

El Camino College Summer and Winter Math Academy Report



2013 – 2016

Executive Summary

This report describes the characteristics of students who participated in either the Summer Math Academy (SMA) or Winter Math Academy (WMA) at El Camino College (ECC), from 2013 to 2016. This three-week program introduces students to the sequence of math courses, from remedial to transfer-level, and provides them with the opportunity to improve their math course placement levels. Ideally, by improving their placements, students will be successful in their math courses and accelerate through the sequence. Over the study period, there were 1,086 enrollments in the MA, with 1,051 unique student participants. Our analysis indicates that many students benefitted from their participation, both in terms of improving their placement levels and succeeding in their math courses. However, when we disaggregated our data by ethnicity, gender, and age, there were many discrepancies between student groups. With continued investment in the MA and increased support to participants, both before and after the MA, the program can help improve overall math course success rates and narrow the equity gaps between student groups. Enrollment has been increasing over time, and program should continue to recruit students, especially from groups that are under-represented or face larger barriers to success. Our key findings include:

- MA participants were younger, more likely to be female, and more likely to be Latino than the larger ECC student body, though enrollment of older students increased over time. White and Asian students were under-represented, compared to the ECC student body.
- Across all terms, almost all participants (93%) initially placed in below transfer-level courses.
- Fifty-nine percent of MA participants were able to improve their math course placement levels. However, of the 989 students who initially placed at the pre-transfer level, only 9% qualified for a transfer level course after completing the Academy.
- Seventy-four percent of MA participants went on to enroll in a math course in the term following the Academy. Students who placed at the highest levels were more likely to take a math course than students who placed at the lowest levels.
- Fifty-six percent of math course enrollments by MA participants resulted in a passing grade. Students were more successful in transfer-level courses, with a success rate of 65%, compared to students in non-transfer level courses, who had a 53% success rate.
- Students who improved their math placement levels over the course of the Academy were somewhat less successful in their math courses (success rate = 54%), than students who did not improve their placement levels (success rate of 59%). This may be due to

the fact that improvers generally enrolled in courses more challenging than their pre-Academy placements.

- When aggregated across math courses and terms, MA participants had a 56% success rate, compared to 52% for the rest of ECC students, who did not participate. This advantage was larger when limited to transfer-level courses, in which MA participants outperformed non-participants by 10 percentage points, with a success rate of 65%.
- The improvement rate for students 35 or more years old was far lower than for younger students; only 37% of the older students improved their placement level, compared to 59% for all students.
- Compared to female participants, males were less likely to enroll in a math course and then pass the courses in which they did enroll, though both groups improved their placement levels at similar rates.
- The most striking disparities were between African American students and the other ethnic groups. African American students entered the Academy at lower placement levels than the other ethnic groups, and also were least likely to improve their placements, enroll in a math course after the Academy, and then pass a math course, if they did enroll. Only 49% of African American students improved their placements, compared to 59% of all participants. Sixty-nine percent enrolled in a math course in the term following the Academy, compared to 74% of all participants. Finally, among those who enrolled in math, their success and retention rates were 49% and 75%, respectively, compared to 56% and 79% for all MA participants.

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Introduction

El Camino College (ECC) offers a three-week Math Academy (MA), both a Summer Math Academy (SMA) and a Winter Math Academy (WMA), for students who want to improve their math course placement level. A higher placement gives students the opportunity to move from remedial to transfer-level math courses more quickly. As stated on the Academy's website, the mission is to

Equip students with the information and tools necessary for success in the sequence of Mathematics courses they take at El Camino College for graduation and transfer. A secondary goal is to provide students with another opportunity to advance semesters of math classes by scoring higher on the College Mathematics Placement Test (CMPT) after three weeks of intensive review of mathematics and learning skills for academic success.

This program has been offered over the summer since 2008 and expanded to the winter term in 2016. In 2013, the Academy became non-credit. Recently, the Academy welcomed current ECC students, in addition to new students.

Research Questions

In this report, we explore the degree to which students benefitted from attending a summer or winter Math Academy from 2013 to 2016. We analyze the characteristics of MA participants, the change in placement levels before and after the Academy, subsequent enrollment in math courses, and outcomes in those courses. In addition, we address whether or not enrollment decisions and outcomes varied by student characteristics. Specifically, we address the following five research questions:

1. What were the characteristics of Math Academy participants?
2. How many students improved their math course placements after participating in the Academy and how many levels did they improve? Did outcomes vary by student characteristics?
3. How many students enrolled in math courses in the semester following the Academy and in which courses did they enroll? Did enrollment rates vary by placement level, improvement, and other student characteristics?
4. How successful were Math Academy students in their math courses in the term following the Academy? Did math course success rates vary by
 - a. Level of improvement during the Academy;
 - b. A student's decision to enroll in a math course above their initial placement level; and
 - c. Other student characteristics?
5. How successful were Math Academy participants in their math courses, compared to students who did not participate in the Academy?

Methodology

Our study population includes ECC students who participated in the 2013, 2014, 2015, and 2016 SMAs, as well as the 2016 WMA. For the purpose of this report, we categorized math courses into seven discrete levels of increasing difficulty, as shown in Table 1. Levels 1 through 4 consist of remedial courses, while levels 5 through 7 include transfer-level courses. For each participant, we collected data on their math placement level prior to attending the Academy (i.e. the “pre-test”) and their revised math placement level at the end of the Academy (i.e. the “post-test”). Using these data, we identified students who were “improvers,” as well as those who did not place into a higher-level math course after completing the Academy. We calculated the number of levels students improved or, in some cases, regressed. We excluded students who did not have a valid pre-test or post-test level recorded from this portion of our analysis.

