HSI STEM Grant Program

Attract, Inspire, Mentor and Support Students (AIMS^2)

Quasi-Experimental Design Study

2021

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Prepared for

California State University, Northridge's (CSUN)

College of Engineering and Computer Science

CSUN | COLLEGE OF ENGINEERING AND COMPUTER SCIENCE

Acknowledgements

This material is based on work supported by the United States Department of Education Hispanic-Serving Institutions Program (STEM) Program (84.031C)—Grant Award Number: #P031C160053. Any opinions, findings and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the United States Department of Education.

SUGGESTED CITATION: ATTRACT, INSPIRE, MENTOR AND SUPPORT STUDENTS (AIMS^2). (2021). 2021 AIMS^2 QUASI-EXPERIMENTAL DESIGN STUDY REPORT. NORTHRIDGE, CA: CALIFORNIA STATE UNIVERSITY, NORTHRIDGE.

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Introduction

With recent trends toward increased accountability and evidence-based intervention programs for closing equity gaps in higher education outcomes, attention toward the trajectory of the fastest growing population in the U.S. becomes crucial and inevitable. According to the latest Census Bureau projections, the proportion of Hispanics between the ages of 20 and 24 is expected to grow from 22% in 2015 to 32% in 2060 (National Science Board 2016). However, Cuellar (2014) found that although there is an increase of Latino/a/x representation in higher education, Latino/a/x educational attainment is behind all other racial and ethnic groups. In particular, one field where there has been a historically persistent underrepresentation of Hispanic/Latinx is Science, Technology, Engineering and Mathematics (STEM). Between 2000 and 2015, there was an increase from 7% to 13% for the share of bachelor's degrees awarded to Hispanic/Latinx students (2018 National Science Foundation Report).

AIMS^2

In 2011, CSUN received grant funding from the U.S. Department of Education for the HSI-STEM and Articulation Programs; they awarded CSUN grant funding to develop programs and services to improve outcomes for Hispanic and low-income students in STEM majors. In particular the purpose of the grant was to improve degree attainment for Hispanic and low-income students in STEM majors. In response, CSUN's College of Engineering and Computer Science (CECS) implemented "Attract, Inspire, Mentor and Support Students" (AIMS^2).

AIMS^2 project goals include the following:

- Improve the academic achievement of Hispanic and low-income students in engineering and computer science fields.
- Enhance faculty and peer environments for Hispanic and low-income students in engineering and computer science fields.
- Improve the transfer of Hispanic and low-income students in engineering and computer science fields to baccalaureate-granting institutions.
- Improve career preparation of Hispanic and low-income students in engineering and computer science fields
- Develop research skills of Hispanic and low-income students in engineering and computer science.
- Increase baccalaureate degree compleEon of Hispanic and low-income students in engineering and computer science fields.

Centering project activities on these project goals, all AIMS^2 students received faculty mentoring, the two more recent cohorts also received peer mentoring, and some students in each cohort participated in conducting research either over the summer or during the academic year.

Table 1. Programmatic components by Cohort year and Fall term

	Faculty Mentoring	Research Experience Summer	Research Experience Academic Year	Peer Mentoring 2018, 2019
Cohort 1, 2016 Fall	X	X	X	
Cohort 2, 2017 Fall	X	X	X	
Cohort 3, 2018 Fall	X	X	X	X
Cohort 4, 2019 Fall	X		X	X

The incoming cohorts for the AIMS[2] program varied in size over the years. The first-time freshman cohort in the third year (2018) was the largest with 30 students, and the first-time transfer cohorts increased in size over each additional year in which the program was active, with the largest cohort being in the final year (2019) with 26 students (Figure 1 presents more details).

Figure 1. Aims[2] Cohort sizes by Entry Year

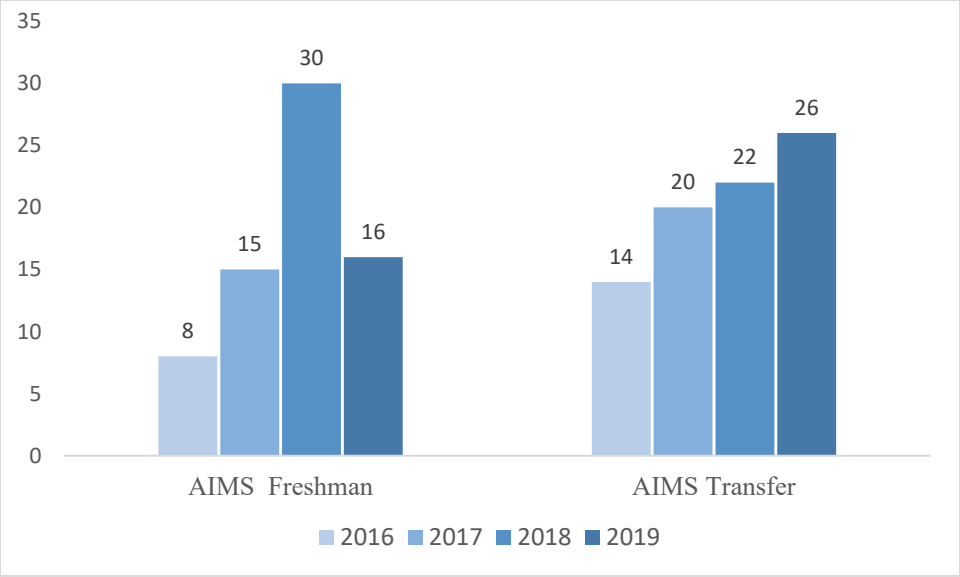


Table 2. Number of students in each Programmatic component by Freshmen vs. Transfers

