



LEVEL PLAYING FIELD
INSTITUTE



SUMMER MATH AND SCIENCE HONORS (SMASH) ACADEMY

Evaluation Report 2013



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EXECUTIVE SUMMARY

To evaluate the impact of the SMASH program in 2013, data were collected from students across all four SMASH sites (UC Berkeley, Stanford, USC, and UCLA). Data collection procedures included: (1) Academic assessments examining growth in mathematics, science, and computer science skills and knowledge, (2) Pre- and Post-SMASH surveys examining students' attitudes and aspirations, (3) Open-ended questions assessing students' experiences and satisfaction with SMASH, (4) Alumni surveys tracking post-secondary data of SMASH alumni, and (5) Longitudinal academic year data to analyze coursetaking and grades. A total of 468 SMASH students were served in 2012-13, including 240 current students and 228 alumni. One hundred students attended SMASH in Southern California at UCLA and USC, and 140 attended the Northern California sites at UC Berkeley and Stanford. The vast majority of all SMASH students were Latino (58%) and African American (28%); 49% were female, 83% were eligible for Free/Reduced Price Lunch (FRPL), and 73% were both Free/Reduced Priced Lunch and First Generation to graduate from college.

Major highlights from the 2013 evaluation include:

Math, Science and Computer Science Knowledge

- In science, 78% of SMASH students demonstrated gains in assessment scores over the course of the program; 91% of students in Biology demonstrated gains in science scores from pre- to post-SMASH.
- In mathematics, 58% of SMASH students demonstrated an increase in mathematics readiness from pre-post, with 70% of Algebra II students improving in performance.
- Across a set of 12 core computer science skills and concepts, SMASH students demonstrated large and statistically significant increases from pre-SMASH (Mean=1.87) to post-SMASH (Mean=2.86).
- Students demonstrated the largest gains in computer science knowledge and ability to use broadcast blocks in Scratch (23% to 75%), use variables in Scratch (24% to 81%), create stories in Scratch (31% to 81%), and in their familiarity with algorithms (20% to 58%).

STEM Attitudes and Aspirations

- Students reported a significant increase in positive attitudes and identification with science and computer science, and significant gains in self-efficacy in science; Increases in attitudes, identification, and self-efficacy in math were small but non-significant.
- STEM aspirations increased significantly from pre-post, including aspirations to pursue a STEM degree in college (Mean=4.30 to 4.48), STEM career aspirations (Mean=4.40 to 4.52), and aspirations to pursue computer science in college and career (Mean=2.96 to 3.11).
- At the completion of SMASH, 77% of students intended to take an AP STEM course in the fall, 89% indicated their plans to declare a STEM major, and 93% indicated the desire to pursue a career in STEM. By comparison, only 15% of all high school graduates (and 7% of African American and 9% of Latino students), took an AP/IB math course, and estimates suggest only 49% of 9-12th graders intend to study STEM in college. ¹

¹ National Science Foundation, [Science and Engineering Indicators](#), 2012), University of the Sciences, [Survey Results: Students' Attitudes on Pursuing Sciences and Healthcare](#), 2012).

Preparation for Applying to College

- Students' understanding of the college applications process and familiarity with financial aid processes increased significantly from pre-post SMASH, with students increasing in their confidence in successfully completing a college application (61% to 71%), knowledge about researching and applying for scholarships and loans (39% to 60%), and knowledge about how to apply for financial aid (FAFSA; 28% to 33%).

Access to STEM Role Models and Networks of Support

- Statistically significant increases were demonstrated in students' access to networks of STEM peers and role models; Specifically, students reported an increase in knowing "students like me" who are interested in STEM (70% to 85%), having access to role models of color (57% to 72%), and access to female STEM role models (46% to 60%).

Leadership, Critical Thinking, and Social Justice Orientation

- Students demonstrated significant increases in leadership skills (Mean=3.73 to 3.96), critical thinking skills (Mean=3.40 to 3.58), social justice orientation (Mean=4.10 to 4.31) and a decrease in the endorsement of negative racial and gender stereotypes.

Post-Secondary Outcomes

- 67% of the SMASH alumni have been tracked. Of these, 100% graduated from high school (compared to the national average high school graduation rate of 75%²) and 83% were enrolled in a four-year university (compared with 45% of all 18-24 year-olds)³
- 67% of SMASH alumni have declared STEM majors. By comparison, only 23% of all college freshmen declare STEM majors⁴.
- Of the 82% of alumni who intended to major in STEM while in high school, 78% declared STEM majors in Year 1 of college, and 88% of those persisted beyond Year 2 in STEM majors.

² National Science Foundation (NSF), [Science and Engineering Indicators](#), 2010.

³ U.S. Dept. of Commerce, Census Bureau, [Percentage of 18-24 Year-Olds Enrolled in Colleges/Universities](#), 2009.

⁴ U.S. Dept. of Education, [Education Dashboard: Percent of Bachelor's Degrees Conferred in STEM Fields](#), 2009.



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ABOUT LPFI

The Level Playing Field Institute (LPFI) is an Oakland-based non-profit that is committed to eliminating the barriers faced by underrepresented people of color in science, technology, engineering and math (STEM) and fostering their untapped talent for the advancement of our nation.

To improve access, opportunity, and equity in STEM, the Level Playing Field Institute:

- Operates **STEM-focused Education Programs** at the middle school and high school level (SMASH Academy and SMASH Prep)
- Conducts **Research on STEM Equity and Opportunity**,
- Executes **Innovative Computer Science Initiatives**

ABOUT SMASH

The Summer Math and Science Honors (SMASH) Academy, the flagship program of the Level Playing Field Institute, is a 3-year, 5-week summer STEM enrichment program for low-income high school students from backgrounds underrepresented in STEM fields. The SMASH program currently operates across four sites in Northern and Southern California. The program began in 2004 at the University of California, Berkeley and has since expanded to Stanford University (2011), University of California, Los Angeles (2012) and University of Southern California (2012). The SMASH program offers rigorous STEM coursework, engaging curriculum which intentionally integrates culturally relevant pedagogy and technology, exposure to diverse STEM role models and networks of STEM



peers, and preparation for the college applications process. In addition to academic enrichment, the program provides students with the opportunity to live on campus in dorms, where they are guided through activities focusing on social development, cultural competence, social justice orientation, and college success skills. This curriculum ensures that students of color are able to discuss and examine issues of race, class, gender, and inequity, while focusing on building confidence and support networks to alleviate barriers to STEM in higher education.

OBJECTIVES OF THE SMASH IMPACT EVALUATION

- (1) Examine the goals, objectives, and activities of the SMASH program and construct measures to assess impact in each critical area.
- (2) Collect data from SMASH students to measure academic growth, attitudes, aspirations, and skills, and understand students' perspectives of the SMASH program.
- (3) Utilize the data and findings to document outcomes and inform program growth and improvement.

