experiences, complete homework assignments, and have open discussions. All SA students were provided a personalized three ring binder and journal that contained all resources and planning documents needed to complete the program. Many other resource documents were provided online through the SA Canvas organization.

Table S1: USF STEM Academy Application

General Information

Gender: (Male/Female) Dropdown
First name I want on my STEM Academy badge:
City and State or Country I want on my STEM Academy badge:
City:
State or Country:
High School Attended:
IB program:*(YES/NO) Dropdown*
Projected STEM Major:*Various Majors Dropdown*
Quantitative (MATH) SAT Score:*500-650 Dropdowns*
Quantitative (MATH) ACT Score:*20-29 Dropdowns*
Unweighted High School GPA:*3.00-4.00 Dropdown*
First Generation College Student: *(YES/NO) Dropdown*
Federal Work Study Eligible: *(YES/NO) Dropdown*
What is the first math course that you believe you will be taking at USF?*Courses Dropdown*
I am taking or I have completed a College Pre-Calculus Trig (MAC1114), Pre-Calculus Algebra (MAC1140) or Pre-Calculus (MAC 1147) course through DUAL ENROLMENT with a C or higher?*(YES/NO) Dropdown*
I have earned credit for Pre-Calculus (MAC1147) through an IB program or through the College Level Examination Program (CLEP)?*(YES/NO) Dropdown*
I am taking or have completed AP Calculus and will take the AP exam before attending USF: *(YES/NO) Dropdown*
My career aspirations after USF are:*Dropdown*
Attend Medical School and earn and MD
Attend Pharmacy, Dental, Physical Therapy or other professional degree program

Attend Graduate School and earn a Master's or Doctoral (Ph.D.) Degree
Get a job first and determine my next steps
I am not sure at the moment

I intend to enroll in courses at USF during summer 2017: *(YES/NO) Dropdown*

I intend to live on campus and will applying for a housing assignment: *(YES/NO) Dropdown*

STEM Academy Lab Coat Size:*(sizes) Dropdown*

STEM Academy Program Information

It is essential that you have reviewed the STEM Academy program and the schedule and are ready to commit to the level of engagement required for the program. Please confirm your understanding of the program through an affirmative answer to the questions below.

I have reviewed the STEM Academy Program and understand that it begins SUNDAY Aug 13 the week prior to the Fall 2017 semester:*radio button YES*

I understand that the STEM Academy Program runs from 9:00am-9:30pm and I am committed to attending all sessions:*radio button YES*

I understand that the STEM Academy Program requires individual and group work and I am committed to collaborative learning and engagement with my group members and the STEM Academy instructors:*radio button YES*

Please rank your research interests from 1-6 with 1 being what you are most interested in.

Cellular/Molecular Research
Ecological/Environmental Research
Microbiology Research
Chemistry/Physical/Engineering Science Research
Neurological/Psychological Research
Biological/Chemical Engineering Research

STEM ACADEMY PERSONAL STATEMENT AND LIVING LEARNING COMMUNITY

Your personal statement is a **VERY** critical part of the application and carries significant weight in the decision process. This is not a piece of writing that you can easily complete during the application and requires that you have taken some time to consider the questions below and to provide a thoughtful,

detailed response. The personal statement should be about 1 page single spaced (~500-700 words) and MUST include answers to these prompts:

1.	*Why will participation assure the success of the STEM Academy?*
2.	*What evidence do you have regarding leadership and working with others?*
3.	*The STEM Academy requires commitment to many types of programming including writing and oral reflections. Why will you be successful with these types of activities?*
4.	*Why are you committed to a degree in science/math (STEM)?*
5.	*If you will also be applying to the STEM Living Learning Community (LLC), you must indicate WHY you want to be included and what you will offer to the success of the LLC program. Only 80 Scholars will be admitted to the LLC!*

I want to be considered for the STEM LLC and have included a response to prompt #5 in my personal statement: *(YES/NO) Dropdown*

Note: If you are interested in being admitted to the STEM LLC, you will need to apply for USF housing and complete the LLC application. We will provide the links to these applications if you are accepted to the STEM Academy program but you may want to SAVE YOUR PERSONAL STATEMENT so that you can utilize this narrative as required in the housing/LLC application.

Table S2. Summary of SA staffing costs for planning and scaling purposes.

| Role	Cost per	Number of Mentors needed for 120 Scholars (5 groups of 24 students)	Total Cost
SA Program Director	$0	1	$0
SA Graduate Mentor	$3,000	5	$15,000
SA Peer Mentor	$475	15	$7,125
SA Graduate Assistant (optional)	$17,500	1	$17,500
Specialized Training from Teaching and Learning Center (optional)	$2,000	1	$2,000

Table S3. STEM Academy Schedule, Overview of Activities, and Learning Outcomes.

