COSUMNES RIVER COLLEGE

OFFICE OF RESEARCH & EQUITY

Evaluation of the Impact of Math Bootcamp on Course Success

Research and Equity

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Executive Summary

Background

The Math Boot Camp (MATH 83) at Cosumnes River College (CRC) is intended to help students brush up on their skills and prepare for mathematics courses. This specialized course uses adaptive learning software (ALEKS PPL) to identify areas for growth in math skills and provide lessons/evaluations in those areas. All sections are assigned tutors and a faculty member. These individuals assist students by supplementing the explanations in ALEKS PPL and by offering mini-lectures on difficult subjects (e.g., factoring).

Previous evaluations of the Math Boot Camp have focused on students who were re-attempting math courses after a substandard grade. This evaluation attempted to expand analysis to the full cohort of summer Boot Camp students. To date, the aforementioned version of the Math Boot Camp has been offered for three summers – serving 204 distinct students. This evaluation sought to discern the impact of the Boot Camp on success (defined as earning an A, B, C, or P in a math course) in the fall immediately following the course. Boot Camp Students – after their *first* enrollment in MATH 83 - were compared to non-boot camp (comparison) students in math courses. Additionally, analyses were conducted for each term and for Hispanic/Latino(a) and Black/African American students, specifically. The latter two comparisons were motivated by a trend observed in the previous evaluation[1] showing possible differential effects for these groups.

Summary of Findings

1. Matched analyses revealed that the average treatment effect for Boot Camp students was a 7.14% increase in course success rate. However, this treatment effect was not statistically significant (although it was extremely close; $p = 0.0574$). There is a 95% chance that the average treatment effect falls somewhere between -0.2% and 14.5%.
2. Fall 2024 was the only term for which the average treatment effect attained significance. Compared to matched controls, students in this term had an increase in course success of 16.0%. On the other hand, in Fall 2025, the estimated effect of Boot Camp was close to 0% - perhaps leading to the lack of significance observed in the finding above.
3. Overall, non-Hispanic/Latino(a) Boot Camp students had a statistically significant treatment effect compared to matched controls. The average treatment effect was estimated to be an increase in course success of 9.4%.

Success rates – the percentage of A, B, C, or P grades out of the total number of enrollments – for Boot Camp and Comparison students can be found in *Table 2* (page 5). Note that due to the nature of the statistical analysis (propensity score matching), the success rates will not exactly match the estimated effects described in the findings above.

Conclusions and Recommendations

In contrast to the prior evaluation, the findings reported here suggest that there was not an overall significant impact of Math Boot Camp on course success. Specifically, it appears as if the impact was minimal for the Summer 2025 Boot Camp students – which drove the estimated effect for Boot Camp

[1] Meinz, P. (2025). *Evaluation of the Impact of Math Bootcamp on Course Success*

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down. Program coordinators should reflect on changes in practice (e.g. implementation of the bootcamp) and context (e.g. changes in the math department offerings, etc.) that may have resulted in changes to program impact. It is also possible that Summer 2025 was an outlier, and we may see a return to the previous trend next year.

Furthermore, there was a significant effect of Boot Camp for non-Hispanic/Latino(a) students. This has potential to lead to equity gaps for Hispanic/Latino(a) students, and should therefore be monitored in future evaluations.

Caveats and Limitations

The present investigation attempted to control for demographic and academic factors via statistical matching. However, it is possible that other factors may account for the differences observed for Math Boot Camp students (or lack thereof). Furthermore, an enrollment and survey evaluation conducted in Fall 2025[2] noted a decline in the percentage of students enrolling in a math course after Boot Camp. This may have biased the results relative to previous years.

[2] Meinz, P. (2025). *Math Bootcamp: Student Feedback and Enrollment Pathways*

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Background and Methodology

Data Gathering and Student Demographics

For the present investigation, data were gathered from the Los Rios Peoplesoft information system. A student was included in the *Boot Camp* group if they participated in the Math Boot Camp in Summer 2023, Summer 2024, or Summer 2025. For this group, data were gathered on the math courses they took in the first fall term immediately following their *first* Math Boot Camp enrollment. For example, if a student took the Math Boot Camp in Summer 2023 and Summer 2024, then their earliest attempt was Summer 2023. The evaluation therefore looked at their math courses in Fall 2023. Students were included in the *Comparison* group if they enrolled in a math course in Fall 2023, Fall 2024, and/or Fall 2025 and never participated in a Math Boot Camp during the three-year period of the study. Grades were gathered for students in the Boot Camp and Comparison group in their math courses – excluding math labs. Additionally, only data on courses in which Boot Camp students enrolled were included for the purposes of this study. In other words, if a Comparison student enrolled in a math course (e.g. MATH 410) that no Boot Camp student attempted, that data was not included. Courses were then coded into math levels – e.g. MATH 333 and MATH 372 were coded as "College Algebra". A full list of levels can be found in the appendix of this report. This coding made it easier to identify proper comparison students (see the statistical method in the next section).