Table 1. Math Courses and Levels

Placement Level	Math Courses
Level 1	12, 37
Level 2	23, 33
Level 3	40, 60, 67
Level 4	70, 73, 80
Level 5	110, 115, 120, 130, 150, 170
Level 6	180
Level 7	160, 165, 190

We then evaluated MA participants’ enrollment in math courses in the term immediately following each Academy – either the fall term after the SMA or the spring term after the WMA. We calculated the enrollment rate and enrollment in specific math courses. We then compared student enrollment decisions – both whether or not to enroll in a math course and what level course to take – by initial and revised placement levels, as well as ethnicity, gender, and age. We also identified students who decided to enroll math classes below the level for which they were qualified.

To assess student outcomes, we calculated math course success and retention rates. The success rate is the percentage of students who receive a passing grade out of all students enrolled as of the census date. The retention rate is the percentage of students who remain enrolled through the end of the course out of all students enrolled on the census date. To calculate overall success and retention rates, we aggregated all MA participants over the five terms that followed the Academies: Fall 2013, Fall 2014, Fall 2015, Spring 2016, and Fall 2016. Students who participated in more than one Academy are counted more than once if they took a math course after each Academy. We also present the data disaggregated by math course level, Math Academy term, whether or not students improved during the Academy, whether or not students enrolled in courses above their initial placement levels, and the three demographic characteristics – ethnicity, gender, and age. Throughout this report, we only

present outcome data (improvement and course grades) for subgroups of students with 10 or more members, in order to maintain confidentiality.

Limitations

Our analysis is limited in several ways. First, data on MA participants were entered by hand and by various faculty members. As a result, some data were missing or inaccurate. In our comparisons of initial and revised math placement levels, we could only include students with valid pre- and post-test data. Our data on student characteristics and math course enrollment were only available for students with I.D. numbers that matched the California Community Colleges Chancellor's Office (CCCCO) I.D. numbers. In each section, we specify the denominators used in our calculations, which are the pool of students for whom the desired data are available. While we intended to compare the outcomes for participants who were new to ECC to those who were current students, those data were incomplete and could not be validated. Therefore, we omitted that analysis.

Finally, we must be careful not to infer causal relationships between Academy participation and math course outcomes. We identify associations between certain variables and outcomes; however, there are many other potentially influential variables that we cannot measure. For much of our analyses, we had to aggregate all Academy participants across the five terms. While this increased our sample size, it may have obscured important changes over time, which could have affected student outcomes. We must also be cautious when comparing the math course outcomes of MA students to their peers who did not participate in the Academy, as the latter group is nearly 50 times larger than the former.

Results

Math Academy Participants

There were 1,086 enrollments in the Summer and Winter Math Academies from 2013 to 2016. Thirty-two students repeated the Academy at least once, resulting in 1,051 unique student participants over that time period. Table 2 presents the number of participants in each term, by their initial math placement level.

The average initial placement level for all MA participants, across all terms, was 2.6. Across the five terms, almost all participants (93%) initially placed below transfer level, ranging from 76% of participants in the 2016 WMA to a high of 97% of participants in the 2016 SMA.¹ Overall, the majority of participants entered the Academy at the lowest levels – Level 1 or Level 2.

¹ These percentages exclude students whose initial placement levels were not recorded or were invalid.

Table 2. Math Academy Participants by Term and Initial Placement Level

Initial Placement	Summer 2013	Summer 2014	Summer 2015	Winter 2016	Summer 2016	Total
Level 1	28	75	99	34	84	320
Level 2	19	37	86	26	76	244
Level 3	11	22	62	21	31	147
Level 4	47	79	84	6	62	278
Level 5		6	12	5	4	27
Level 6	13	2	9	20	4	48
Level 7		3		2		5
No level*	1	1	6		9	17
Total	119	225	358	114	270	1,086

*These enrollments did not have valid initial placement levels recorded.

Ethnicity, Gender, and Age

We were unable to identify the CCCCO I.D. numbers for 37 of the recorded MA enrollments. In addition, 20 students who did have I.D. numbers did not enroll at ECC in the term following the Academy. Therefore, we had to remove these students from our analyses of student demographics and course outcomes, though we were able to include them in our analysis of math placement before and after the Academy. As a result, we have complete demographic data for 1,029 Academy enrollments and 994 unique participants. Table 3 presents the demographic characteristics of the participants in each term, as well as the characteristics of all unique student participants across the five terms.

As shown above, Latino students comprised at least half of the MA participants in every term, making up 59% of all students who participated in one or more academy over the five terms. Latino students make up about 50% of the ECC student body in any given term; therefore, they were somewhat over-represented among MA participants. On the other hand, White students were under-represented in the MA population. They accounted for 9% of all student participants, compared to about 13% of the ECC student body. Asian students were similarly under-represented. Overall, African American students comprised 15% of all student participants, matching their representation in the ECC student body. However, the participation of African American students varied widely across terms, from a low of 8% of participants in Summer 2013 to a high of 23% of participants in Winter 2016.

In every term, female students outnumbered male students in the Academy, comprising 58% of all unique student participants. Female students make up around 51% of the larger ECC population. The distribution of participants by age skews much younger when compared to the ECC student body, though the representation of older students in the MA has been increasing over time. In Summer 2013, 93% of MA participants were under the age of 25, compared to 79% in Summer 2016. Cumulatively, 82% of Academy participants have been from that age group, though they make up about 70% of the ECC student body.