	Total	Received Faculty Mentoring	Participated in Research[1]	Received Peer Mentoring 2018-19; 2019-20 Cohorts
First-time Freshmen	69	69	25	45
First-time Transfers	82	82	42	44
Total	**151**	**151**	**44**	**89**

1. Includes summer (N=41) or academic year research (N=57)

AIMS^2 Summative Evaluation

The purpose of this summative evaluation is to examine outcomes associated with student persistence/retention, success and completion in a Bachelor's granting public institution. Using a quasi-experimental design (QED) approach, this evaluation examines outcomes between students who participated in AIMS^2 and a matched control group. In light of the pre-established grant goals, the research questions guiding this study examine success outcomes related to higher education attainment for AIMS^2 participants in comparison to a matched control group. Further, how these outcomes differ among females in AIMS^2 in comparison to females in the matched control group is also addressed. Finally, among AIMS^2 participants which components of the grant activities and programs are more effective?

The following hypotheses are tested:

Hypothesis$_1$ AIMS^2 participants will have higher rates of gateway course completion in comparison to matched, control group.

Hypothesis$_2$ AIMS^2 participants will have higher rates for being On-track to degree completion in comparison to matched, control group.

Hypothesis$_3$ AIMS^2 participants will earn higher number of units in comparison to matched, control group.

Hypothesis$_4$ AIMS^2 participants will have higher rates for good academic standing in comparison to matched, control group.

Hypothesis$_5$ AIMS^2 participants will have higher grade point averages (GPA) in comparison to matched, control group.

Hypothesis$_6$ AIMS^2 participants will have higher rates of persistence rates in STEM in comparison to matched, control group.

Hypothesis$_7$ AIMS^2 participants will have higher rates of students completing degrees in comparison to matched, control group

> **Hypothesis$_{1\text{-}7a}$** Female AIMS^2 participants will have higher success with regard to the measured outcomes in comparison to females in the matched control group.

Hypothesis$_8$ Outcome success will vary among AIMS^2 participants with regard to the program component students participate in (e.g. research, peer-mentoring etc.).

Methodology

Institutional and program-level data for students in the institution's College of Engineering and Computer Science (CECS) were obtained from CSUN's Office of Institutional Research. The dataset included all AIMS^2 participants (first-time freshmen and first-time transfers) and a comparison for each AIMS^2 group with students who had programs of study in the CECS, and had similar cohort years of entry. All first-time transfers in the dataset include students from transfer institutions that were part of the projects (Glendale Community College,

College of the Canyons, Pierce College, and Moorpark College). In addition, the comparison groups were limited to those who either identified as Hispanic/Latinx or received a PELL financial aid award since these were criteria for recruiting AIMS^2 participants.

This analysis aligns with the designation of "meets standards, with reservations" for the Institute of Educational Sciences' (IES), *What Works Clearinghouse* (WWC) Standards. Statistical adjustment of propensity score matching was adopted to identify a matched control group since the intervention sample and the comparison groups were different with regard to baseline characteristics. Propensity scoring, a technique, through logistic regression calculates the conditional probability of a case being assigned to the treatment group (i.e. AIMS^2). Furthermore, propensity scores allow for causal inference in quasi-experimental design studies (Rosenbaum & Rubin 1983).

To control for bias in the effects of the treatment, propensity scores were generated without replacement and with a tolerance of 0.1 with priority to exact matching (see Austin, 2011; Thoemmes, 2012). Predicting factors were selected based on their influence on the exposure (self-selection in being an AIMS^{2}participant) and their influence on the outcome (Pirracchio et al. BMC Medical Research Methodology 2012). These factors included first-generation college student status, admissions GPA, gender, full-time load in the first term, as well as the number of units students transferred in with at the start of their cohort year, therefore controlling for AIMS^2 participants' characteristics prior to their program experiences. This technique found 62 comparison matches for 69 AIMS^2 first-time freshman, and 73 comparison matches for 82 AIMS^2 first-time transfers.[1]

Table 3. Group Size Comparisons at Baseline vs. Propensity Score Matching

	Baseline		**Propensity Score Matching**	
	AIMS^2	Comparison	AIMS^2	Comparison
First-time Freshman	69	2,058	69	62
First-time Transfers	82	997	82	73

To verify that the matched control group did not significantly differ with regard to the exogenous factors identified, *t*-tests or Chi-square (χ^2) tests were used. Tables 4 and 5 provide the results indicating the significant differences at baseline, ($p< .05$) and the remaining significant differences ($p<.05$) after propensity score matching.

