Math Bootcamp: Student Feedback and Enrollment Pathways

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Executive Summary

Background

In Summer 2022, the Math Department at Cosumnes River College (CRC) revamped their MATH 83 (Math Bootcamp) course offering. MATH 83 utilizes adaptive learning software (ALEKS PPL) to identify areas for growth in math skills (e.g. fractions, factoring, plotting trigonometric curves, trigonometric identities, limits of elementary functions, etc.) and provide lessons/evaluations in those areas. Additionally, all three sections of MATH bootcamp (with a total of 62 students) had tutors and an assigned faculty member. These individuals assisted students by supplementing the explanations of ALEKS PPL when students needed additional help and by providing short ("mini") lectures on potentially confusing topics. This initial evaluation of the Math Bootcamp describes student feedback and the enrollment pathways they took before and after math bootcamp. Future evaluations will look at course success and help seeking behavior after participation.

Summary of Findings

Note that only high-level findings are reported here. Additional details can be found beyond this executive summary.

Bootcamp Student Demographics

1) Of the 62 bootcamp students, a notable portion were Hispanic/Latino(a) (*Table 1*, page 3). The majority of students had a gender identity of female.
2) The vast majority of students enrolled in the Bootcamp were continuing students (80.6%), followed by returning students (12.9%; *Table 1*, page 3). Very few students were first-time new/special admit.

Pathways to and from Math Bootcamp

1) Students in the Math Bootcamp expressed the desire to improve their math skills, overcome previous struggle, refresh math skills, or pass a specific course (*Table 5*, page 6).
2) As such, the majority of the students enrolled in Math Bootcamp had either received and unsuccessful grade in their most recent math course (56.4%; *Table 2*, page 4) or received a C grade in their most recent math course (12.9%).
3) Of the 32 students who had previously received a non-successful grade in a math course at CRC, a total of 20 (62.5%; *Table 2*, page 4) re-enrolled in the same course in Fall 2023.
4) Although 75.8% of Math Bootcamp students enrolled in a math course in Fall 2023, only a small subset of students with no prior math experience enrolled. Of the 14 students in Math Bootcamp who had no math experience at CRC, a total of 4 enrolled in a math course in Fall 2023 (28.6%; *Table 2*, page 4).

Bootcamp Survey Feedback

1) Students experienced a statistically significant decline in math anxiety over the course of Math Bootcamp – from an average rating of 3.5 to 2.65.
2) Most students were referred to the Bootcamp by an instructor or counselor (*Table 4*; page 6).
3) The top benefit of taking the Bootcamp as reported by students was "Feeling more prepared and/or confident for future math courses" (*Table 6*, page 7).
4) Most students expressed general positive affirmation for ALEKS and the mini-lectures (*Table 7*, page 7, and *Table 8*, page 8, respectively). Some thought ALEKS explanations were good but sometimes required supplementation from tutors/faculty. Others thought that the mini-lectures were helpful, but a small subset would have liked some practice problems to accompany the lectures.

Conclusions and Recommendations

Most of the students entering the Math Bootcamp had a goal of improving or refreshing their math skills. This statement is supported by the fact that many students entering the Bootcamp had either recently not successfully passed a math course at CRC or received a low successful grade. A total of 75.8% of the Bootcamp students enrolled in math in Fall 2023, with the plurality of students re-enrolling in a course they had previously not passed. Nevertheless, students who had no prior math experience at CRC, enrolled at low rates into a math course in Fall 2023. This may be an area of future emphasis. The feedback provided by students was generally positive. Students had significantly lower self-reported math anxiety by the end of the Bootcamp. They liked the explanations in ALEKS, and generally liked the mini-lectures. Still, some students thought ALEKS was mostly helpful but they required additional explanation from the tutors/faculty. Others thought it could be helpful to get practice problems associated with the mini-lectures (which were also well received by students).

Caveats and Limitations

The findings from the enrollment data elucidate the paths that students take to get into the Math Bootcamp, and the qualitative feedback suggests that the students had a positive experience during their enrollment. These data should be validated with course performance (and help seeking) data in Fall 2023.