METHODOLOGY

Data Collection

The SMASH impact evaluation included five different forms of data collection: (1) Academic assessments examining growth in mathematics, science, and computer science knowledge, (2) Pre-Post-SMASH student survey examining students' attitudes and aspirations, (3) Open-ended qualitative questions to understand student experiences with the program, (4) Alumni survey tracking post-secondary data of SMASH alumni, and (5) Student demographic data and academic year data to analyze coursetaking and grades. Details about each form of data collection are included in Figure 1 (below).

Analytical Procedures

All quantitative data were analyzed using SPSS statistical package. The percentages for each item were recorded (e.g., % strongly agree/agree) for both pre- and post-SMASH responses; the percentage change between pre- and post- was then calculated to determine growth or stagnation. Each item was grouped with its corresponding scale/variable and reliability analyses were conducted; for reliable scales, individual items were summed into scales. The mean of each scale (pre- and post) was then calculated and paired-samples T-tests were run to determine if the mean values changed significantly from pre- to post- condition⁵

All qualitative data were analyzed using HyperResearch. Open-ended items were analyzed by compiling codes and sorting into numerical categories in order to produce frequency reports based on general themes.

Figure 1.

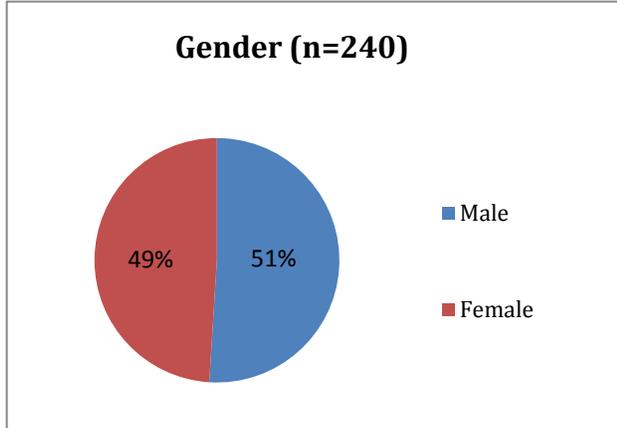
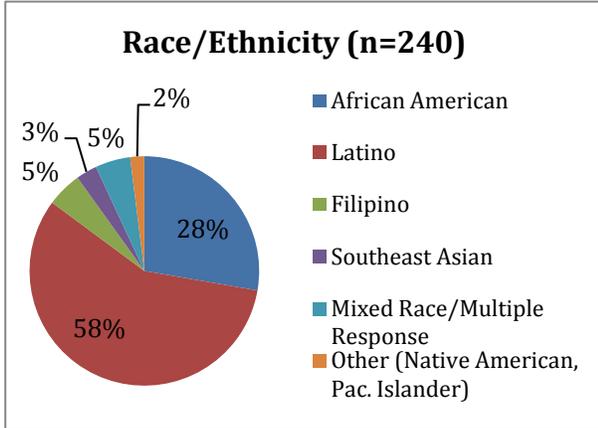
		Description	Data Collection Procedures
Academic Assessments	Math	The Mathematics Diagnostic Testing Project (MDTP) tests were designed by a joint workgroup between the California State University (CSU) and the University of California (UC) in 1977. The tests are designed to measure student readiness for a broad range of	SMASH students were given mathematics assessments to determine readiness for their Fall 2013 math courses and examine impact of the SMASH math courses. Tests included: Algebra II, Mathematics Readiness, Calculus Readiness, and Beginning Calculus, and were

⁵ **Methodological note:** All scales are comprised of items rated on a 5-point Likert scale, and the mean values on each scale range from 1-5 with 5 being the highest possible value. Mean values and significant pre-post changes are reported. All item percentages reported reflect the percent of students who strongly agreed and/or agreed with each item.

		mathematics courses and to provide students and teachers with diagnostic information about student preparedness.	administered to students prior to the start of the SMASH program and again at the end of the program. Data are reported for 210 of the 240 current SMASH students who completed both the pre- and post- math assessments.
	Science	A group of SMASH instructors and science curriculum consultants developed assessments for Biology, Chemistry, and Physics. Students were assessed on biology concepts including cells, photosynthesis, cellular respiration and human biology; chemistry concepts including chemical bonds, stoichiometry, elements, compounds and mixtures, and solubility; and physics concepts including one-dimensional kinematics, Newtonian mechanics and conservation of energy.	The science assessment was given to each student in their science class on the first day of SMASH and again on the last day of SMASH. Tests included: Biology, Chemistry, and Physics, and data are reported for 210 of the 240 current students, who completed both the pre- and post- science assessments.
	Computer Science	A set of key concepts and skills for students to master within the computer science course were developed in conjunction with the CS lead instructor and aligned to the CS curriculum. The 12-item CS concept inventory asked students to self-report their familiarity with CS programming languages and application of CS problem solving techniques, including using variables in scratch, programming in Java or JavaScript, knowledge of problem solving strategies and understanding of HTML and CSS.	The 12 questions were included in the pre-post SMASH survey which students completed prior to SMASH and at the completion of the program.
Pre-Post SMASH Impact Student Survey		The SMASH impact survey was designed by LPFI's research department in consultation with research literature in education and psychology. 29 variables were identified as key metrics to examine SMASH impact, including attitudes towards math and science, STEM college and career aspirations, leadership skills, and access to STEM role models (see appendix). Items were developed to measure each scale. Additional items were included to measure students' perceptions of SMASH impact.	All students completed the pre-SMASH survey prior to the beginning of the program (on the weekend they moved into the dorms) and the post-SMASH survey on the last day of the program. Data is reported for 224 of the 240 current SMASH students.
Qualitative Data Collection		Open-ended items were included in the pre-post- survey to examine student experience within SMASH, aspects which had the greatest/least impact on them, and satisfaction with their courses.	Data were collected on open-ended items in the pre-post SMASH survey administered at the beginning and end of the SMASH program.
SMASH Alumni Survey		An alumni survey was designed by the LPFI research department to capture updated information on the post-secondary outcomes of SMASH alumni (including college of enrollment, major, PT/FT status, etc.).	The alumni survey was sent out in early 2013 to the 178 alumni who had completed the SMASH program as of June 2012. Responses were received for more than half of alumni, and alumni data are available for 119 of the 178 alumni (67%).
Student Demographic and Academic Year Data		Demographic data includes gender, race/ethnicity, income, family educational background. Academic year data includes coursetaking, grades, and in some cases, test scores.	Demographic data were collected during the application process and academic year data (including test scores, grades, coursetaking, etc.) is collected from students 2 times per year. *Academic year data will be available in Spring 2014.

SMASH ACADEMY DEMOGRAPHIC DATA

	1 st Years	2 nd Years	3 rd Years	Total Current Students	Total Alumni	Total Students + Alumni
University of CA, Berkeley	22	28	20	70	179	249
Stanford University	20	23	27	70	49	119
University of CA, Los Angeles	23	27	0	50	0	50
University of Southern CA	22	28	0	50	0	50
Total Students	87	106	47	240	228	468



Academic Data	
Average Current Math Grade	B+ /A-
Average GPA	3.64
Socioeconomic Indicators	
Free/Reduced Price Lunch Eligibility	83%
Average Household Income	\$51,495
Average Household Headcount	4.6
First Generation College	81%
Both FRPL & First Generation	73%

SMASH EVALUATION RESULTS

GOAL #1: Ensure students are academically prepared to be successful in STEM coursework at top universities.