Baseline comparisons between the AIMS^2 and the matched comparison group showed that traditionally underrepresented groups in STEM are in fact overrepresented among AIMS^2 participants. For first-time freshmen, there were statistically significant differences for Gender, first-generation status and Admissions GPA (Table 1). In comparison to freshman in CECS,

[1] A matched sampling technique (i.e. Case control matching) was also tested to reduce sample selection bias. Matched comparison group cases were identified using 1:1 matching with a match tolerance of 0. However, this technique found 63 comparison matches for 63 AIMS^{2}first-time freshman, and 41 comparison matches for 41 AIMS^{2}first-time transfers. Because propensity score technique yielded a larger sample size, the analyses were conducted on the propensity score matched groups.

females (33% vs. 14%), and first-generation college students (77% vs. 59%) were over represented among AIMS^2 first-time freshman. Additionally, the mean admissions GPA was higher among AIMS^2 participants (*m*=3.5, *sd*=.4) in comparison to the matched control group (*m*=3.3, *sd*=.4). After propensity score matching, the only remaining difference was that females were underrepresented in the matched control group in comparison to the AIMS^2 group (33% AIMS^2 vs. 17% Control).With regard to Transfer students, females (28% vs. 12%), and first-generation college students (62% vs. 47%) were over represented. Admissions transfer GPA were similar for participants and non-participants. Another baseline difference was that a higher percentage of AIMS^2 transfer students were enrolled full-time for their first semester (87% vs. 68%). After propensity score matching, the only remaining difference was that Hispanic/Latinx students were underrepresented in the matched control group in comparison to the AIMS^2 group (74% AIMS^2 vs. 53% Control).

Table 4. Equivalencies between AIMS[2] Participants and comparison group for First-time Freshmen at Baseline, and with Propensity Score Matching

	Baseline (N=2,127)				Propensity Score Matching (N=131)			
	AIMS[2] % / mean(sd) (N= 69)	**Comparison[1]** % / mean(sd) (N=2,058)	***t* /χ^2 Sig.*** (*p*<.05)	**Effect Size[3]**	**AIMS[2]** % of Total/ mean(sd) (N=69)	**Comparison** % of Total/ mean(sd) (N=62)	***t* /χ^2 Sig.*** (*p*<.05)	**Effect Size[3]**
Race/Ethnicity								
African American/Black	3%	4%			3%	2%		
Asian	9%	7%			9%	3%		
Hispanic/Latinx	82%	82%			81%	87%		
White	7%	5%			7%	3%		
Unknown	0%	2%			0%	0%		
Multi-Race	0%	0.8%			0%	0%		
International	0%	0.1%			0%	0%		
Gender			χ^2=20.5*	3.1			χ^2=4.1*	2.3
Female	33%	14%			33%	17%		
Male	67%	87%			67%	83%		
Age[2]	18.3 (.4)	18.4 (.5)			18.3 (.4)	18.5 (.9)		
First-Generation	77%	59%	χ^2=8.6*	2.4	77%	73%		
Low-income (PELL)	83%	65%	χ^2=9.2*	2.6	83%	71%		
Admissions GPA	3.5 (.4)	3.3 (.4)	*t*=3.6*	0.4	3.5 (.4)	3.4 (.5)		
Full-time 1st semester	100%	98%						
Transfer Units	11.9 (16.1)	6.6(18.8)	*t*=2.5*	0.5	11.9 (10.5)	9.5(14.3)		
Cohort 1, 2016 Fall	12%	19%			12%	16%		
Cohort 2, 2017 Fall	22%	27%			22%	18%		
Cohort 3, 2018 Fall	44%	26%			44%	29%		
Cohort 4, 2019 Fall	23%	28%			23%	37%		

1. Baseline cohort matched on Hispanic and/or PELL with a program of study in the college of Engineering and Computer Science.
2. Age calculated as of September 1st of the starting cohort year.
3. Cohen's D and Odd Ratios (Exp(B) are used for Effect Size.