Table 3. Characteristics of Math Academy Participants, By Term

	SMA 2013	SMA 2014	SMA 2015	WMA 2016	SMA 2016	Total Unique Students*	
African American	8%	13%	18%	23%	14%	153	15%
American Indian or Alaska Native			0.3%	1%		2	0.2%
Asian	16%	14%	13%	14%	10%	125	13%
Latino	64%	56%	60%	50%	62%	587	59%
Pacific Islander		1%			1%	5	1%
Two or More	1%	5%	3%	3%	3%	33	3%
Unknown or Decline			1%		1%	4	0.4%
White	11%	10%	5%	9%	10%	85	9%
Female	57%	61%	58%	54%	59%	580	58%
Male	43%	39%	42%	46%	41%	414	42%
19 or less	81%	70%	56%	41%	57%	610	61%
20 - 24	12%	18%	23%	31%	23%	212	21%
25 - 34	5%	7%	13%	15%	14%	107	11%
35 - 44	1%	2%	4%	5%	2%	30	3%
45 - 54		2%	3%	4%	3%	23	2%
55+	2%	1%	1%	4%	1%	12	1%
Total	109	210	338	111	261	994	100%

Note: The student ages reported here come from the term following participation in the Academy. For students who participated in multiple Academies, we use their characteristics from their first term of participation when describing the population of unique students. The population of unique students excludes those without CCCC I.D. numbers, as well as those without demographic information for the term following the Academy.

Initial and Revised Placements

We assessed the degree to which student placement levels changed before and after participating in the Academy. Due to missing data, we were able to calculate the change in placement levels for only 1,065 of the 1,086 enrollments. Fifty-nine percent of participants in that population improved their math course placement scores. The average initial math placement level was 2.6, while the average revised placement level was 3.5, with an average increase of 0.87 levels.

Table 4 shows students' initial and revised placements; Table 5 presents the same data, expressed as a percentage of the students who began at each placement level. Cells shaded in green indicate an improved placement, while cells shaded in grey denote no change. Orange cells highlight students whose placement levels dropped after participating in the Academy.

Table 4. MA Participant Counts by Initial and Revised Placement Levels

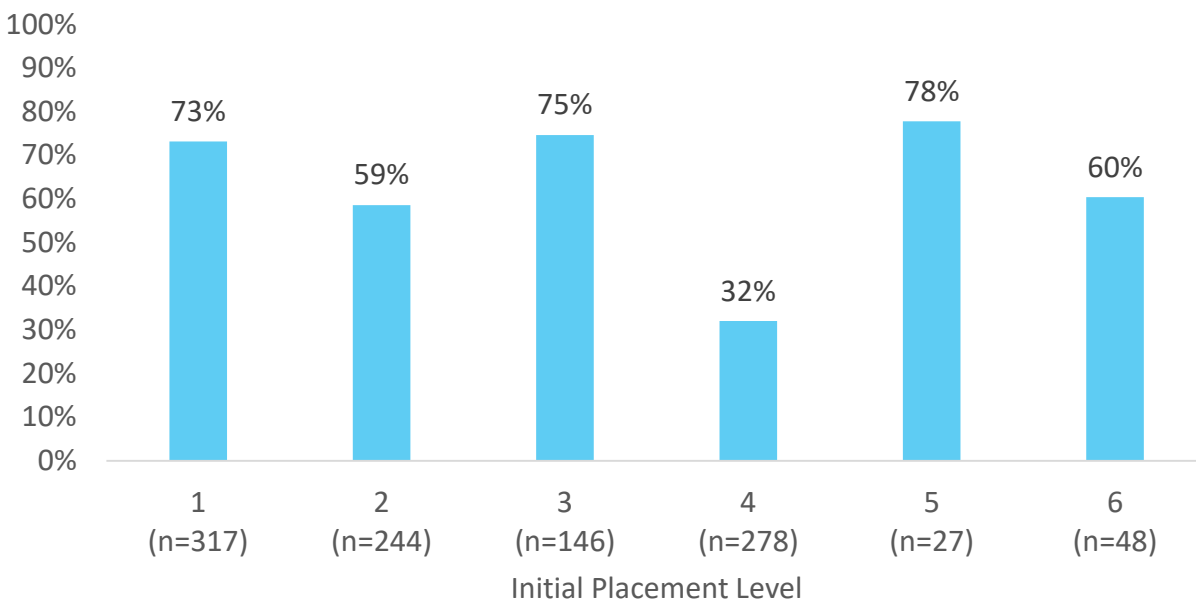
	Post-test							
Pre-test	1	2	3	4	5	6	7	Total
1	85	145	40	47				317
2	11	90	28	114	1			244
3	5	5	27	106	1	2		146
4	2		9	178	19	51	19	278
5				2	4	9	12	27
6				4		15	29	48
7				1			4	5
Total	103	240	104	452	25	77	64	1,065

Table 5. Percent of MA Participants at Each Revised Placement Level, by Initial Placement Level

	Post-test							
Pre-test	1	2	3	4	5	6	7	Total
1	27%	46%	13%	15%				317
2	5%	37%	11%	47%	0%			244
3	3%	3%	18%	73%	1%	1%		146
4	1%		3%	64%	7%	18%	7%	278
5				7%	15%	33%	44%	27
6				8%		31%	60%	48
7				20%			80%	5
Total	103	241	104	453	25	78	64	1,065

The proportion of students who improved varied by initial placement level, with 78% of Level 5 students improving their placements, compared to a low of 32% for students who initially placed at Level 4. (See Figure 1.) Of the 989 students who initially placed at the pre-transfer level, only 9% qualified for a transfer level course after completing the Academy. Students were more successful at moving up from Level 1 and Level 3, than from Level 2 and Level 4. The figure below omits the five students who initially placed at Level 7, as there was no way for them to move to a higher level. Still, three of those Level 7 students were initially placed in Math 160 and were later approved to take Math 190. While these courses are similar, we will consider the change an “improvement” when we later analyze outcomes in math courses.