	Day	Size of Session	Session Activities	Learning Outcomes
Module 1	SUN Evening	Full Academy and Group of 24 Breakouts	Meet and Greet; Opening Reception and Keynote Address; Team Breakouts	1) Understand importance of collaboration; 2) Complete team building and collaboration exercises; 3) Understand expectation of being an Academy Scholar; 4) Active reflective writing on the question of the day and oral report out
Module 2	MON AM Session	Individual Groups of 24	Pipetting and Standard Curve Hands on Lab Experience	1) Master micropipetting; 2) Complete a standard curve Bradford assay to determine unknowns
Module 3	MON PM Session 1	1/2 of Academy in SMART Lab	Academic Success Center (ASC) Resources; Introduction to the SMART Lab; Study Skills Session	1) Understand resources available in the ASC; 2) Become familiar with layout and technology of SMART Lab; 3) Learn study skills
Module 4	MON PM Session 2	Individual Groups of 24	Reflection and discussion on session 1	1) Participate in active reflection of previous activities; 2) Complete team building and collaboration exercises
Module 5	MON PM Session 3	1/2 of Academy in SMART Lab	The Art of Reflection: A Strategy for Achieving Success in College and Beyond	1) Understand reflection and its benefits; 2) Know how to apply and practice reflective thinking and writing; 3) Understand how reflection can help develop and communicate competencies
Module 6	MON Evening Session	Full Academy and Group of 24 Breakouts	Demystifying Graduate School Workshop; Individual Team Breakouts; Reflective Writing and Report Outs; Team Building Exercises	1) Understand pathway to research PhD and contrast to professional school; 2) Team building and collaboration: 3) Active reflective writing on question of the day and oral report out
Module 7	TUES AM Session 1	Individual Groups of 24	USF as a Research University Introduction; Getting Started in Undergraduate Research Action Workshop	1) Understand USF as a research university: 2) Understand expectations for engaging in UG research and role of Office for Undergraduate Research: 3) Develop action plan to engage in UG research

Module				
Module 8	TUES PM Session 1	Individual Groups of 24	Researching a Mentor and the Conversation of Research Action Workshop	1) Understand faculty rank: 2) Understand how to utilize department websites to determine faculty research agendas; 3) Analyze a faculty research profile and develop questions to engage in conversation of research
Module 9	TUES PM Session 2	Groups of 6	"Search for the Seal" Scavenger Hunt Research Exercise	1) Work as a team to develop a procedure to solve exercise: 2) Team building and collaboration; 3) Experience USF campus
Module 10	TUES Evening Session	Individual Groups of 24	Individual Team Breakouts; Reflective Writing and Report Outs; Team Building Exercises	1) Discussion of previous activities 2) Complete team building and collaboration exercises; 3) Active reflective writing on question of the day and oral report out
Module 11	WED AM Session 1	1/2 of Academy in SMART Lab	Regression Analysis Using Excel	1) Use Excel spreadsheet to complete linear regression analysis; 2) Calculate R^2; 3) Data analysis: Determine accuracy and precision of calculated unknowns; 4) Data analysis: Determine pipetting efficiency score
Module 12	WED AM Session 2	1/2 of Academy in SMART Lab	Pre-Calculus Math Challenge	1) Work as team of 6 Scholars to collect data and fit parabolic equation
Module 13	WED PM Session	Individual Groups of 24	Research Lab Tours and Hands on Lab Exercise (cell biology, physiology or organic chemistry)	1) Understand scope of research ongoing in USF research labs; 2) Complete a hands-on lab experience
Module 14	WED Evening Session	Individual Groups of 24	Individual Team Breakouts; Reflective Writing and Report Outs; Team Building Exercises	1) Discussion of previous activities; 2) Complete team building and collaboration exercises; 3) Active reflective writing on question of the day and oral report out
Module 15	THRU AM Session 1	Full Academy in SMART Lab	Creating a Personal Branding Plan to Credential Your Skills and Experience PART I	1) Learn what a Personal Branding Plan (PBP) is and how to begin drafting components; 2) Create a personal vision statement and understand its value