A strict comparison between Boot Camp students and Comparison students would be very difficult to interpret. Prior academic background and experience may explain why students in the Boot Camp are more or less successful. For example, suppose there were proportionately more students with above average high school GPAs in Boot Camp courses, then a difference could be explained by the presence of "better" students in the Boot Camp and not necessarily effectiveness of the course. To that end, several academic/demographic variables were gathered that have previously documented correlations with course success – income, Black/African American status (e.g. if they selected a Black/African American race/ethnicity on their application to CRC), Hispanic/Latino(a) status, and high school GPA. If a student did not have a high school GPA, then their GPA at CRC prior to the term of the fall math course was used in lieu. Additionally, the previous math level attempted for each student (prior to the fall term after bootcamp) was gathered (if it existed) along with the grade earned in that level. If a student's most recent attempt involved multiple courses in the same math level, then the highest grade was taken.

All in all, 139 Boot Camp students were identified (with 140 enrollments in Fall 2023 – Fall 2025) and 6100 Comparison students were identified (with 6862 enrollments in Fall 2023 – Fall 2025). A breakdown of enrollments can be found in *Table 1* below. For the purposes of analysis, students without a GPA were excluded – resulting in 139 Boot Camp and 5948 Comparison students with 139 and 6709 enrollments, respectively.

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Table 1. Enrollments for Bootcamp and Comparison Students

		Bootcamp		Comparison	
Measure	**Group**	**Enrollments**	**%**	**Enrollments**	**%**
Term	Fall 2023	48	34.3%	2550	37.2%
	Fall 2024	42	30.0%	2034	29.6%
	Fall 2025	50	35.7%	2278	33.2%
Post Bootcamp Course Level	Calculus 1	31	22.1%	653	9.5%
	Calculus 2	10	7.1%	254	3.7%
	Calculus 3/Beyond	2	1.4%	110	1.6%
	College Algebra	38	27.1%	926	13.5%
	General Education/Statistics	22	15.7%	3482	50.7%
	Pre-Calculus/Bio Calc	14	10.0%	374	5.5%
	Trigonometry	23	16.4%	1063	15.5%
Income	Below Poverty	41	29.3%	1646	24.0%
	Low	28	20.0%	1585	23.1%
	Middle And Above	48	34.3%	2619	38.2%
	Unable to Determine	23	16.4%	1012	14.7%
Black/AA	Black/AA	25	17.9%	915	13.3%
	Not Black/AA	115	82.1%	5947	86.7%
Hispanic/ Latino(a)	Hispanic/Latino(a)	45	32.1%	2087	30.4%
	Not Hispanic/Latino(a)	95	67.9%	4775	69.6%
Grade of Most Recent Math Course	A	8	5.7%	330	4.8%
	B	13	9.3%	328	4.8%
	C/P	17	12.1%	282	4.1%
	D	15	10.7%	256	3.7%
	FWI	52	37.1%	1191	17.4%
	None	35	25.0%	4475	65.2%
Most Recent Math Course Attempted	Arithmetic	1	0.7%	16	0.2%
	Calculus 1	18	12.9%	236	3.4%
	Calculus 2	5	3.6%	92	1.3%
	Calculus 3/Beyond	1	0.7%	30	0.4%
	College Algebra	24	17.1%	382	5.6%
	General Education/Statistics	16	11.4%	868	12.6%
	Intermediate Algebra	4	2.9%	125	1.8%
	Intro Algebra	0	0.0%	42	0.6%
	None	35	25.0%	4475	65.2%
	Pre-Algebra	0	0.0%	16	0.2%
	Pre-Calculus/Bio Calc	9	6.4%	134	2.0%
	Trigonometry	27	19.3%	446	6.5%

GPA	Less than 1.0	9	6.4%	275	4.0%
	>= 1.0 and < 2.0	38	27.1%	1993	29.0%
	>= 2.0 and < 3.0	92	65.7%	4413	64.3%
	>= 3.0	0	0.0%	28	0.4%
	No GPA	1	0.7%	153	2.2%
Total		**140**		**6862**	