Table 5. Equivalencies between AIMS[2] Participants and matched comparison group for First-time Transfers at Baseline, and with Propensity Score Matching

	Baseline (1,079				Propensity Score Matching (N=155)			
	AIMS[2] % / mean(sd) (N=82)	**Comparison[1]** % / mean(sd) (N=997)	***t* /χ^2 Sig.* (*p*<.05)**	**Effect Size[3]**	**AIMS[2]** % of Total/ mean(sd) (N=82)	**Comparison** % of Total/ mean(sd) (N=73)	***t* /χ^2 Sig.* (*p*<.05)**	**Effect Size[3]**
Race/Ethnicity			χ^2=14.0*	2.6			χ^2=7.4*	1.2
African American/Black	4%	2%			4%	1%		
Asian	10%	13%			10%	7%		
Hispanic/Latinx	74%	53%			74%	53%		
White	9%	25%			9%	33%		
Multi-Race	2%	2%			2%	0%		
Unknown	1%	5%			1%	6%		
International	0	0.1%			0%	0%		
Gender			χ^2=16.3*	2.8				
Female	28%	12%			28%	25%		
Male	72%	88%			72%	75%		
Age[2]	25.0 (4.6)	25.5 (5.3)			25.0 (4.6)	25.6 (4.8)		
First-Generation	62%	47%	χ^2=5.9*	1.8	62%	53%		
Low-income (PELL)	77%	75%			77%	78%		
Admissions GPA	3.02 (.4)	2.98 (.4)			3.0 (.4)	3.0 (.4)		
Full-time enrolled 1st semester	87%	68%	χ^2=12.9*	3.1	87%	78%		
Transfer Units	74.1 (16.1)	74.0 (18.8)			74.0 (19)	75.0 (16)		
Cohort 1, 2016 Fall	17%	20%			17%	18%		
Cohort 2, 2017 Fall	24%	29%			24%	29%		
Cohort 3, 2018 Fall	27%	26%			27%	25%		
Cohort 4, 2019 Fall	32%	25%			38%	29%		

1. Baseline cohort matched on Hispanic and/or PELL with a program of study in the college of Engineering and Computer Science.
2. Age calculated as of September 1st of the starting cohort year.
3. Cohen's D and Odd Ratios are used for Effect Size.

Dependent Variables

Persistence in STEM was measured as a dependent variable at two time-points. First, 2nd term persistence included tracking whether students were actively enrolled in a STEM major in the subsequent soring spring term after the entry fall term, and overall STEM persistence followed students' active enrollment in STEM majors as of Spring 2020 when the institutional data were extracted. This measure aligns with grant objectives 3b/3.2 (First-year student retention in STEM field major) and 6a/6.1 (Transfer-student retention in a STEM field major).

Another dependent variable, "Completed a minimum of 24 units per year," yielded the outcome for percent of students being 'on-track' for each group. As an additional measure, comparisons for the mean number of units earned in the first and second year, were also examined. Among Transfers, most have higher than 24 units in the first year because they transferred in with units, therefore the outcome is more so a measure of 2nd year unit completion among Transfers. These measures align with grant objectives 6b/6.2 (transfer students on track for 3-year degree completion in a STEM field), and 6b/6.2 (first-year students on track for 4-year degree completion in a STEM field).

The outcome, "Gateway course completion," was indicated with a grade notation of A, B, C, or credit in low-success courses in STEM. Courses were identified as part of the grant objective by project stake-holders based on historical trends in success rates[2].

As an outcome variable, Good academic standing was indicated as both a cumulative total Grade Point Average (GPA) and a CSUN GPA of 2.0 or higher, at the conclusion of any matriculated term. This measure aligns with grant objectives 1b/1.2 (Good academic standing). As an additional measure for examining differences in GPA, comparisons for 1st term and 2nd term mean cumulative GPAs are presented.

With regard to degree completion as an outcome, student records were tracked to identify those who completed a degree within the 3-year timeframe. The measures included whether a student completed a degree in the College of Engineering and Computer Science, and the number of years it took them. For the analyses, cases were limited to the first two entry cohorts (2016, and 2017) so that students would have 3 years available in which to complete a degree. Degree completion at CSUN in any term after transfer term in 3-years aligns with grant objectives 6c/6.3.

Furthermore, to assess the impact of which program elements yielded more successful outcomes, program participation data were obtained from the AIMS[2] project coordinator. Comparisons of success outcomes between students who participated in peer and faculty mentoring alone, and those who participated in both mentoring and research, were deemed the

[2] For first-time Freshmen courses included: CE 240; ECE 240; COMP 110; CIT 160: ME 209; MSE 227; MATH 150 A/L. Among Transfer students these gateway courses included: AM 316, CE 340, ME 370, MSE 304, ECE 340/L, ECE 350, ECE 320/L, MSE 304, MSE 304, MSE 362, MSE 402, CE 340, COMP 333, COMP 322/L, COMP 380/L, CIT 270/L, CIT 360

most useful for assessing this impact. For this hypothesis, cases were limited to AIM^2 participants in the 2018 and 2019 cohorts (the only cohorts to whom faculty mentoring, peer mentoring and research were available). The distribution of participants showed that 62 students in the two cohorts participated in faculty and peer mentoring, and 27 students participated in Research in addition to peer and faculty mentoring. The Research experience was offered either in the Summer and/or during the Academic Year, and these were combined for the analyses.

Demographics and Background

Variables related to demographics were obtained from CSUN's office of Institutional research. These included cohort entry year, Admissions GPA (High School for freshman and Transfer GPA for transfers), transfer units, first-generation status based on reported parent/guardian education level, full-time enrollment in the first-term, low-income status, gender, age and race/ethnicity.