Background and Methodology

Method

Math faculty in each bootcamp section (three in total) administered a survey at the start of the course (the *pre-survey*) and a survey after the course (the *post-survey*). The pre-survey asked students about their math anxiety, how they learned about the math bootcamp, their academic goals, their goals for the bootcamp, their work hours/enrollment, and their course history. The post-survey asked students about their math anxiety, the usefulness of the program, what benefits they received, their experience with ALEKS and the mini-lectures, and any general feedback/improvement advice. In both surveys, math anxiety was reported by each student on a five-point Likert scale (1 – *Not Anxious* to 5 -*Very Anxious*). To supplement this breadth of information, the Research and Equity Office gathered data on student demographics and enrollment history. These data were used to describe the pathways that students took prior to enrolling in Math Bootcamp along with their ultimate enrollment in math (in Fall 2023).

Student Demographics

A total of 63 students took the pre-survey (one more than the number of enrolled students at census) and 54 took the post survey. A total of 62 students were enrolled in the Math Bootcamp after the deadline to drop without a W (census). A demographic breakdown of these students can be found in *Table 1* below. In terms of race/ethnicity, students who identify as Hispanic/Latino(a) were represented in higher proportion than other groups. This was also true for female students. Interestingly, the vast majority of students served by the Bootcamp were continuing students. A small but notable number were returning to their studies after at least a one term break (*returning* students).

Table 1. **Demographic Breakdown of Bootcamp Students**

Race	Headcount	%
African American	5	8.1%
Asian	9	14.5%
Filipino	6	9.7%
Hispanic/Latino	22	35.5%
Multi-Race	7	11.3%
Native American	1	1.6%
Other Non-White	1	1.6%
White	11	17.7%
Gender	**Headcount**	**%**
Female	37	59.7%
Male	24	38.7%
Unknown	1	1.6%
Age Group	**Headcount**	**%**
24 or Younger	41	66.1%
25 or older	21	33.9%
Enrollment Status	**Headcount**	**%**
Continuing Student	50	80.6%
First Time Student (New)	3	4.8%
Returning Student	8	12.9%
Special Admit	1	1.6%
Total	**62**	

Findings and Analysis

Student Enrollment Pathways

Students were classified on the basis of their prior enrollment in math into four groups: those that received an A or B in their most recent math attempt at CRC (the *High Successful Attempt* group); those that received a C in their most recent math attempt (the *Low Successful Attempt* group); those that did not successfully complete their most recent math attempt (the *Non-Successful Attempt* group); and students who had not attempted a math course at CRC (the *No Math Course at CRC* group). On the basis of their enrollment after the Math Bootcamp (in Fall 2023), students were also classified into 6 groups; those attempting a higher math course than their previous attempt (the *Attempting Higher* group); those attempting a lower math course than their previous attempt (the *Attempting Lower* group); those that changed paths after their last attempt (e.g. from STEM to SLAM; the *Changed Paths from Last Attempt* group); those attempting a math course for the first time (the *First Attempt of a Math Course* group); those

reattempting their last math course (the *Reattempting* group); and those not attempting a math course (the *No Attempt After* group).

The aforementioned groupings on the basis of prior/subsequent enrollment were cross-tabulated, and the results can be found in *Table 2* below. In terms of prior enrollment, the majority of students that enrolled in the Math Bootcamp (*N* = 35; 56.5%) had non-successful grade in their most recent math course attempt. Over half of these students (*N* = 20; 57.1%) reattempted their last math course in Fall 2023. Five (14.2%) attempted a lower course, and four (11.4%) attempted a course that was higher. Of the students that had no prior math experience at CRC, 71.4% did not enroll in a math course in Fall 2023. Finally, 100% (*N* = 8) of the students in the low successful attempt course attempted a higher course in Fall 2023. All in all, 75.8% enrolled in a math course in Fall 2023.