Findings and Analysis

Success rates – the percentage of A, B, C, or P grades – out of the total number of enrollments can be found in *Table 2* below. Denominators for the success rates in *Table 2* can be found in *Table 1*. The analysis described here used propensity score matching to help remove possible demographic/confounding interpretations of success for Boot Camp and Comparison students. With propensity score matching each student in the Boot Camp group is matched to another student or set of students in the Comparison with similar demographic characteristics, a.k.a., similar "propensities" to participate in Boot Camp. Then their outcomes are compared. Because the comparison students have similar demographics, one may be more certain that the effect of the intervention (the Math Boot Camp) is not attributable to simple demographic differences (e.g., like high school GPA). What follows in the next paragraph is information necessary for replication of statistical methodology (and may not be immediately accessible to the practitioner).

Table 2. Success Rates for Bootcamp and Comparison Students

Measure	Group	Bootcamp	Comparison
Term	Fall 2023	47.9%	47.8%
	Fall 2024	57.1%	48.1%
	Fall 2025	38.0%	51.6%
Post Bootcamp Course Level	Calculus 1	35.5%	28.0%
	Calculus 2	70.0%	37.8%
	Calculus 3/Beyond	50.0%	40.9%
	College Algebra	39.5%	32.6%
	General Education/Statistics	54.5%	60.3%
	Pre-Calculus/Bio Calc	57.1%	61.2%
	Trigonometry	52.2%	39.3%
Income	Below Poverty	36.6%	46.4%
	Low	53.6%	46.0%
	Middle And Above	50.0%	53.3%
	Unable to Determine	52.2%	47.6%
Black/AA	Black/AA	44.0%	34.8%
	Not Black/AA	47.8%	51.4%
Hispanic/Latino(a)	Hispanic/Latino(a)	42.2%	45.1%
	Not Hispanic/Latino(a)	49.5%	50.9%

Grade of Most Recent Math Course	A	75.0%	77.6%
	B	53.8%	50.3%
	C/P	35.3%	42.9%
	D	53.3%	54.7%
	FWI	50.0%	42.4%
	None	37.1%	48.8%
Most Recent Math Course Attempted	Arithmetic	100.0%	43.8%
	Calculus 1	77.8%	44.5%
	Calculus 2	60.0%	52.2%
	Calculus 3/Beyond	0.0%	63.3%
	College Algebra	50.0%	44.5%
	General Education/Statistics	50.0%	48.0%
	Intermediate Algebra	0.0%	56.0%
	Intro Algebra	-	64.3%
	None	37.1%	48.8%
	Pre-Algebra	-	37.5%
	Pre-Calculus/Bio Calc	55.6%	50.0%
	Trigonometry	37.0%	56.3%
GPA	Less than 1.0	-	35.7%
	>= 1.0 and < 2.0	22.2%	26.5%
	>= 2.0 and < 3.0	34.2%	35.1%
	>= 3.0	55.4%	56.8%
	No GPA	0.0%	54.2%
Total		**47.1%**	**49.1%**

Students were propensity score matched in order to estimate both marginal and stratified/moderation effects. Full optimal propensity score matching was used for the covariates: GPA, course attempted in fall, income, term of enrollment, Hispanic/Latino(A) status, Black/African American status, previous course level attempted, and previous grade in that level. Exact matches were required for Black/African American status, Hispanic/Latino(a) status, and term of enrollment. Propensity score was estimated with logistic regression. This matching specification resulted in strong balance. A summary of the samples before and after matching can be found in *Table 3 (below)* and *Table 4* (next page). The strong match is evidenced in *Table 4* by the absolute value of the standardized differences all having values less than 0.1.

Table 3. Pre-Matching Balance Bootcamp vs. Comparison

Variable	Means Bootcamp	Means Comparison	Standardized Difference	Variance Ratio
Logistic Propensity Score	0.057	0.020	0.836	2.874
GPA	3.063	3.126	-0.090	1.200
Fall Course Attempt: Calculus 1	0.223	0.096	0.305	