Figure 1. Percent of MA Participants Improving Math Placement, by Initial Placement Level



Placement Levels, by Student Group

The average initial placement level for MA participants was 2.6; however, some student groups entered at higher levels than others did.² Further, some groups improved more than others did. See Table 6 for average placement scores and improvement rates, disaggregated by the various demographic subgroups.³

Both African American students and students over the age of 34 had lower improvement rates and average degree of improvement, when compared to their peers. While African American students and Latino students both started with an average placement level of 2.4, 62% of Latino students improved their placement levels, compared to only 49% of African American students. After the Academy, Latino students had an average placement level of 3.3, compared to 3.0 for African American students. Asian students started with the highest average placement levels before and after the Academy – 3.6 and 4.6, respectively. They had the second highest improvement rate (61%) behind Latino students (62%).

² We did not compare the placement scores of MA students to other ECC students who took the placement exam.

³ For the purpose of this analysis, we counted the three students who began and ended at the highest placement level (Level 7) as “improved,” since their placement level did not drop.

Table 6. Placement Levels and Improvement, by Demographic Group

	Number of Students	Percent Improved	Average of Pre-Level	Average of Post-Level	Average of Change
African American	160	49%	2.4	3.0	0.56
Asian	131	61%	3.6	4.6	0.94
Latino	607	62%	2.4	3.3	0.93
Two or More	34	55%	3.2	4.1	1.00
White	86	57%	3.0	3.9	0.90
Female	601	59%	2.5	3.3	0.85
Male	428	60%	2.8	3.7	0.90
19 or less	618	59%	2.8	3.7	0.92
20 - 24	224	64%	2.4	3.3	0.91
25 - 34	117	65%	2.4	3.2	0.84
35+	70	37%	2.5	2.8	0.31

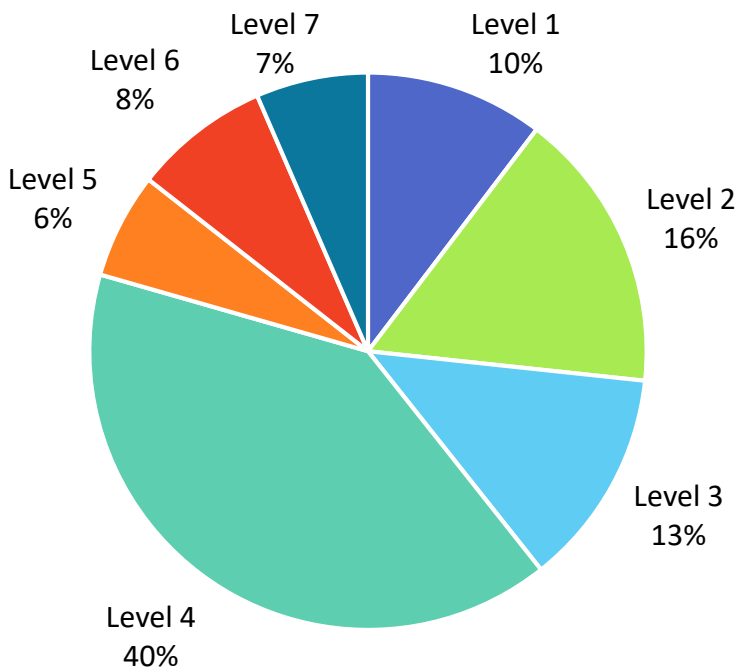
Note: The total number of enrollments is greater than the total number of unique students who enrolled in a MA at least once.

While male students had a slightly higher initial placement level than female students, the two groups improved at similar rates and to the same degree. Students 20 to 24 years old and 25 to 34 years old had the lowest average initial placement levels (2.4), but they had the highest improvement rates (64% and 65%, respectively). The youngest students, who made up the majority of participants, had the highest initial and revised average placement level, though fewer of them improved. Most strikingly, the improvement rate was far lower for students who were at least 35 years old; only 37% of them improved their placement level. Though they made up a small percent of Academy participants, these data suggest that older students may not be gaining as much from the Academy, in terms of placement levels, than younger students.

Math Course Enrollment

Of the 1,049 MA participants with valid I.D. numbers, 74% (n=774) enrolled in at least one math course in the term following the Academy. MA students enrolled in 18 different math courses over the five terms, with 79% of the enrollments in remedial math courses. Forty-percent of enrollments were in Level 4 courses – one step below transfer level – and three courses had over 100 cumulative enrollments: Math 80 (n=211), Math 23 (n=128), and Math 73 (n=104). Figure 2 displays enrollment by math course level. See Appendix A for a full list of math courses.

Figure 2. Math Courses Taken After the Math Academy, by Course Level



Improvers and non-improvers enrolled in math courses at almost the same rate; 75% of those who improved their placement scores and 73% of those who did not improve chose to take a math course in the term following the Academy.⁴ Fifty-nine percent of those students enrolled in a math course that was higher than their initial placement level. The other 41% chose to take a math course at or below their pre-Academy level, regardless of their revised placement score. Not surprisingly, 92% of students who improved their math placement scores and then enrolled in a math course in the following term did indeed chose a course that was higher than their initial placement level. However, there was a small group of students (n=37) who chose not to take a higher course, even though their placement improved. Likewise, there was a small group of students (n=33) who enrolled in a higher-level math course, even though they did not improve their placement scores during the Academy.