Analysis

Tests of hypotheses involved different techniques for each type of outcome (categorical vs. numerical). The Chi-square test of proportion was used for categorical data where percentages were observed and independent sample t-tests were used where numerical data with means and standard deviations were observed. Significance was established with *p- value* <.05. Effect sizes were calculated with Cohen's d for numerical outcomes, and Odds Ratios from logistic regressions were used for categorical outcomes. For Cohen's d, effect sizes are defined as "small">0.2, "moderate">0.5, and "large">0.8; for odds ratios, effect sizes are defined as "small">1.5, "moderate">3.5, and "large">9.0 (MRC, 2016). Due to small group sizes for females, significance tests were not used for hypotheses related to the differences in outcomes among female AIMS^2 participants and females in the matched control group, and for differences within AIMS^2 participants who participated in faculty and peer mentoring only, and those who also participated in Research.

Results

For first-time freshmen, the success outcomes were higher overall for AIMS^2 students in comparison to the matched control. On average there was an improvement of 24 percentage points between the groups for categorical outcomes, and 6 points for numerical outcomes for AIMS2 participants. The largest differences between the groups were in retention in STEM and successful gateway course completion, with a percentage point gap of 32 and 35. The overall differences were statistically significant for all outcomes measured. With regard to females, the pattern remained consistent for AIMS^2 female participants; they had higher success outcomes albeit with smaller group sizes, 23 AIMS^2 females, and 11 females in the matched comparison. Table 6 provides details on the results of the statistical tests and effect sizes for all dependent variables among freshmen.

For Transfer students, the trend was similar with AIMS^2 students having higher rates and means with regard to the success outcomes. On average the AIMS^2 participants were 11 percentage points higher for categorical outcomes, and 6 points higher for numerical outcomes. The largest differences between the groups were in on track to degree completion (24 units per year) and successful gateway course completion, with a percentage point gap of 19 and 15. Since

Transfer students enter having earned units which are factored into their overall units earned in the first year, the difference largely stemmed from the number of students meeting the criteria in the second year. With regard to gender, with group sizes of 23 females in AIMS^2 and 18 females in matched control, the success metrics were higher in the female AIMS^2 group. Degree completion rate was higher among female AIMS^2 participants with 77% earning a degree in College of Engineering and Computer Science within 3 years of entry in contrast to 56% among the matched control group. This difference did not meet the threshold for statistical significance but was approaching it (p=.07) due to the limited sample size. Table 7 provides details on the results of the statistical tests and effect sizes for all dependent variables among Transfer students.

Table 6. Success Outcomes for AIMS^2 participants in comparison to Matched Control group for First-time Freshmen

	AIMS^2 % (n)/ mean(sd) (N=69)	**Matched Control % (n)/ mean(sd) (N=62)**	***t* /χ^2**	**Effect Size[1]**	**Sig. *(p<.05)***	**Female AIMS^2 % (n)/ mean(sd) (N=23)**	**Female Matched Control % (n)/ mean(sd) (N=11)**
Successful Gateway Course Completion	73.9% (51)	41.9% (26)	13.8	3.92	*	78.0% (18)	45.5% (5)
Retention in STEM (2nd term, fall to spring)	100.0% (69)	82.0% (51)	13.4	-	*	100.0% (23)	91.0% (10)
Retention in STEM	73.9% (51)	38.7% (24)	16.5	4.49	*	73.9% (17)	54.5%(6)
On-Track	67.0% (46)	45.0% (28)	6.1	2.43	*	73.9% (17)	27.3% (3)
Good Academic Standing (Not on Probation)	94.4% (65)	79.0% (49)	6.7	4.31	*	100.0% (23)	90.9% (10)
Number of Units Earned 1st year	39.0 (10.9)	31.3(16.8)	3.3	0.55	*	37.7 (6.5)	28.8(7.9)
Number of Units Earned 2nd year	59.8 (23.5)	43.9 (30.3)	3.4	0.59	*	58.80 (20.5)	41.4 (22.5)
Cumulative GPA 1st term	3.1 (0.6)	2.7 (0.9)	3.3	0.58	*	3.21 (0.5)	2.80 (0.5)
Cumulative GPA 2nd term	2.9 (0.8)	2.4 (1.1)	2.5	0.45	*	2.87 (0.8)	2.45 (1.1)

1. Effect size using Cohen's d for continuous outcomes and Exp. (b) Odds Ratios for categorical outcomes.

Table 7. Success Outcomes for AIMS² participants in comparison to Matched Control group for Transfer Students