Table 2. **Cross-Tabulation of Prior and Subsequent Enrollment Groups**

Prior Math Experience	Current Enrollment in MATH/STAT						Total
	Attempting Higher	Attempting Lower	Changed Paths	First Attempt	No Attempt After	Reattempt	
High Successful Attempt	2		2		1		5
Low Successful Attempt	8						8
Prior Non-Successful Attempt	4	5	2		4	20	35
No Math Course at CRC				4	10		14
Total	**14**	**5**	**4**	**4**	**15**	**20**	**62**

A breakdown of prior course attempts can be found in *Table 2* below. The largest proportion of students entering bootcamp had not previously attempted a math course (*N* = 14; 22.22%). This was followed by students who attempted MATH 333, MATH 335, and MATH 400 (15.87%, 14.29%, 11.11%, respectively).

Table 2. **Prior Math Course**

Course	Headcount	%
MATH 120	2	3.23%
MATH 30	1	1.61%
MATH 300	2	3.23%
MATH 333	10	16.13%
MATH 335	9	14.52%
MATH 355	1	1.61%
MATH 370	5	8.06%
MATH 400	7	11.29%
MATH 401	4	6.45%
MATH 420	1	1.61%
STAT 300	6	9.68%
No CRC Course	14	22.58%
Total	**62**	

Finally, a breakdown of subsequent enrollment after Math Bootcamp can be found in the table below. A total of 24.19% of students did not enroll in a math course after the Bootcamp. The largest targets of enrollment were MATH 333, MATH 335, MATH 400, and MATH 401. Note that one student enrolled in two courses, so the percentage column will add to slightly more than 100%. The headcount column will add to 63 (although the "Total" row reflects the unduplicated count).

Table 3. Subsequent Math Course

Course	Headcount	%
MATH 300	2	3.23%
MATH 310	1	1.61%
MATH 333	14	22.58%
MATH 335	10	16.13%
MATH 341	1	1.61%
MATH 355	1	1.61%
MATH 400	7	11.29%
MATH 401	7	11.29%
MATH 410	1	1.61%
STAT 300	4	6.45%
No Attempt After	15	24.19%
Total	**62**	

Referrals to the Math Bootcamp

The vast majority of students in the Math Bootcamp were either referred by an instructor or a counselor. This seems to confirm the aforementioned observation that many of the students in Math Bootcamp had a non-successful completion or low successful completion of a Math course prior to enrollment. A breakdown of how students learned about the Bootcamp can be found in *Table 4* below.

Table 4. **How did you learn about the math boot camp?**

Mode of Notification	N	%
Advertisement	7	11.1%
Counselor	17	27.0%
Friend	4	6.3%
Math Center	1	1.6%
Online	1	1.6%
Teacher	34	54.0%
Total	**63**	

Goals for Participation in the Math Bootcamp

Not surprisingly, when asked about their goals for participating in Bootcamp, the majority of students said they hope to improve/overcome previous struggle in math (50.8%), prepare for a specific course/achieve a grade (22.2%), or refresh skills they had learned in the past (17.5%). A breakdown of response codes for this question can be found in *Table 5* below.

Table 5. **What are your goals for participating in the math bootcamp?**

Response	N	%
Improve/Overcome Previous Struggle	32	50.8%
Prepare for Specific Course/Achieve a Grade	14	22.2%
Refresh Skills	11	17.5%
Build Confidence	3	4.8%
Overcome a Gap in Math (e.g. in pre-college)	2	3.2%
Other/No Response	7	11.1%
Total	**63**	

Math Anxiety and Usefulness Ratings

A total of 30 students who participated in Bootcamp provided data on their math anxiety. Student math anxiety declined from an average of 3.5 (SD = 1.38) to 2.65 (SD = 1.11) – a statistically significant change ($t(29)$ = 3, $p < .01$). Additionally, in the post-survey, on a scale of 1 (*Not at all useful*) to 5 (*Extremely useful*), students rated the bootcamp highly – an average response of 4.85 (N = 54, SD = 0.41).