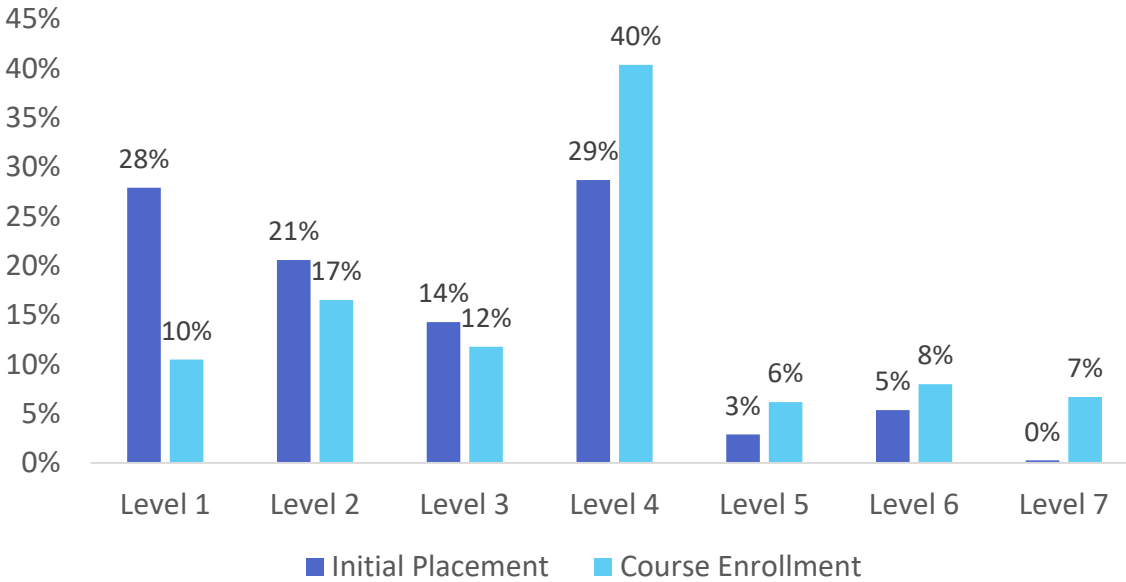
Figure 3 compares the distribution of students by initial placement level to the distribution of student enrollment in math courses by level.⁵ As shown, the proportion of students who enrolled in a Level 1, 2, or 3 math course was smaller than the proportion of students who placed at those levels prior to attending the Academy. Conversely, the proportion of students enrolled in a math course at Level 4 or higher was greater than the proportion of students who began at those levels. In other words, the distribution of students shifted toward higher-level math courses after the Academy. Notably, 28% of participants who later chose to enroll in a math course would have had to take a Level 1 course had they not had the opportunity to

⁴ The population analyzed here includes only students with CCCCO I.D. numbers and valid improvement data.

⁵ This includes students who both chose to take a math course following the Academy and for whom pre-test/initial placement level data were available.

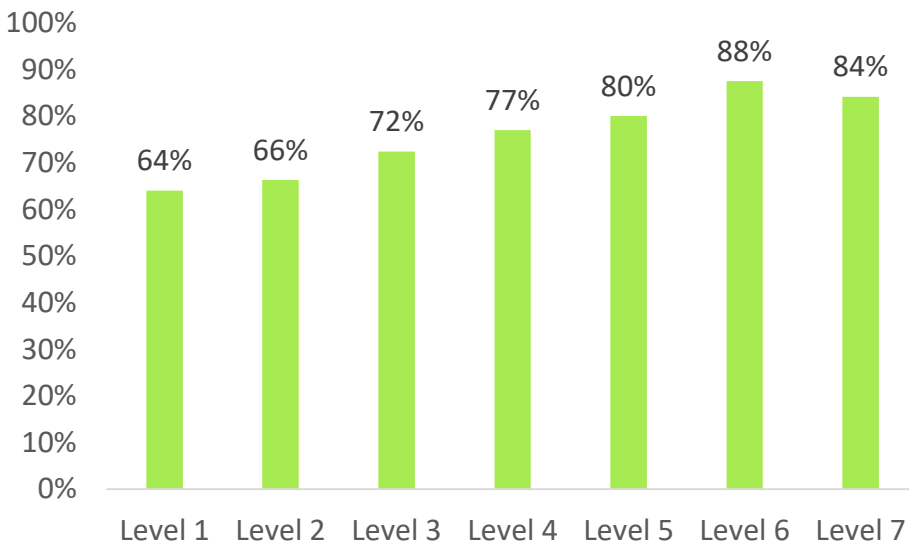
improve during the Academy. Only 10% of MA participants who subsequently enrolled in math took a Level 1 course.

Figure 3. Initial Placement vs. Course Enrollment, by Level



Students' initial and revised placements were associated with their decisions to enroll in a math course. Figure 4 shows the course enrollment rates by students' post-Academy placement levels. The 340 students who placed at Level 1 or Level 2 were much less likely to enroll in a math course than the smaller group of 135 students who placed at Level 6 or Level 7.

Figure 4. Math Course Enrollment Rate, by Revised Placement Level



As shown in Table 7, enrollment rates also varied by other student characteristics. Among the various ethnic groups, African American MA participants were least likely to enroll in a math course in the subsequent term; only 69% of them did compared to 83% of white students. Female students had a higher enrollment rate (78%) than male students (71%). Finally, the youngest students (19 years old or less) enrolled at a higher rate (80%) than older students.