	AIMS² % (n) /mean(sd) (N=82)	**Matched Control % (n) / mean(sd) (N=73)**	***t* /χ^2**	**Effect Size[1]**	**Sig. *(p<.05)***	**Female AIMS² % (n)/ mean(sd) (N=23)**	**Female Matched Control % (n)/ mean(sd) (N=18)**
Successful Gateway Course Completion	85.4% (70)	69.9% (51)	5.4	2.52	*	82.6% (19)	77.8% (14)
Retention in STEM (2nd term, fall to spring)	100.0% (82)	93.0% (68)	5.8	-	*	100.0% (23)	94.0% (17)
Retention in STEM (overall)	65.9% (54)	60.3% (44)	0.5			52.2% (12)	44.4% (8)
On-Track	72.0% (59)	53.4% (39)	5.7	2.24	*	73.9% (17)	55.6% (10)
Good Academic Standing (Not on Probation)	93.9% (77)	86.3% (63)	2.6			95.7% (22)	83.3% (15)
Number of Units Earned 1st year	102.4 (18.3)	92.1(23.1)	2.7	0.43	*	100.6 (21.8)	94.6 (34.5)
Number of Units Earned 2nd year	117.2 (40.0)	104.8 (51.8)	1.7			113.3 (39.4)	107.8 (58.9)
Cumulative GPA 1st term	3.0 (0.5)	2.99 (0.4)	0.1			2.99 (0.4)	2.95 (0.4)
Cumulative GPA 2nd term	2.95 (0.7)	2.68 (0.9)	2.1	0.01	*	2.90 (0.7)	2.68 (0.9)
	AIMS² % (n) /mean(sd) (N=34)	**Comparison % (n) / mean(sd) (N=34)**	**χ^2 Sig. p<.05**	**Effect Size[1]**	**Sig. *(p<.05)***	**AIMS² % (n) / mean(sd) (N=7)**	**Comparison % (n) / mean(sd) (N=10)**
Degree Completion (within 3 years)	76.5% (26)	55.9% (19)	3.2			57.0% (4)	40.0% (4)

1. Effect size using Cohen's d for continuous outcomes and Exp. (b) Odds Ratios for categorical outcomes, not reported where p>.05

Program Participation

Students who participated in research along with peer and faculty mentoring, showed higher rates of success with regard to the outcome measures. Comparisons for cumulative GPA and Units earned indicated that the average cumulative GPA's and average number of units earned were higher among students who participated in both Research and mentoring. Research participants had statistically significantly better outcomes for successful gateway course completion among freshmen, and on-track to degree completion for both freshmen and transfers. This finding is consistent with prior studies highlighting the positive impact of undergraduate research experience with regard to sense of belonging, and increased confidence in understanding in STEM (Lopatto, 2010).

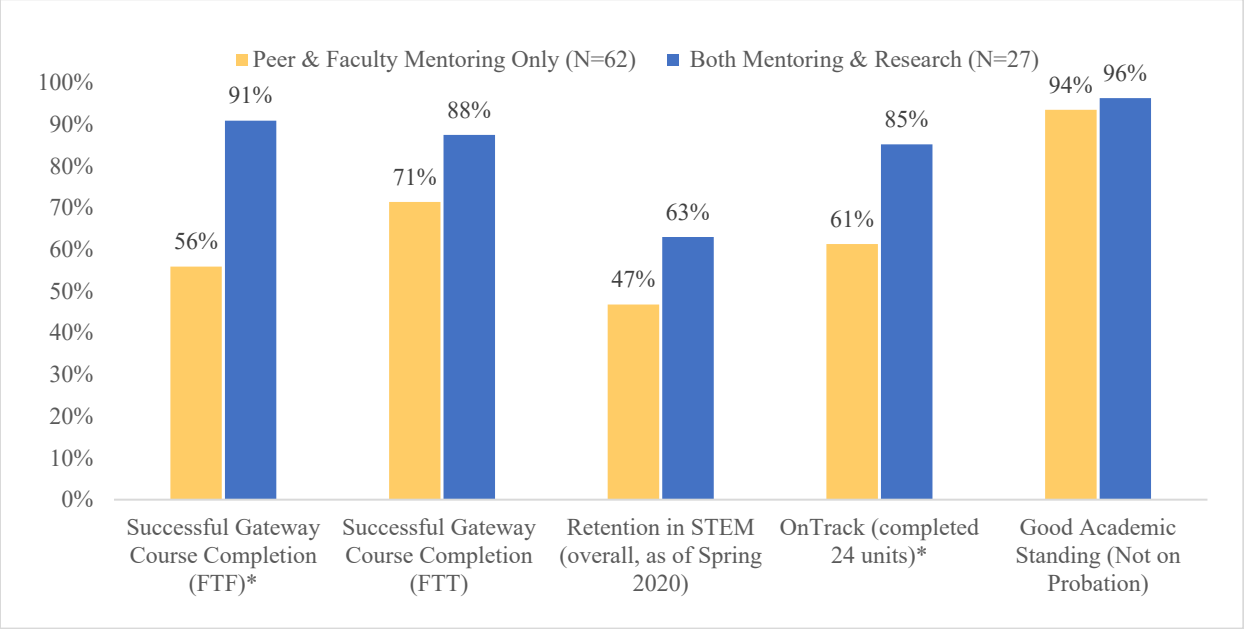
Table 8. Success outcomes by Program Participation (Mentoring only vs. Mentoring & Research) [1]