Mathematics Readiness⁶

- 58% of SMASH students demonstrated an increase in mathematics readiness from pre- to post-SMASH, with an

"We were able to construct our own knowledge...Especially in calculus, I became empowered to become a motivated, independent scholar."

-3rd year SMASH: Berkeley student

⁶ After the 2013 program, SMASH staff and instructors identified incongruence between the math assessment and the course content, which could account for the large percentage of students who did not demonstrate improvement. Modifications to the assessment and curriculum to ensure alignment are in process for 2014.

average of six more items correct on the post exam. Five percent of students had no change from pre-post and 37% decreased in performance (Figure 2).

Figure 2.

Overall Math Assessment Data			
	# of students	% of students	Avg. # items (+/-)
Increase (post>pre)	122	58%	+6 items
No Change (post=pre)	10	5%	0 items
Decrease (post<pre)	78	37%	-4 items
TOTAL SAMPLE	210	--	+2 items

- In Algebra II, the majority of students demonstrated an increase in readiness skills (70%), and these students increased by an average of 7 items, or 16%. The percentage of students demonstrating increases from pre to post increased 15 percentage points from 2012.
- Performance increases on the more challenging exams were somewhat lower, with just 54% of students demonstrating increases on the Math Analysis (Pre-Calculus) exam, 52% demonstrating increases on the Calculus Readiness exam, and 45% demonstrating increases on the Beginning Calculus exam (Figure 3).

Figure 3.

Mathematics Pre-Post Data, By Course					
		# of students	% of students	Avg. # items (+/-)	Avg. % increase
ALGEBRA II (n=64)	Increase	45	70%	+7 items	16%
	Same	2	3%	0 items	
	Decrease	17	27%	-3 items	7%
MATH ANALYSIS (n=102)	Increase	55	54%	5 items	11%
	Same	4	4%	0 items	
	Decrease	43	42%	4 items	8%
CALCULUS READINESS (n=33)	Increase	17	52%	5 items	13%
	Same	4	12%	0 items	
	Decrease	12	36%	3 items	8%
BEGINNING CALCULUS (n=11)	Increase	5	45%	4 items	13%
	Same	0	3%	0 items	
	Decrease	6	55%	-4 items	13%

- Among students who demonstrated growth from pre-post, 37% increased by 3-5 items, and another 23% increased by 8 or more items (Figure 4).
- Among students who demonstrated no growth from pre-post, 41% decreased by 3-5 items, but far fewer decreased by more than 8 items (8% versus 23%; Figure 5).

Figure 4.

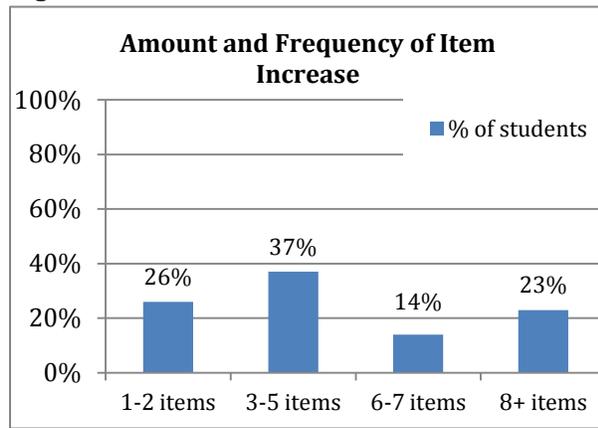
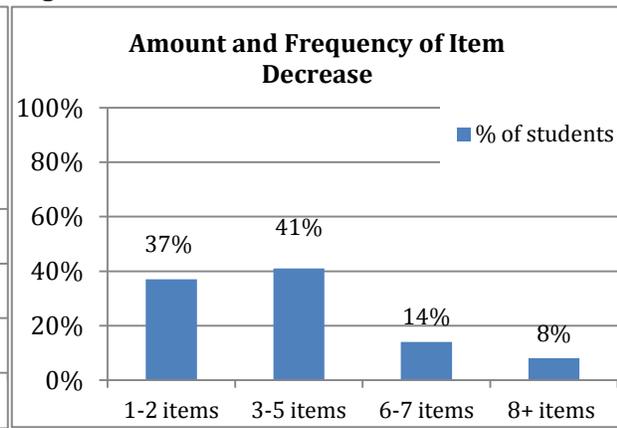
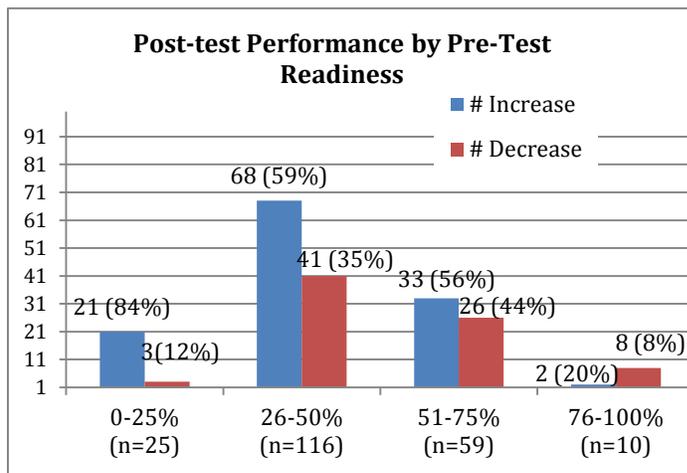


Figure 5.



- When examining pre-test scores, the students who demonstrated lower pre-test scores (0-50%) were much more likely to demonstrate increases on the post-test than students who had higher pre-test scores (51-100%; Figure 6).

Figure 6.



"[SMASH coursework] goes beyond what normally a high school class would cover, and also, the science class includes a lab, unlike high school science."

-2nd year SMASH: UCLA student

Science Readiness

- 78% of SMASH students demonstrated an increase in science assessment scores over the course of the program, with an average increase of 4 items. Eight percent demonstrated no change, and 14% decreased in performance from pre- to post-SMASH (Figure 7).
- Overall, on average students scored a 39% during the pre-SMASH test and 49% during the post-SMASH exam.

Figure 7.

Overall Science Assessment Data			
	# of students	% of students	Avg. # items (+/-)
Increase (post>pre)	163	78%	4
No Change (post=pre)	16	8%	0
Decrease (post<pre)	30	14%	-2
TOTAL SAMPLE	209		+2.8 items

- Students demonstrated significant gains in Biology, with 91% increasing from pre-post by an average of 17%.
- Almost three-quarters of students increased in performance in Chemistry (72%), and 65% demonstrated an increase from pre-post SMASH in Physics (Figure 8).

Figure 8.