Table 7. Math Course Enrollment Rate, by Student Characteristics

	Academy Participants	Enrollment Rate
African American	160	69%
Asian	131	82%
Latino	607	74%
Two or More	34	82%
White	86	83%
Female	601	78%
Male	428	71%
19 or less	618	80%
20 - 24	224	70%
25 - 34	117	65%
35+	70	67%

Math Course Outcomes

While 774 MA students enrolled in a math course in the term following the Academy, nine participants enrolled in two math courses in the same term. As a result, Math Academy students earned 783 grades, which we include in our calculations of success and retention rates. Fifty-six percent of math course enrollments by Academy participants resulted in passing grades. Math course success rates varied by term, from a low of 52% for the Summer 2013 Academy, to a high of 60% for the Summer 2014 Academy. The overall retention rate in those math courses across all terms was 79%, though it ranged from 76% for Summer 2015 to 82% for Summer 2014. Students were more successful in transfer-level courses than remedial courses. The success rate in transfer-level courses was 65%, compared to 53% for non-transfer level courses. The retention rates were similar – 80% for transfer level and 78% for non-transfer level courses. However, there were fewer transfer level students – only 161 compared to 622 remedial course enrollments.

Outcomes by Level of Improvement

Table 8 presents course outcomes, by term and by whether or not students improved their math placement level after completing the Academy. Figure 5 shows the enrollment decisions and success rates of students who completed the Academy.

Table 8. Math Course Outcomes for Students Who Did and Did Not Improve Their Math Placement Level

Term	Did Not Improve			Improved			All Participants		
	Total Grades	Success Rate	Retention Rate	Total Grades	Success Rate	Retention Rate	Total Grades	Success Rate	Retention Rate
SMA '13	33	48%	79%	52	50%	79%	86	50%	79%
SMA '14	76	62%	86%	94	57%	80%	171	60%	82%
SMA '15	74	54%	78%	148	51%	74%	224	52%	76%
WMA '16	40	68%	83%	52	50%	73%	92	58%	77%
SMA '16	88	61%	85%	115	57%	76%	210	58%	79%
All	311	59%	83%	461	54%	76%	783	56%	79%

Students who improved their math placements during the Academy were less successful than students who did not improve their placements, by 6 percentage points. The success rate for the improvers was 54%, compared to a 59% for the non-improvers.⁶ That relationship held for every term, except for the Summer 2013 Academy, in which the improvers had a higher success rate, by 2 percentage points. The gap between the two groups was most prominent among students who enrolled in remedial courses; we did not see a difference in the success metrics for the improved and non-improved students when we limited our analysis to transfer-level courses.

Outcomes by Improvement and Enrollment Decision

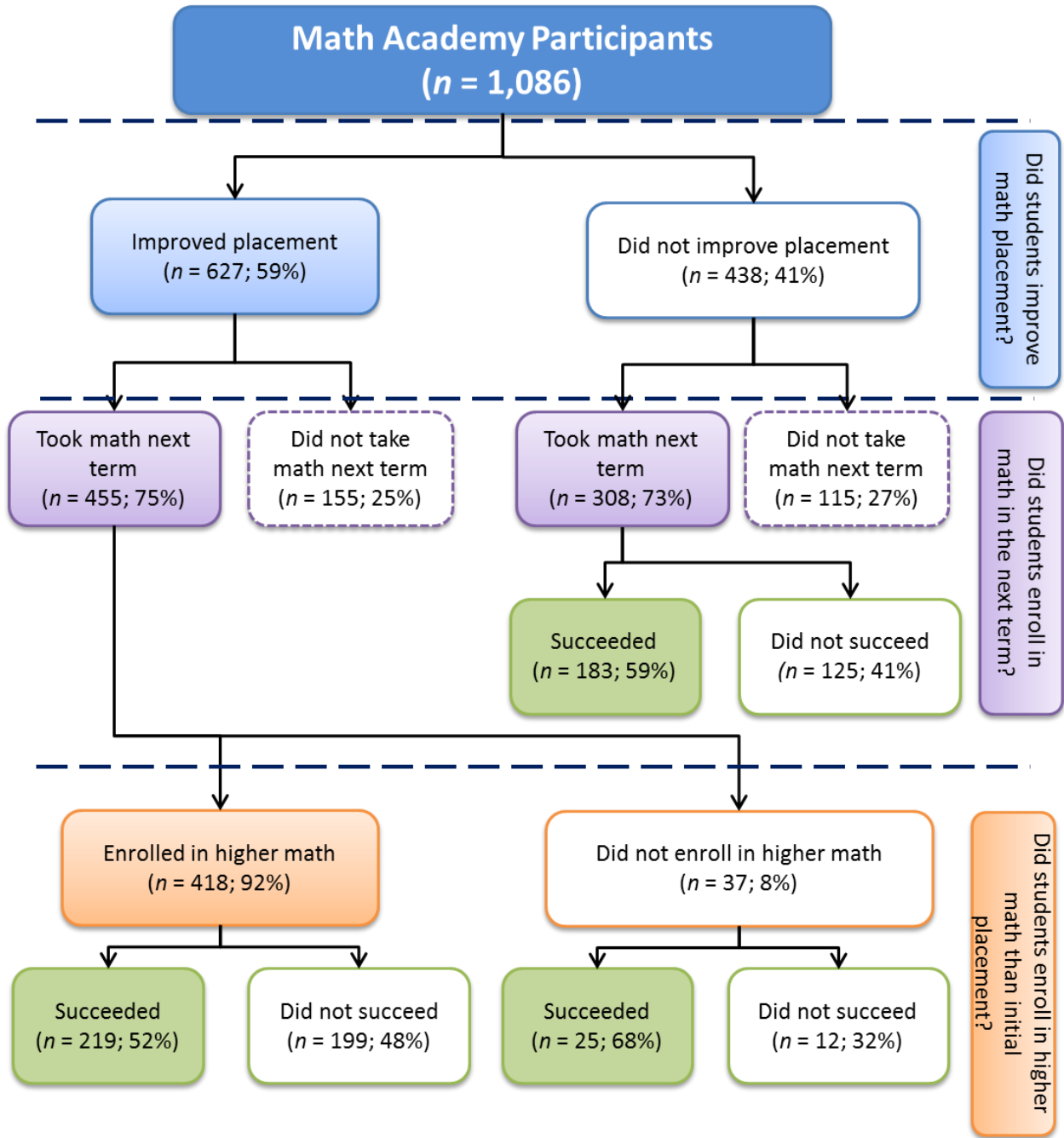
Not all of the students who improved their math course placement took a course at that higher level. The decision tree below follows the enrollment decisions of students who did and did not improve their placement levels. Of the 1,065 participants for whom improvement data were available, 75% took math in the fall. Of those students, 92% chose to enroll in a course above their initial placement level.⁷ On the other hand, 37 students who did improve their placement level decided to enroll in a course at a lower level.⁸ The success rate for the improvers who enrolled in math courses higher than their initial placement was 52%, compared to 68% for the 37 students who did not choose a higher-level course. Students who enrolled in courses below their placement levels may have had an advantage in terms of probability of success; however, they were left with a longer journey to through their math course sequence, which could decrease the chance of completing a transfer-level math course.