	Peer & Faculty Mentoring Only (N=62)	**Both Mentoring & Research** (N=27)	***t*** **/χ^2 Sig.** p<.05
Successful Gateway Course Completion (FTF) [2]	56% (19)	91% (10)	χ^2 =4.5*
Successful Gateway Course Completion (FTT) [2]	71% (20)	88%(14)	
Retention in STEM (overall, as of Spring 2020)[3]	47% (29)	63%(17)	
On-Track (completed 24 units)	61%(38)	85% (23)	χ^2 =5.0*
Good Academic Standing (Not on Probation)	94% (58)	96% (26)	
Number of Units Earned 1st year	68.3 (37.8)	76.0 (33.4)	
Number of Units Earned 2nd year	93.7(36.8)	104.3 (32.4)	
Cumulative GPA 1st term	2.96 (.6)	3.10 (.5)	
Cumulative GPA 2nd term	2.85 (.7)	3.01 (.5)	

1. Total number of cases are limited to cohorts 2018 and 2019.
2. For Freshmen, N=45, 32 received mentoring only, and 11 received both; Transfers N=45, 28 received mentoring and 14 received both.
3. Retention in STEM (2nd term, fall to spring) was not included because 100% of AIMS^2 participants were retained.

To account for self-selection bias, baseline differences were assessed and the two groups were not found to be statistically significantly different with regard to exogenous, demographics and background characteristics (gender, race/ethnicity, first-generation status, admissions GPA, age at entry, transfer units and full time 1st term enrollment). Details are provided in Table 9 in Appendix B.

Figure 2. Success Outcomes by Program Participation (Peer & Faculty Mentoring Alone vs. Both Mentoring & Research)



*denotes statistical significance (p<.05)

Figure 3. Cumulative GPA comparisons by Program Participation

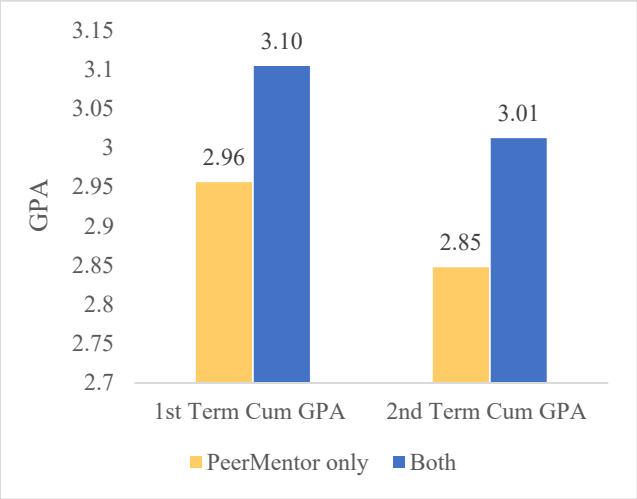
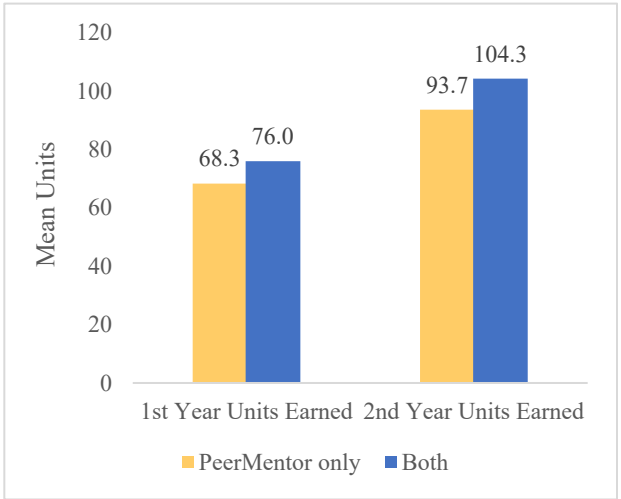


Figure 4. Units earned by Program Participation



Summary

AIMS^2, a grant-funded program to improve outcomes for Hispanic and low-income students in STEM, has been highly effective in increased academic success outcomes among its participants. AIMS^2 students have outperformed a matched control group on all outcome measures among both freshmen and transfers. In particular, there were statistically significant differences for all nine outcomes for Freshmen, and for five out of ten outcomes among Transfers. Moreover, among AIMS^2 participants, the research component of the program, holding other variables constant, trended towards higher success in outcomes in comparison to AIMS^2 participants who received faculty and peer mentoring only.