Science Pre-Post Data, By Course					
		# of students	% of students	Avg. # items (+/-)	Avg. % increase
BIOLOGY (n=81)	Increase	74	91%	4.6	17%
	Same	5	6%	0	-
	Decrease	2	2%	-2	7%
CHEMISTRY (n=88)	Increase	63	72%	3.5	15%
	Same	9	10%	0	-
	Decrease	16	18%	-1.8	8
PHYSICS (n=40)	Increase	26	65%	3.3	13%
	Same	2	5%	0	-
	Decrease	12	30%	-2.5	10%

- Among students who demonstrated growth from pre-post, 41% increased by 3-5 items, and another 34% increased by 8 or more items (Figure 9).
- Among students who decreased from pre- to post-SMASH, 70% decreased slightly, by 1-2 items (Figure 10).

Figure 9.

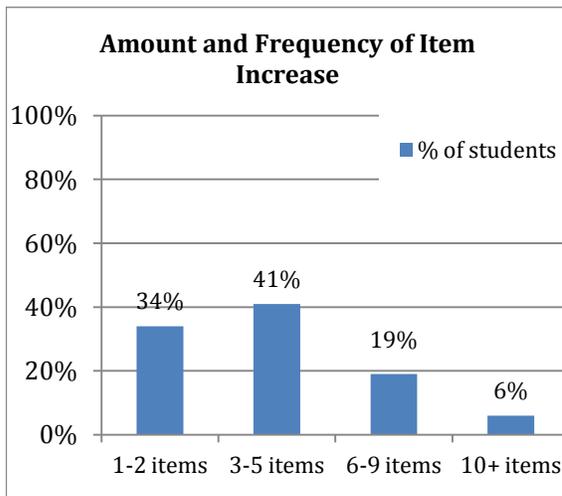
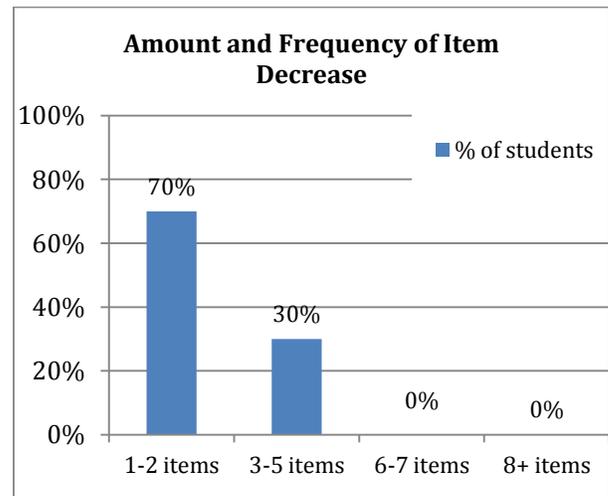
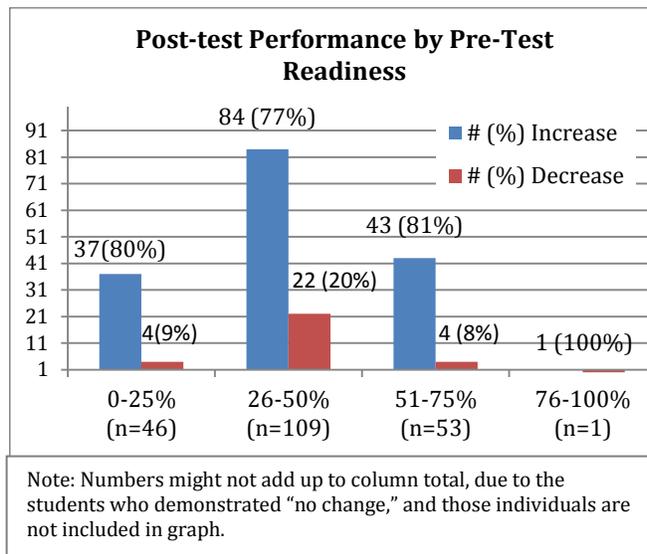


Figure 10.



- Post-SMASH test performance was roughly equally across all pre-SMASH performance levels; Increases in students' science performance was demonstrated across all performance levels and there was not much variation by pre-test scores.

Figure 11.



Computer Science Skills and Knowledge

- The majority of SMASH students entered the program with little to no familiarity with CS programming languages (fewer than 10% had any familiarity with programming in Java, C++, CSS, or JavaScript) and less than 25% had familiarity with Scratch, HTML and creating webpages.
- When examining a core set of 12 CS knowledge and skills, SMASH students demonstrated a statistically significant increase from pre-SMASH (Mean=1.87) to post-SMASH (Mean=2.86), $p < .007$.
 - Students demonstrated the largest gains in knowledge about using broadcast blocks, variables, and creating stories in Scratch (by increasing 52, 57, and 50 percentage points, respectively). By the end of SMASH, 81% of students rated their knowledge for using variables and creating stories in Scratch as "very good" or "good."
 - The percentage of students reporting familiarity with algorithms also increased by 38 percentage points, with the percentage of students rating their familiarity as "very" or "somewhat" good increasing from 20% to 58%.
 - The percentage of students self-reporting knowledge of using the programming languages Java, C++ and Python increased from 7% to 24%.
- Students also gained clarity on what the field of computer science is, increasing by 37 percentage points in "understanding what computer science is", and the percentage of students who did not know anything about the topics traditionally covered in CS courses decreased by 32 percentage points, from 36% to 4%.

Technology Skills and Knowledge

⁷ Pre-post differences are considered "statistically significant" if the p-value is < 0.05 (meaning the differences are unlikely to have occurred by chance).

- SMASH students demonstrated a significant increase in technology skills and knowledge from pre-SMASH (Mean= 3.83) to post-SMASH (Mean=4.14), $p < .00$.
- Students demonstrated a 17 percentage point increase from pre- to post-SMASH in self-rating of skills using data processing spreadsheets (MS Excel), and a 15 percentage point increase in their overall technology skills.

Goal #2: Ensure students develop skills and access support networks necessary to succeed in STEM in higher education.

Self-Efficacy in Math and Science

- SMASH students demonstrated a small, yet non-statistically significant, increase in self-efficacy in mathematics (Mean Diff= .02) and a statistically significant increase in self-efficacy in science (Mean diff=.07).
- Students reported high levels of self-efficacy in math and science at both pre- and post-SMASH, and at the end of the program, 95% of students believed they are capable of doing well in math and science.

Scholar Identity

- SMASH students were highly-identified as students at both pre and post. Ninety-seven percent of students indicated that being a successful student is important to them.
- The percentage of students defining themselves as a scholar increased from 74% to 78% from pre- to post.

Belongingness in STEM

- Although the percentage of SMASH students reporting feeling like their ideas count increased (72% to 76%) and the percentage of students feeling like they are important contributors in their math and science classes also increased (72% to 77%), the overall belongingness scale decreased from pre- to post.

Access to Mentors in STEM

"Ms. Arguello (Computer Science instructor) has really inspired me to pursue computer science."

-2nd year SMASH: Stanford student

- Students reported a small increase in access to STEM mentors from pre-SMASH (Mean=4.09) to post-SMASH (Mean=4.11).
- 77% of students indicated that they have at least one mentor who they talk to about their college or career goals, and 80% rated their mentor as supportive in helping them reach their goals.

Access to Network of STEM Peers

- Participating in the SMASH program resulted in a significant increase in students' access to networks of STEM peers (Pre-SMASH Mean=3.94, Post-SMASH Mean=4.28).