Fall Course Attempt: Calculus 2	0.072	0.037	0.134
Fall Course Attempt: Calculus 3/Beyond	0.014	0.016	-0.011
Fall Course Attempt: College Algebra	0.266	0.132	0.303
Fall Course Attempt: General Ed/Statistics	0.158	0.507	-0.956
Fall Course Attempt: Pre-Calc/Bio-Calc	0.101	0.055	0.152
Fall Course Attempt: Trigonometry	0.165	0.157	0.024
Below Poverty Income	0.295	0.238	0.124
Low Income	0.194	0.232	-0.095
Middle Income	0.345	0.382	-0.078
Income Unable to Determine	0.165	0.147	0.049
Fall 2023 Enrollment	0.338	0.372	-0.072
Fall 2024 Enrollment	0.302	0.297	0.012
Fall 2025 Enrollment	0.360	0.331	0.059
Black/AA	0.173	0.132	0.107
Hispanic/Latino(a)	0.324	0.308	0.034
Most Recent Math Grade: A	0.058	0.049	0.036
Most Recent Math Grade: B	0.094	0.049	0.153
Most Recent Math Grade: C/P	0.122	0.042	0.245
Most Recent Math Grade: D	0.108	0.038	0.225
Most Recent Math Grade: FWI	0.367	0.177	0.394
No Prior Math Grade	0.252	0.645	-0.905
Most Recent Math Course: Arithmetic	0.007	0.002	0.059
Most Recent Math Course: Calculus 1	0.129	0.035	0.281
Most Recent Math Course: Calculus 2	0.036	0.014	0.120
Most Recent Math Course: Calculus 3/Beyond	0.007	0.004	0.032
Most Recent Math Course: College Algebra	0.165	0.057	0.292
Most Recent Math Course: General Ed/Statistics	0.115	0.129	-0.044
Most Recent Math Course: Intermediate Algebra	0.029	0.019	0.061
Most Recent Math Course: Intro Algebra	0.000	0.006	-0.079
Most Recent Math Course: None	0.252	0.645	-0.905
Most Recent Math Course: Pre-Algebra	0.000	0.002	-0.049
Most Recent Math Course: Pre-Calc/Bio Calc	0.065	0.020	0.182
Most Recent Math Course: Trigonometry	0.194	0.066	0.323

Table 4. Post-Matching Balance Bootcamp vs. Comparison

Variable	Means Bootcamp	Means Comparison	Standardized Difference	Variance Ratio
Logistic Propensity Score	0.057	0.057	0.009	0.930
GPA	3.063	3.046	0.025	1.066
Fall Course Attempt: Calculus 1	0.223	0.203	0.048	
Fall Course Attempt: Calculus 2	0.072	0.068	0.015	
Fall Course Attempt: Calculus 3/Beyond	0.014	0.016	-0.010	

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Fall Course Attempt: College Algebra	0.266	0.262	0.008
Fall Course Attempt: General Ed/Statistics	0.158	0.168	-0.026
Fall Course Attempt: Pre-Calc/Bio-Calc	0.101	0.115	-0.049
Fall Course Attempt: Trigonometry	0.165	0.168	-0.006
Below Poverty Income	0.295	0.292	0.007
Low Income	0.194	0.196	-0.005
Middle Income	0.345	0.329	0.034
Income Unable to Determine	0.165	0.183	-0.048
Fall 2023 Enrollment	0.338	0.338	0.000
Fall 2024 Enrollment	0.302	0.302	0.000
Fall 2025 Enrollment	0.360	0.360	0.000
Black/AA	0.173	0.173	0.000
Hispanic/Latino(a)	0.324	0.324	0.000
Most Recent Math Grade: A	0.058	0.056	0.006
Most Recent Math Grade: B	0.094	0.091	0.008
Most Recent Math Grade: C/P	0.122	0.127	-0.015
Most Recent Math Grade: D	0.108	0.103	0.016
Most Recent Math Grade: FWI	0.367	0.353	0.028
No Prior Math Grade	0.252	0.269	-0.040
Most Recent Math Course: Arithmetic	0.007	0.010	-0.038
Most Recent Math Course: Calculus 1	0.129	0.117	0.036
Most Recent Math Course: Calculus 2	0.036	0.033	0.015
Most Recent Math Course: Calculus 3/Beyond	0.007	0.010	-0.031
Most Recent Math Course: College Algebra	0.165	0.170	-0.013
Most Recent Math Course: General Ed/Statistics	0.115	0.107	0.027
Most Recent Math Course: Intermediate Algebra	0.029	0.025	0.025
Most Recent Math Course: Intro Algebra	0.000	0.001	-0.019
Most Recent Math Course: None	0.252	0.269	-0.040
Most Recent Math Course: Pre-Algebra	0.000	0.001	-0.011
Most Recent Math Course: Pre-Calc/Bio Calc	0.065	0.070	-0.020
Most Recent Math Course: Trigonometry	0.194	0.187	0.018