Further areas of focus with regard to the evaluation of the program may include additional time to track degree completion outcomes for all entry cohorts and assessment of

endogenous factors that may be influencing the outcomes (i.e. campus engagement, supplemental support programs participation etc.). Additionally, a tracking system to assess whether short-term outcome measures are sustained over longer durations beyond degree completion would provide further valuable insight on impact of the program. With findings from this quasi-experimental design study as evidence, the program would make a larger impact if it were expanded and scaled to provide the opportunity for more students to participate in AIMS^2.

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Appendix A: Data Elements and Definitions

Data Type	Institutional Data Variables	Data Element/ Grant Objective
Cohort	Start Term	Start Term (Fall 2016, Fall 2017, Fall 18, Fall 19)
Cohort	Entry Type	First-time or First-time Transfer Flag
Demographic	First Term Unit Load	Full-time/part-time in first term, units enrolled
Demographic	PELL Recipient	PELL Recipient Y/N
Demographic	Ethnicity: Hispanic	Ethnicity: Hispanic, Y/N?
Demographic	Age at entry / Birthdate	Age at entry / Birthdate (calculated as of Sept 1 of cohort year)
Demographic	Gender	Gender
Demographic	First-generation	First-generation based on reported education level for Parent
Demographic	Admissions GPA	Baseline GPA (High school for FT and Source school for FTT)
Demographic	Academic Level upon entry	Academic Level upon entry (Freshman, Sophomore, Junior, Senior)
Demographic	Transfer units	Units completed upon entry, FTF had entry units because of AP and college credits earned in High school.
Outcome	Persistence in STEM (2nd Term)	First-year persistence in STEM field major: Persistence =retained in CECS (CSM included with did not retain) Next-term persistence = enrollment in subsequent spring term in a declared major in majors in CECS;
Outcome	Persistence in STEM (Overall)	Persistence in a STEM field major as of Spring 2019=retained in CECS (CSM included with did not retain)
Outcome:	Cumulative units earned first year (@1stYearUnitsEarned)	First-year students on-track toward degree completion at the end of 1st and 2nd year (6b/6.2)
Outcome:	Cumulative units earned second year (@2ndYearUnitsEarned)	Transfer students on-track toward degree completion at the end of 1st and 2nd year (6b/6.2)
Outcome:	Degree completion date/term/year (either one of the date markers) Degree Program Name Degree School/Division Name (e.g. CECS)	Transfer-student degree completion (6c/6.3): Degree completion at CSUN in any term after transfer term within 3-years as follows: Fall 16 entry (3-year degree completion for FTTs): 2016-17, 2017-18, 2018-19 Fall 17 entry (3-year degree completion for FTTs): 2017-18, 2018-19, 2019-20 Degree completion data, Degree Program, Is degree in the CECs?
Outcome	Time to Degree in years	Time to Degree in years
Outcome:	Course Grade/Success (FTF)	Successful gateway course completion (1a/1.1): Valid grade notation of A, B, C, or credit in high-enrolled, any one of low-success courses in STEM fields: FTFs: CE 240; ECE 240; COMP 110; CIT 160: ME 209; MSE 227; MATH 150 A/L.
Outcome:	Course Grade/Success (FTT)	Successful gateway course completion (1a/1.1): Valid grade notation of A, B, C, or credit in high-enrolled, any one of low-success courses in STEM fields: FTTs: AM 316, CE 340, ME 370, MSE 304, ECE 340/L, ECE 350, ECE 320/L, MSE 304, MSE 304, MSE 362, MSE 402, CE 340, COMP 333, COMP 322/L, COMP 380/L, CIT 270/L, CIT 360
Outcome:	Cum GPA First fall term (@1stTermCumGPA)	Cumulative GPA as of end of first fall term
Outcome:	Cum GPA Second term (@2ndTermCumGPA)	Cumulative GPA as of end of Spring term subsequent to First fall term
Outcome	Good academic standing (1b/1.2):	Both a cumulative total GPA and cumulative CSUN GPA of 2.0 or higher at the conclusion of first year (fall and spring terms). Not on Academic Probation.

Appendix B: Baseline Differences by Program Participation (AIMS^2)

Table 9. Baseline Characteristics by Program Participation (Mentoring only vs. Mentoring & Research)

	Peer & Faculty Mentoring Only % (n)/ mean(sd) (N=62)	**Both Mentoring & Research** % (n)/ mean(sd) (N=27)	***t*** **/χ^2**
Admissions GPA	3.26 (.46)	3.20(.46)	*t* =.06
First Generation	64% (38)	67% (16)	χ^2 =.038
Female	37% (23)	26% (7)	χ^2 =1.05
Age at Entry	21.6 (4.7)	21.6 (3.4)	*t*= 0.02
Full-time 1st semester	95% (59)	96% (26)	χ^2 =.05
Hispanic/Latinx	82% (51)	82% (22)	χ^2 =.008
PELL	81% (50)	82% (22)	χ^2 =.01
Transfer Units	38.6 (35.1)	49.3(34.7)	*t* =1.33

*Differences are not statistically significant for all variables (p>.05)