- Specifically, the percentage of students indicating that they know students from similar backgrounds as their own who are interested in STEM increased by 15 percentage points; The percentage of students who reported feeling part of a community of STEM students increased by 12 percentage points.

Goal #3: Ensure students understand the college admissions process and are competitively prepared to apply and be accepted to a 4-year university.

College Aspirations

- Prior to SMASH, 93% of students aspired to attend a four-year university after graduation; this percentage increased slightly to 95% post-SMASH.
- 94% aspired to pursue education beyond the four-year Bachelor’s and wanted to pursue advanced degrees (Master’s, Ph.D., MBA, MD). This percentage remained the same from pre- to post-SMASH.
- 99% of students indicated that attending college is very important to them.

Interest in Colleges/Universities

- When asked what colleges students aspired to attend, the vast majority of students listed high-prestige four-year universities in both pre- (96%) and post-SMASH (97%) conditions.
- From pre- to post-SMASH, 33 students’ (15%) aspirations for colleges they are most likely to attend increased in prestige/competitiveness (e.g., students listed a CSU or a community college in the pre-survey, and a UC or a private university in the post-survey).
- Post-SMASH, 140 students (63%) aspired to attend a SMASH university site for college, an increase from 130 students who aspired to attend a SMASH university site prior to SMASH.

Understanding of College Application Process

- SMASH students’ knowledge of and preparation for the college application process increased significantly from pre-SMASH (Mean=3.58) to post-SMASH (Mean=3.70).
- The percentage of students demonstrating confidence in successfully completing a college application and writing a successful personal statement increased by 10 percentage points and by 5 percentage points, respectively.
- Ninety-six percent of students completed SMASH with knowledge and understanding of the “A-G” requirements for admission to UC/CSU, compared with 84% of students prior to SMASH.

“SMASH provided everything I need to get a better understanding of STEM majors as well as a better understanding of college.”
 -1st year SMASH: UCLA student

Familiarity with Financial Aid Application Processes

- SMASH student familiarity with financial aid processes and applications increased significantly over the course of the summer program. Students' familiarity increased from an average score of 3.25 to an average score of 3.79 from pre-post (Diff=.54).
- The percentage of students demonstrating knowledge about how to apply for financial aid increased by 33 percentage points (28% to 61%) and the percentage of students demonstrating knowledge about student loans and how to apply for them increased by 21 percentage points (39% to 60%).
- Students also became more confident in their ability to obtain financial aid to finance their college education (61% to 78%).

Goal #4: Instill social responsibility, critical thinking, civic awareness, and leadership in all students.

"The core class teachers explained every concept very well and allowed us to think critically of real world application problems. Normally, I do not connect math or science with the real world, but these teachers allowed me to see STEM in a whole different light."

-2nd year SMASH: Stanford student

Leadership Skills

- Students demonstrated a large, significant increase in their leadership skills from pre-SMASH (Mean=3.73) to post-SMASH (Mean=3.96).
- A 13 percentage point increase was demonstrated in students' comfort in leading, planning, and decision-making within groups (61% to 69%), and comfort in being persuasive and assertive when working with peers (65% to 78%).

Critical Thinking

- A significant increase was seen from pre- to post-SMASH in students' self-reported critical thinking skills (Mean=3.40 to Mean=3.58).
- The percentage of students reporting confidence in their ability to evaluate arguments and theories increased by 14 percentage points (68% to 82%) and the percentage of students reporting confidence in challenging assumptions increased by 10 percentage points (37% to 47%).

Cultural Competency

- Seventy-nine percent of students rated themselves highly in cultural competence at the start of the SMASH program, and this percentage increased to 92% by the end of the program.
- Students increased their comfort level in interacting with diverse peers by 3 percentage points (85% to 88%).

Social Justice Orientation

- Students demonstrated a significant increase in identification with social justice principles from pre-SMASH (Mean=4.10) to post-SMASH (Mean=4.31).

- Post-SMASH, 88% of students indicated that challenging injustice is something that is important to them, compared with 77% prior to SMASH.
- The percentage of students demonstrating the desire to use STEM knowledge to solve problems within their communities increased by 3 percentage points (81% to 84%).

Endorsement of Racial and Gender Stereotypes

- The endorsement of negative racial and gender stereotypes about ability in STEM fields decreased, but not significantly, from pre-SMASH to post-SMASH (1.40 to 1.33, and 1.64 to 1.55, respectively).
- The percentage of students who held the belief that African Americans/Latinos are “less capable” in STEM fields decreased 5 percentage points, from 20% to 15%.
- The percentage of students who believed that “men are smarter than women” decreased from 13% to 8% over the duration of the program.

“It inspired me to see people of color doing extremely well in their lives.”

-1st year SMASH: Stanford student

Goal #5: Develop and reinforce students’ STEM interests, attitudes, and aspirations.

Attitudes towards Math and Science

- SMASH students generally held highly positive attitudes towards math and science prior to the start of the program.
- Students demonstrated a slight, non-significant increase in positive attitudes towards mathematics from pre-SMASH to post-SMASH (Mean=4.07 to 4.11).
- In science, significant gains were seen in students’ positive attitudes towards science from pre-SMASH (Mean=4.27) to post-SMASH (Mean=4.36).
- In math, the percentage of students who described math and science as “fun” versus boring increased by 7 percentage points and 4 percentage points, respectively.
- Post-SMASH, 92% of students indicated that they “liked” science (a decrease of 1 percentage point), and 83% indicated that they “liked” math (an increase of 4 percentage points), leaving only 8% of students neutral or disliking science, and 17% neutral or disliking math.

Attitudes towards Computer Science

“AMAZING course. I have never been so charmed by a new subject before. I would (eventually) love to take the AP computer science test.”

-2nd year SMASH: UCLA student

- Over the course of the SMASH program, students demonstrated a large and significant increase in their attitudes towards computer science (Mean=3.53 to Mean=3.91).
- The percentage of students who indicated that they “liked” computer science increased from 52% to 75%, and the percentage of students who indicated that they thought computer science was “fun” versus boring increased from 50%

to 71%.

Identification with Math and Science

- Students were very highly identified with both math and science prior to SMASH and over 95% believed math was important and useful before starting the program. Students demonstrated a slight increase in identification with math (Mean=4.62 to 4.68) and were significantly more identified with the field of science after the completion of the SMASH program (Mean=4.46 to 4.58).
- Students increased by 6 percentage points in the belief that success in science is “an important part of who I am.”
- Over 90% of all students believed math and science were important to them, they cared about doing well in the subjects, and felt it was important to have a strong math and science background.

Identification with Computer Science

- Students started the SMASH program far less identified with computer science than they were with math and science (Mean=3.40). Identification with computer science increased significantly from pre- to post-SMASH (Mean=3.74).
- The percentage of students who indicated that they see the field of computer science relevant to their everyday lives increased from 43% to 67%, and there was a 19 percentage point increase in students who indicated the belief that computer science can be an effective tool to solve community issues (42% to 63%).
- Among first year students (most of whom had never taken a computer science course), the relevance of computer science to their everyday lives increased even more dramatically, from 31% to 61%.