⁶ These success rates are calculated for the population of 772 course enrollments for which improvement data were also available. This is smaller than the total number of grades used to calculate the overall success rate.

⁷ For students who enrolled in multiple math courses in the same term, we include only the higher-level of the two courses for this analysis.

⁸ There were also 34 participants who enrolled in math courses above their placement level, even though they did not improve during the Academy. It is unclear why or how they were allowed to do so.

Figure 5. Math Enrollment Decision Tree



Outcomes by Math Course

As previously mentioned, most MA participants enrolled in remedial math courses after the Academy, and those students were less successful than participants who went on to take transfer-level math. Three courses had over 100 cumulative enrollments by MA participants over the study period. See Table 9 for outcomes in each of those courses.

Table 9. Outcomes in Math 80, Math 23, and Math 73, for Students Who Did and Did Not Improve Their Math Placement Level

Course	Did Not Improve			Improved			All Participants		
	Total Grades	Success Rate	Retention Rate	Total Grades	Success Rate	Retention Rate	Total Grades	Success Rate	Retention Rate
Math 80	84	62%	85%	122	39%	66%	211	48%	73%
Math 23	52	65%	85%	74	57%	78%	128	59%	81%
Math 73	45	73%	91%	59	51%	81%	104	61%	86%
All	311	59%	83%	461	54%	76%	783	56%	79%

Math 80, a Level 4 course, enrolled the most MA students (n=211). However, those students had a lower success rate (48%) and retention rate (73%) compared to the overall outcomes for all math courses. Further, the Math 80 students who improved their math placements were much less successful than the Math 80 students who did not improve their math placements, by 23 percentage points, and that relationship held in every term.

Math 23, a Level 2 course, enrolled 128 MA students across the five terms. They had slightly higher success and retention rates compared to all courses combined. The improvers underperformed compared to non-improvers, with a 9 percentage point gap between the success rates and a 6 percentage point gap between the retention rates for the two groups.

Math 73, a Level 4 course, enrolled 104 MA students across the five terms. The success rate for those students was 61%, which exceeds the overall success rate of 56%. Likewise, the retention rate in Math 73 was 86%, compared to the overall math course success rate of 79%. Though students were more successful in Math 73 than Math 80 and Math 23, the gap between the improvers and non-improvers was large. Math 73 students who improved their placements succeeded at a rate of 51%, which was 22 percentage points below their peers who did not improve their placement levels.

Outcomes by Demographic Group

While different student subgroups enrolled in math courses at similar rates, course outcomes varied by ethnicity, gender, and age. See Table 10 for math course outcomes disaggregated by student characteristics.

Table 10. Math Course Outcomes, by Ethnicity, Gender, and Age

	Enrollments	Percent of Enrollments	Success Rate	Retention Rate
African American	110	14%	49%	75%
Asian	107	14%	72%	85%
Latino	450	58%	50%	77%
Two or More	28	4%	54%	82%
White	71	9%	76%	89%
Female	468	60%	59%	81%
Male	306	40%	51%	76%
19 or less	495	64%	57%	81%
20 - 24	156	20%	52%	74%
25 - 34	76	10%	64%	84%
35+	47	6%	45%	70%

African American and Latino students were least successful in their math courses, with success rates of 49% and 50%, respectively. These two groups also had the lowest retention rates (75% for African Americans and 77% for Latinos) and made up a combined 72% of all MA students enrolled in math courses. White students, who made up only 9% of MA participants enrolled in math courses, outperformed the other groups with a success rate of 76% and a retention rate of 89%. The gap between the success rates for African American and white students was 27 percentage points. Female students outperformed male students in terms of success and retention. Students between the ages of 25 and 34 were the most successful age group, while older students were the least successful, with only 45% of students over the age of 34 passing their math courses. However, these two groups made up only 16% of the MA students who enrolled in math courses.

Outcomes Compared to Non-MA Participants

We compared the outcomes of MA participants to their peers in the same math courses who did not participate in an Academy.⁹ As shown in Table 11, the MA participants were more successful than the non-MA participants, by 3.3 percentage points. (See Table 11.) MA students were also retained at higher rates, again by 4 percentage points.

⁹ We limited this analysis to only those math courses in which a MA participant was enrolled and only in the terms following each Academy. We then aggregated the data across those five terms to calculate the success metrics.