Module 16	THRU AM Session 2	Individual Groups of 24	Reflection and discussion on session 1	1) Participate in active reflection of previous activities; 2) Complete team building and collaboration exercises
Module 17	THRU AM Session 3	Full Academy in SMART Lab	Creating a Personal Branding Plan to Credential Your Skills and Experience PART II	1) Develop sections of the Curriculum Vitae (academic resume)
Module 18	THRU PM Sessions (Optional)	Scholars sign up to attend these concurrent optional sessions	Medical Admissions Workshop; Office of National Scholarships Meet and Greet; Office for Undergraduate research Meet and Greet; Nanotechnology Engineering Lab Tours	Various depending on session
Module 19	FRI AM Session	Full Academy in SMART Lab and Main Library	STEM Career Presentation and Career Speed Dating Session	1) Understand scope of career opportunities for graduates with STEM degree; 2) Research professionals participating in career speed dating and develop questions; 3) Understand pathway to various careers
			Closing Program	Awards, Mentor Recognition, Certificates of Completion, Final group Breakouts

Figure S1. Distributions of Propensity Scores of Probability of Selecting into STEM Academy Program Pre and Post-Matching.
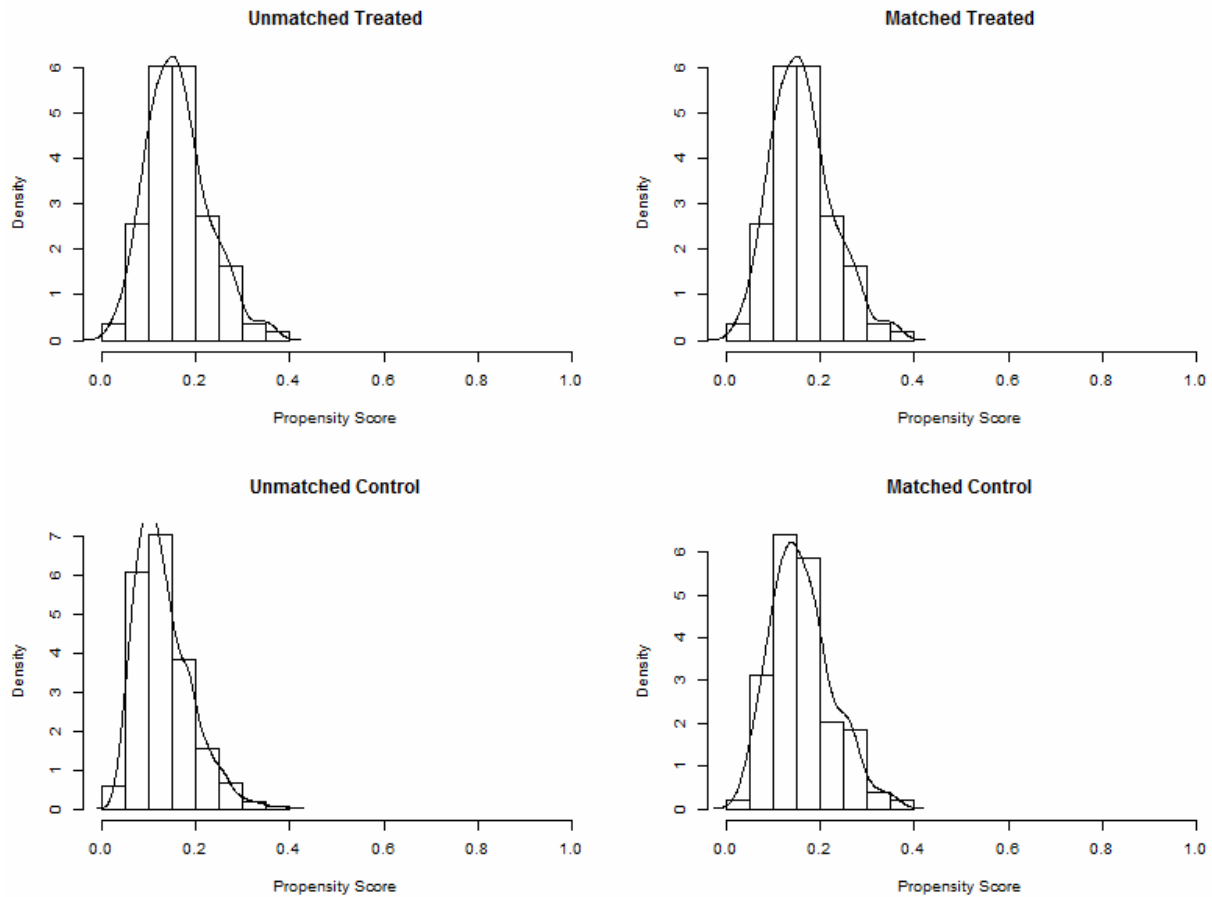
Note: This figure displays the distributions of propensity scores (reflecting the probability of assignment to treatment condition, or in this case program) across "treated"/program and "untreated"/comparison participants before and after the matching procedure. Note that the distributions are less similar in the unmatched graphs than in the matched graphs. This suggests that the matching procedure created a comparison sample that is more similar to the program participants based on the covariates used to calculate propensity scores per participant.