Interest in Pursuing Advanced STEM Coursework

- 77% of students entered SMASH intending to take an AP or advanced STEM course in the fall and this number rose slightly, to 79%, after the 5-week program.
- When specifically examining computer science courses, only 36% of students planned to take an additional computer science course beyond SMASH in the fall, and this percentage increased to 50% post-SMASH.

STEM College Aspirations

- SMASH students demonstrated a significant increase from pre-SMASH (Mean=4.30) to post-SMASH (Mean=4.48) in their desire to pursue a STEM degree in college.
- The majority of SMASH students entered the program with the articulated desire to pursue STEM education in college (80%). This percentage increased to 89% at the completion of the program.

STEM Career Aspirations

- The vast majority of students entered SMASH with the desire to pursue careers within STEM fields, yet there was still growth in STEM career aspirations from pre- to post-SMASH. (Mean=4.40 to Mean=4.52).
- At the completion of SMASH, 93% of students imagined themselves working within the fields of science, technology, engineering, or mathematics (compared to 87% pre-SMASH).
- Further, from pre- to post-SMASH, 14 students changed the career they are interesting in pursuing from a non-STEM career to a STEM career.

Computer Science Aspirations

- Students' desire to pursue computer science in college and career increased significantly from pre-SMASH (Mean=2.96) to post-SMASH (Mean=3.11).
- While only 15% of students entered SMASH intending to study computer science in college, this percentage increased to 26% after the program.
- The percentage of students who indicated the desire to pursue a career in computer science increased from 22% to 35% over the course of the SMASH program.

"I am interested in pursuing computer science after hearing the guy whose job was affiliated with Facebook."

-2nd year SMASH: UCLA student

Access to Role Models in STEM

- SMASH students reported a significant increase in access to role models in STEM fields from pre-post (Mean=3.30 to 3.66).
- SMASH students also reported a significant increase in access to STEM role models from diverse racial and gender backgrounds (Mean=3.34 to 3.67).
- The percentage of students who had personal familiarity with individuals with careers in STEM fields increased from 31% to 44%.

"The speakers were all people I believe the scholars could look to as role models. They were all minorities successful in their pursuits in STEM fields. We did grow more interested in pursuing the respective fields."

-3rd year SMASH: Stanford student

- Post-SMASH, 78% of students indicated they had met individuals working within STEM fields who impacted their future college and career goals, an increase from 60% pre-SMASH.
- The percentage of students who met individuals with careers in STEM who 23 percentage points in meeting people with careers in STEM who "look like me" (from 46% to 69%).
- There was also a 14 and 15 percentage point increase (respectively), in the percentage of students reporting exposure to STEM role models of color (57% to 72%) and female STEM role models (46% to 60%).
- When asked to name "one person who is a role model to you," 30 students (15%) listed a SMASH instructor, LPFI staff, or SMASH speaker as a role model on the post-survey.

Goal #6: Monitor and track enrollment, persistence, and graduation in STEM in higher education.

Total SMASH Alumni Demographics

- As of June 2013, SMASH had a total of 228 alumni (students who both completed the SMASH program and graduated from high school).
- 179 students have completed the SMASH: Berkeley program and another 49 students completed the SMASH: Stanford program (Figure 12).

Figure 12.

SMASH Site	# Years of Operation	# of Alumni*
University of CA, Berkeley	9	179
Stanford	2	49
University of CA, Los Angeles	1	n/a
University of Southern California	1	n/a

*SMASH alumni are defined as students who have completed the SMASH program and have graduated high school as of June 2013.

SMASH Alumni Racial, Gender, and Socioeconomic Demographics

- The majority of SMASH alumni are Latino (53%) and African American (25%), with 22% comprising all other groups.
- SMASH alumni are relatively equal in terms of gender, with slightly more females (51%) than males (49%).
- Roughly half of the SMASH alumni are eligible for Free/Reduced Price Lunch (FRPL, 46%), will be first-generation college graduates (52%), and 30% are both FRPL and first generation.

Figure 13.

	# of Alumni	% of Alumni
Race/Ethnicity		
African American/Black	59	26%
Chicano/Latino	116	51%
Southeast Asian	12	5%
Mixed Race/Multiple Response	20	9%
Other (Native American, Pacific Islander)	21	9%
Gender		
Male	116	51%
Female	112	49%
SES*		
Free/Reduced Price Lunch (FRPL)	118	52%
First Generation College	120	53%
Both FRPL & First Generation	76	33%

*The number of FRPL and First Generation students was much lower in earlier years of the SMASH program (2004-2009); these percentages have increased substantially and the alumni percentages will continue to increase as these students matriculate through high school.

Higher Education Enrollment Data

(High school graduation classes of 2007 through 2012; Class of 2013 higher education enrollment data will be available in spring 2014)

- 100% of SMASH students graduated from high school, with 79% taking an AP STEM course during high school (Figure 14).
- 86% of SMASH alumni are currently enrolled in a four-year university, and 7% are currently enrolled in graduate school.
- 67% of SMASH alumni are currently declared STEM majors, with the most common major reported by SMASH alumni being engineering.
- In terms of persistence in STEM, 82% intended to major in STEM while in high school and 78% of those went on to declare a STEM major in Year 1; 88% of those who declared STEM majors in Year 1, persisted through Year 2 with STEM majors.
- The most frequent colleges of attendance among alumni are U.C. Davis, U.C. Berkeley, and Stanford (Figure 16).

Figure 14.

SMASH ALUMNI (HS Graduation Class 2008-2012)		% of Alumni
High School Completion Data	Graduated from HS with Diploma	100%
	Did not graduate from HS	0%
High School A.P. Coursework	Took A.P. course during HS	87%
	Took A.P. STEM course during HS	79%
Intended Type of College/University	Intended to attend a 2-year college while in HS	4%
	Intended to attend a 4-year college while in HS	96%
College Enrollment Status	Enrolled in undergraduate studies	86%
	Enrolled in graduate studies	7%
	Not enrolled in any college (completed Bachelor's degree)	4%
	Not enrolled in any college (did not complete degree)	3%
Type of College/University Currently Attending (Enrolled Undergraduates Only)	4-year college/university	90%
	2-year college	10%
Courseload (Undergraduates Only)	Full-time undergraduate	90%
	Part-time undergraduate	3%
	Not currently enrolled	7%
College Graduation Data	Number of SMASH alumni who have completed a Bachelor's degree	14
	% of college graduates currently attending graduate school	64%
"Top 50" Highest-Ranked University*	% currently enrolled in top 50 highest ranked college/university	43%
Current Declared Major (All Students)	STEM Major	67%
	Non-STEM Major	27%
	Undecided	7%
Current Declared Major (Freshmen Only)**	STEM Major	58%
	Non-STEM Major	26%
	Undecided	16%
Persistence in STEM***	Intended to Major in STEM while in HS	82%
	Intended to Major in STEM in HS and did in Year 1 of college	78%
	Declared STEM major as freshman and persisted beyond Year 1 in STEM (current sophomores or above)	88%
<p>* According to the U.S. News and World Report University Rankings (2012). **By comparison, only 23% of all U.S. college freshman declare STEM majors (including high-income, non-first generation students). ***Persistence rates were calculated by taking the number of alumni who declared STEM majors as freshman and examining their year one, year two, and year three majors. Note: All alumni data is based on the 119 of the 178 alumni who responded to the alumni survey. The above percentages include responses for only those alumni for whom there are available data.</p>		

Figure 15.