Table 11. Math Course Outcomes for Math Academy Participants and Non-Participants

Course	Non-MA Students			MA Students			All ECC Students		
	Total Grades	Success Rate	Retention Rate	Total Grades	Success Rate	Retention Rate	Total Grades	Success Rate	Retention Rate
Remedial	24,813	51%	76%	622	53%	78%	25,435	51%	76%
Transfer	13,825	55%	73%	160	65%	80%	13,985	56%	73%
All	38,638	52%	75%	782	56%	79%	39,420	53%	75%

In general, ECC students – both MA participants and non-participants – were more successful in transfer-level courses than remedial courses, though by a small margin. While MA students and non-MA students performed similarly in the remedial math courses, they outperformed their non-MA peers in transfer-level courses. MA students had a 65% success rate in the transfer-level courses, compared to a 55% success rate for the non-MA students. Though this margin is wide, it is important to note that we are comparing a small group of 160 MA students to a much larger group of 13,825 non-participants.

Conclusions

In this report, we described the characteristics of the 1,086 participants in the MA from 2013 to 2016, following them from initial enrollment in the Academy to eventual enrollment in a math course. While there were disparities between different groups of students, our data suggest that students did benefit from their participation in the Academy. Our analysis shows that many MA participants improved their math course placement levels, and that, overall, participants who subsequently enrolled in math courses outperformed non-MA participants in the same courses. However, there was significant variation in the degree to which placement levels changed, the rate of subsequent math course enrollment, and math courses outcomes among MA participants. Though students entered the Academy at different placement levels, 93% were not prepared for transfer-level math courses. By the end of the program, 59% of participants improved their placements, though fewer moved from a remedial to a transfer-level course placement. It was most difficult for students to move up from an initial placement at Level 4, which is one step below transfer-level. Only 32% of those students improved their placements. Similarly, Level 2 stood out as a potential roadblock, with only 59% of Level 2 initial placements improving. Program coordinators may want to investigate why those leaps are so difficult and how instructors can help students overcome those barriers.

In order for the MA to achieve its mission of accelerating participants through the ECC math course sequence, students must enroll in math courses, ideally above their initial placement levels, in the subsequent terms. Seventy-four percent of participants did enroll in a math course; however, students whose revised placements were at Level 1 or Level 2 were much less likely to enroll than those at the two highest levels. These findings warrant additional investigation. With a better understanding of student decision-making, program coordinators

can design interventions that encourage students to seek a return on their investment in the Academy by enrolling in a math course.

In addition to encouraging students to attempt a math course following the Academy, program coordinators may consider following-up with students after the Academy. Our results suggest that certain groups of MA participants could benefit from continued support in their math courses. In particular, students who did improve their placements and subsequently enrolled in remedial math courses were less successful when compared to MA participants in the same courses who did not improve their placements. This trend may be due to the decision of the improvers to enroll in courses that were more challenging than the courses for which they initially qualified to attempt. On the other hand, these data suggest that students benefitted from the Academy even if they did not improve their placements. The knowledge and skills gained during the Academy may have helped students succeed in their math courses, even if they did not qualify for a higher-level course.

There is an implicit tradeoff when students choose to take a math course above their initial placement level. Students who choose to forgo the benefit of an improved placement and enroll at or below their initial placement may have superior success rates in those courses, compared to students who enrolled higher; however, in the short-term, they could not reap one of the primary benefits of improving their placement level – to move through the math course sequence more quickly. On the other hand, though students who do attempt more challenging courses may be bypassing one step toward fulfilling their math goal, they cannot continue to move forward if they do not pass those more challenging courses. Program coordinators should consider these tradeoff, to determine if all students should be encouraged students to enroll in higher math courses even if it may lower their probability of success in those courses. This apparent disadvantage may be mitigated with increased support.

Lastly, when we disaggregated the data by student characteristics – ethnicity, gender, and age – we found significant discrepancies between groups. While students 35 or more years old made up only 6% of MA participants, their numbers have increased over time. This demographic group may need targeted support as the oldest students generally underperformed, compared to younger students. Likewise, compared to female participants, males were less likely to enroll in a math course and then pass the courses in which they did enroll, though both groups improved their placement levels at similar rates. The most striking disparities were between African American students and the other ethnic groups. African American students entered the Academy at lower placement levels than the other ethnic groups, and also were least likely to improve their placements, enroll in a math course after the Academy, and then pass a math course, if they did enroll. These data reflect larger trends related to equity at ECC.

In conclusion, our analysis clearly indicates that students benefitted from their participation in the MA and that the program deserves continued investment. Enrollment has been increasing over time, and program should continue to recruit students, especially from groups that are under-represented or face larger barriers to success. The MA is well-positioned to prepare students for success in their math courses and to also address equity-related issues on campus.

Appendix A

Table 12. MA Participant Enrollment and Outcomes in Specific Math Courses

		Total Grades	Success Rate	Retention Rate
Level 1	MATH-12	31	61%	81%
	MATH-37	50	56%	86%
Level 2	MATH-23	128	59%	81%
Level 3	MATH-40	77	40%	75%
	MATH-60	13		
	MATH-67	9		
Level 4	MATH-73	104	61%	86%
	MATH-80	211	48%	73%
Level 5	MATH-110	1		
	MATH-115	1		
	MATH-120	2		
	MATH-130	6		
	MATH-150	15	87%	87%
	MATH-170	23	65%	78%
Level 6	MATH-180	61	64%	79%
Level 7	MATH-160	3		
	MATH-165	2		
	MATH-190	46	61%	80%
	All Courses	783	56%	79%