Next, to estimate the effect of Boot Camp on course success, a logistic regression was fit with the treatment (Boot Camp), covariates, and all interactions as predictors of course success – including full matching weights. The *avg_comparisons()* function in the *marginaleffects* package in R statistical software was used to perform g-computation in the matched sample to estimate the average treatment effect for the treated (ATT). Cluster-robust variances were used to estimate its standard error with subclassification (determined from propensity matching) and student (because students may have enrolled in multiple courses during the three-term period) as the clustering variable.

ATT estimates, *p*-values, and confidence intervals can be found in *Table 5* below. Overall, estimated ATT for Boot Camp relative to the Comparison was 7.14%. That is to say, Boot Camp students had a success rate that was 7.14% higher than the Comparison group after matching. This difference was not statistically significant ($p = 0.0574$) and there is a 95% chance that the ATT falls between -.2% and 14.5%. Furthermore, there were no statistically significant effects observed for Black/AA or non-Black/AA

students. The effect for non-Hispanic/Latino(a) students was, on the other hand, statistically significant. The estimate ATT of Boot Camp for this group was 9.4% (p = 0.0412). The estimated ATT of Boot Camp for Hispanic/Latino(a) students was 2.4% (p = 0.7309). Finally, within each of the three fall terms, the estimated ATT for Boot Camp was 6%, 16.04%, and 0.74% for Fall 2023, Fall 2024, and Fall 2025, respectively. Only the ATT for Fall 2024 was statistically significant (p = 0.0149).

Table 5. Estimated ATTs for Boot Camp Students

					95% Confidence Interval	
Group	**Estimated ATT**	**SE**	***z***	***P***	**Lower Bound**	**Upper Bound**
Overall	7.14%	0.0376	1.9	0.0574	-0.23%	14.50%
Non-Black/AA	6.33%	0.0412	1.54	0.124	-1.74%	14.40%
Black/AA	11.05%	0.0927	1.19	0.233	-7.12%	29.20%
Non-Hispanic/Latino(a)	9.44%	0.0462	2.04	0.0412	0.38%	18.50%
Hispanic/Latino(a)	2.35%	0.0683	0.34	0.7309	-11.03%	15.70%
Fall 2023	6%	0.0697	0.86	0.3895	-7.67%	19.70%
Fall 2024	16.05%	0.0659	2.43	0.0149	3.12%	29%
Fall 2025	0.74%	0.059	0.13	0.9007	-10.83%	12.30%

Conclusions and Recommendations

In contrast to the prior evaluation, the findings reported here suggest that there was not an overall significant impact of Math Boot Camp on course success. Specifically, it appears as if the impact was minimal for the Summer 2025 Boot Camp students – which drove the estimated effect for Boot Camp down. Program coordinators should reflect on changes in practice (e.g. implementation of the bootcamp) and context (e.g. changes in the math department offerings, etc.) that may have resulted in changes to program impact. It is also possible that Summer 2025 was an outlier, and we may see a return to the previous trend next year.

Furthermore, there was a significant effect of Boot Camp for non-Hispanic/Latino(a) students. This has potential to lead to equity gaps for Hispanic/Latino(a) students, and should therefore be monitored.

Caveats and Limitations

The present investigation attempted to control for demographic and academic factors via statistical matching. However, it is possible that other factors may account for the differences observed for Math Boot Camp students (or lack thereof). Furthermore, an enrollment and survey evaluation conducted in Fall 2025[3] noted a decline in the percentage of students enrolling in a math course after Boot Camp. This may have biased the results relative to previous years.

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Appendix

Course-Level Mappings

Level	Course
Arithmetic	Math 20, 200, 200A, 200B, 22
Pre-Algebra	MATH 30, 210
Intro Algebra	MATH 100, 101, 102, 51, 51A, 51B
Intermediate Algebra	MATH 110, 112, 120, 125, 144, 52, 53, 54, STAT 100
General Education/Statistics	MATH 300, 310, STAT C1000
College Algebra	MATH 333, MATH 372
Trigonometry	MATH 335, 373, 341, 343, 29
Pre-Calc/Bio Calc	MATH 350, 355, 356, 370, 384
Calculus 1	MATH 400
Calculus 2	MATH 401
Calculus 3/Beyond	MATH 402, 410, 420, 483, 484