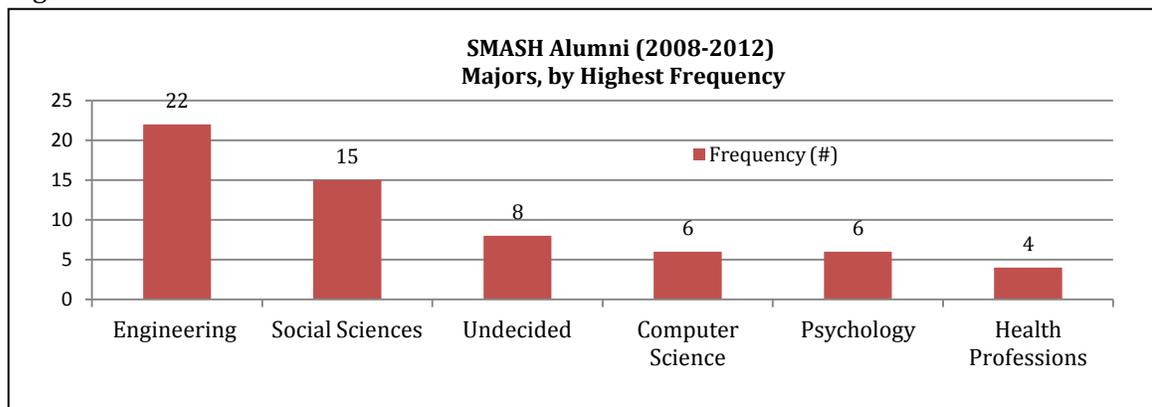


Figure 16.

Name of College/University	# of Students Currently Enrolled
UC Davis	11
UC Berkeley	6
Stanford University	6
UC Santa Cruz	5
San Francisco State University	3
San Jose State University	4
University of San Francisco	4
UC Los Angeles	3
UC Merced	3
UC San Diego	2
UC Santa Barbara	2
UC Irvine	2
Emory University	2
MIT	2
Middlebury College	2
University of Pennsylvania	2
Santa Clara University	2
University of the Pacific	2
Whittier College	2



STUDENT PERCEPTIONS OF SMASH IMPACT

SMASH students were asked to indicate their satisfaction with the SMASH program overall and with their math, science, and computer science courses.

- The vast majority of students were highly satisfied with the SMASH program overall (76%).
- In mathematics, 81% of students were satisfied with their course, with 80% believing the course was meaningful and 70% indicating that the course stimulated further interest in mathematics.
- In science, 85% of students indicated overall satisfaction with the course and 82% indicated the course was relevant, meaningful, and stimulated their interest in science.

- 74% of students were satisfied with their computer science course, 70% indicated that it stimulated further interest in computer science, and 70% indicated that this course went beyond what is offered at their high school.

SMASH alumni were asked to reflect on their experiences in the SMASH program:

- 80% indicated that their participation in SMASH increased their science and technology skills; 77% indicated that participating in SMASH increased their math skills.
- 77% believed that participating in SMASH increased their confidence in their ability to do well in math and science classes in college.
- 68% indicated that SMASH increased their interest in studying STEM in college.
- The majority of students indicated that SMASH gave them a more positive view about the STEM abilities of underrepresented racial groups (81%) and women (78%).



"In my classes I improved my public speaking confidence and skills. In biology I conducted many experiments, whereas in school I don't conduct any. In Algebra 2 I learned different about function and also conducted many experiments. Overall every class improved my skills and knowledge."

-1st year SMASH: Berkeley student

"SMASH has been the best experience of my life. It has given me so many opportunities and really has opened doors to me that not every student has. I am honored to be part of SMASH."

-1st year SMASH: USC scholar

Appendix 1. Scale Mean Differences (Pre-Post): Paired-Samples T-Test Results by Scale

Scale	Mean (Pre)	Mean (Post)	Mean Diff (Pre-Post)	Sig. (2-tailed)
Goal #1				
Computer Science Knowledge	1.87	2.86	.99	.00**
Technology Skills	3.83	4.14	.31	.00**
Goal #2				
Access to STEM Mentors	4.09	4.11	.02	.76
Network of STEM Peers	3.94	4.28	.34	.00**
Self-Efficacy in Math	4.13	4.15	.02	.36
Self-Efficacy in Science	4.07	4.15	.07	.00**
Goal #3				
College Application Preparation	3.58	3.70	.11	.01*
Familiarity with Financial Aid	3.25	3.79	.53	.00**
Goal #4				
Leadership Skills	3.73	3.96	.23	.00**
Critical Thinking Skills	3.40	3.58	.18	.00**
Social Justice Orientation	4.10	4.31	.20	.00**
Endorsement of Stereotypes-Gender (R)	1.40	1.33	-.06	.09
Endorsement of Stereotypes-Race (R)	1.64	1.55	-.09	.08
Goal #5				
Attitudes towards Science	4.27	4.36	.09	.01*
Attitudes towards Math	4.07	4.11	.03	.41
Identification with Math	4.62	4.68	.05	.06
Identification with Science	4.46	4.58	.12	.00**
Attitudes towards Computer Science	3.53	3.91	.38	.00**
Identification with Computer Science	3.40	3.74	.34	.00**
STEM College Aspirations	4.30	4.48	.17	.00**
STEM Career Aspirations	4.40	4.52	.12	.00**
Computer Science Aspirations	2.96	3.11	.14	.01*
Access to STEM Role Models	3.30	3.66	.36	.00**
Access to Diverse STEM Role Models	3.34	3.67	.33	.00**

Note: *p<.10, **p<.05, indicative of significant increases from pre- to post-SMASH; All scale items were measured using a 5-point Likert scale, with the mean range for scales ranging between 1-5; The endorsement of stereotypes scales were reverse-coded, so a decrease from pre-post is indicative of less endorsement of stereotypes; Goal #6 was not included because it contains no pre-post scales.