Benefits to Bootcamp

When asked what the benefits of bootcamp were in the post-survey, Math Bootcamp participants most frequently selected "Feeling more prepared and/or confident for future math courses" (*Table 6* below). This was followed by "Learning Study Skills" and "Making connections with students and/or faculty". "Determining an appropriate math course to take in the fall" was the least frequently selected option.

Table 6. **What were the benefits of participating in Math Boot Camp?**

Benefits	%
Determining an appropriate math course to take in the fall	38.9%
Learning study skills	68.5%
Making connections with students and/or faculty	61.1%
Feeling more prepared and/or confident for future math courses	96.3%
Other, please describe	22.2%
Total	**54**

ALEKS and the Mini-Lectures

When asked to provide feedback on the helpfulness of ALEKS, many students stated that ALEKS was helpful and did not offer any additional feedback (N = 27; 50%). Seven students (13.0%) thought that ALEKS was helpful but occasionally needed help from faculty/tutors. Nine (16.7%) also thought ALEKS was helpful but sometimes the explanations were unclear, and a further four thought the explanations were too wordy (7.4%). Of note, one student thought the explanation of graphing trigonometric functions was lacking. ALEKS only demonstrated creating a table of values – e.g., and did not show how to graph using the period of the function etc.

Table 7. **Did you find the explanations in ALEKS helpful?**

Response	N	%
Helpful (no additional feedback)	27	50.0%
Helpful, but sometimes needed additional help from tutors/instructors	7	13.0%
Helpful, but sometimes explanations were unclear	9	16.7%
Helped, but more explanation of right/wrong answers	2	3.7%
Helpful, but sometimes too wordy/overexplained	4	7.4%
Other	4	7.4%
Total	**54**	

Similar to the feedback on ALEKS, a large portion of students thought the mini-lectures were helpful and provided no additional feedback (46.3%; *Table 8* below). Another subset thought that they helped to deepen understanding (14.8%). Some thought it would have been helpful to have practice problems associated with the lecture (7.4%). Two students thought the factoring mini-lecture was very helpful.

Table 8. **If you participated in the mini-lecture did you find it helpful?**

Response	N	%
Helpful (no additional feedback)	25	46.3%
Helpful - Tutor/instructor helped with deeper understanding	8	14.8%
Helpful - It helped to refresh concepts	4	7.4%
Helpful, but would have liked practice problems	4	7.4%
Helpful, especially the factoring mini-lecture	2	3.7%
Helpful, but too long/too much time away from ALEKS	2	3.7%
Liked the individual attention	2	3.7%
Asked for tutor to speak up/slow down	2	3.7%
Other	6	11.1%
Total	**54**	

General Feedback and Improvement

When asked how the bootcamp could be improved, a large portion of students thought the Bootcamp was good in its current state (48.1%; *Table 9*). Others wanted more mini-lectures (7.4%) and a subset wanted some exposure to their upcoming course (5.6%). Smaller subsets would have liked more time on ALEKS (3.7%) and/or more variable teaching styles (3.7%). Many of the pieces of feedback did not fit a coherent theme (24.1%). Of note, one student would have liked to have more encouragement after a low performance on an evaluation and another would have liked to see feedback on wrong answers after a test.

Table 9. **How can the faculty members/tutors improve the program?**

Response	N	%
Good as is	26	48.1%
Wanted more mini-lectures	4	7.4%
Wanted exposure to the course they were preparing for	3	5.6%
More time on Aleks	2	3.7%
Wanted more variability in teaching styles	2	3.7%
Other/Not Easily Themed	13	24.1%
No Feedback	4	7.4%
Total	**54**	

Finally, when asked about general observations, a plurality of students did not offer additional information (48.1%). A small subset wanted more breaks (3.7%), but most offered affirmations of the course and/or described a specific aspect they liked (e.g. snacks).

Table 10. **Do you have any other general observations?**

Response	N	%
None	26	48.1%
Offered additional affirmation of the course	9	16.7%
Said the tutors were helpful	7	13.0%
Liked the snacks	2	3.7%
Wanted more breaks	2	3.7%
Other	8	14.8%
Total	**54**	

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