Appendix 2. Pre- and Post-SMASH Item Frequencies

ITEMS	SCALE (Reliabilities= α)	PRE-SMASH (%Strongly/Somewhat Agree)	POST-SMASH (%Strongly/Somewhat Agree)	PRE-POST DIFFERENCE
RateWordSpreadsheetSkillsAs	Technology Skills (α =.86)	60%	77%	17%
RateInternetResearchSkillsAs		81%	87%	6%
OverallTechnologySkills		56%	71%	15%
KnowledgeOfBroadcastBlocksScratch	Familiarity with CS Programming Languages (α =.76)	23%	75%	52%
KnowledgeOfUsingVariablesScratch		24%	81%	57%
KnowledgeProgrammingjavaCPython		7%	24%	17%
KnowledgeOfCreatingWebpage		13%	33%	20%
KnowledgeUsingCSS		5%	26%	21%
KnowledgeUsingJavaScript	Application of CS Problem Solving Techniques to Computer Software & Hardware Design (α =.79)	8%	25%	17%
HowFamiliarWithCSAlgorithms		20%	58%	38%
HowRateAbilityCreateStoryScratch		31%	81%	50%
HowRateUnderstandingHTMLCSS		12%	34%	22%
HowRateKnowledgeProblemSolving		61%	78%	17%
HowRateSkillsIndividualTagsHTML		13%	33%	20%

HowRateStructureSyntaxCSS		6%	26%	20%
HowFamiliarPartsComputer		58%	67%	9%
MetPeopleSTEMeImpactCareerChoice		60%	78%	18%
KnowPeopleCareersSTEM	Access to Role Models in STEM ($\alpha=.66$)	31%	44%	13%
RoleModelsInSTEMPeopleOfColor	Access to Diverse Role Models in STEM ($\alpha=.81$)	57%	72%	15%
RoleModelsSTEMFemale		46%	60%	14%
HaveMentorTalkCollegeCareerGoals	Access to Mentors in STEM ($\alpha=.84$)	75%	77%	2%
HowSupportiveIsMentor		80%	80%	0%
KnowLotOfStudentsLikeMeSTEM		70%	85%	15%
FeelPartOfCommunityStudentsSTEM	Network of STEM Peers ($\alpha=.84$)	76%	88%	12%
HavePeersSupportSTEMGoals		72%	83%	11%
HowMuchKnowCareersSTEM		73%	90%	17%
PostHSExpectations (4-year college)		93%	95%	2%
HighestEdExpected(Master's +)	College Aspirations (n/a)	94%	94%	0%
HowImportantCollegeEducation		99%	99%	0%
PlanToMajorSTEM	STEM College Aspirations ($\alpha=.96$)	80%	89%	9%
PlanToCompleteSTEMDegree		83%	91%	8%
PlanTakeAPMathSciInFall		74%	77%	3%
UnderstandWhatCSIs		48%	85%	37%
PlanToMajorCS		15%	26%	11%
PlanToPursueCSCareer	Computer Science Aspirations ($\alpha=.81$)	22%	35%	13%
LikelyTakeMoreCSClasses		37%	41%	4%
PlanToPursueSTEMCareer	STEM Career Aspirations ($\alpha=.90$)	86%	89%	3%
ImagineMyselfWorkingSTEMinFuture		87%	93%	6%
PeopleCareersSTEMLookLikeMe		46%	69%	23%
MathFunBoring	Attitudes towards Math ($\alpha=.89$)	69%	76%	7%
LikeDislikeMath		84%	83%	-1%
HowImportantMath		94%	97%	3%
CareDoingWellMath	Identification with Math ($\alpha=.79$)	96%	97%	1%
HowImportantStrongMathBackground		96%	95%	-1%
SuccessfulMathImportant		88%	88%	0%
MathOneBestSubjects		75%	74%	-1%
ThinkMathSkillsAre	Self-Concept/Self-Efficacy in Math ($\alpha=.84$)	78%	78%	0%
IfTookMathTestNowHowExpectToDo		72%	70%	-2%
HowWellDoMathNextYear		88%	89%	1%
ComparedOtherStudentExpectDoMath		78%	84%	6%
CapableDoingWellMath		97%	95%	-2%
LikeDislikeCS	Attitudes towards Computer Science ($\alpha=.88$)	52%	75%	23%
CSFunBoring		50%	71%	21%
SeeExamplesCSEverydayLife	Identification with Computer Science ($\alpha=.68$)	43%	67%	24%
CSCanSolveCommunityProblems		42%	63%	21%
LikeDislikeScience	Attitudes towards Science ($\alpha=.84$)	88%	92%	4%
SciFunBoring		85%	88%	3%
HowImportantSci		93%	94%	1%
CareDoingWellSci	Identification with Science ($\alpha=.72$)	96%	99%	3%
HowImportantStrongSciBackground		93%	92%	-1%
SuccessSciImportant		79%	85%	6%
ScienceOneOfBestSubjects		72%	79%	7%
ThinkScienceSkillsAre	Self-Concept/Self-Efficacy Science ($\alpha=.92$)	72%	77%	5%
IfTookSciTestNowHowExpectDo		64%	68%	4%
HowWellDoInSciNextYear		84%	88%	4%
CompareOtherStudentsHowExpectDoSci		74%	80%	6%
CapableDoingWellSci		93%	95%	2%
SomeoneLikeMeSuccessfulCS		50%	67%	17%
LikeToLeadPlanningDecMaking		60%	73%	13%
FeelConfidentLeadershipRolesSchool	Leadership Skills ($\alpha=.86$)	66%	70%	4%
PersuasiveAssertiveWithPeers		65%	78%	13%
LeadershipSkillsAre		61%	75%	14%
ConfidentAbilityEvaluateArguments		68%	82%	14%
AbleExamineDiffViewsAndEvidence	Critical Thinking Skills ($\alpha=.76$)	82%	86%	4%
ConfidentAbilityChallengeAssumptions		37%	47%	10%
ChallengingInjusticeImportant	Social Justice Orientation ($\alpha=.62$)	77%	88%	11%
PlanUseSTEMKnowledgeCommunityProblems		81%	84%	3%
DefineMyselfAsScholar	Scholar Identity ($\alpha=.55$)	74%	78%	4%
BeingSuccessfulStudentImportant		98%	97%	-1%
BeingSuccessfulSchoolMoreImpPopular		93%	96%	3%
FeelAwkwardInMathSciClass	Belongingness in STEM ($\alpha=.83$)	76%	67%	9%
FeelIdeasCountMathSciClass		72%	76%	4%
FeelLikeMatterMathSciClass		72%	77%	5%

HowComfortableInteractPeersDiffBackgrnd		85%	88%	3%
RateMyCulturalCompetence		79%	92%	13%
KnowApplyFinancialAid	Familiarity with Financial Aid ($\alpha=.85$)	28%	61%	33%
KnowStudentLoansHowToApply		39%	60%	21%
KnowHowResearchScholarships		63%	78%	15%
ConfidentAbilityObtainFinAid		61%	78%	17%
HowPreparedPerformWellSAT		57%	61%	4%
HowConfidentAbilityWritePersStatmt	College Application Preparation ($\alpha=.73$)	64%	69%	5%
HowPreparedSuccessfullyCompleteCollApp		61%	71%	10%
HowFamiliarAGReqs		84%	96%	12%
AfAmLatinosLessCapableSuccessSTEM	Explicit Racial Stereotypes about Math and Science ($\alpha=.82$)	7%	7%	0%
AsiansWhitesBetterMathSci		9%	8%	-1%
AsiansWhitesSmarter		0%	2%	2%
WomenLessCapableSTEMSuccess	Explicit Gender Stereotypes about Math and Science ($\alpha=.89$)	9%	1%	-8%
MenBetterMathSciAbilities		0%	1%	1%
MenSmarterThanWomen		0%	1%	1%