



# Gaps in Math Achievement by Demographic Group

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The purpose of this report is to understand gaps in math achievement by demographic group including first generation (FG), minority, and Pell students. Along with institutional data, this report utilizes survey data collected by the PACE center to inform how time spent studying influences Math Placement Exam (MPE) performance.

## Executive Summary

FG, minority, and Pell students are significantly less likely to place into college algebra compared to their peers after controlling for prior academic preparation. Additionally, self-reported data concludes that there are not differences in the amount of time FG, minority and Pell students spend preparing for the MPE. Results suggest that students should expect to spend two or more hours preparing for the MPE in order to place into college algebra or higher regardless of CCE index score.

FG, minority, and Pell students are also significantly less likely to complete their AUCC math requirement within the first year compared to their peers after controlling for prior academic preparation. Results also show that the strong positive association between first-year math completion and retention to the second-fall is equally important for all demographic groups. Further inquiry into institutional strategies that enhance MPE performance and encourage first-year AUCC completion specifically for FG, minority, and Pell students is recommended.

## Data

The data for this analysis includes the FA14 first-time, full-time (FTFT) cohort of new freshman. There are 4284 students in the FA14 cohort. Nearly 24% are first generation and approximately 21% are minority and Pell recipients. This report also includes math survey data collected by the PACE center for 67% of the first-time, full-time (FTFT) cohort.

College algebra placement is a proxy measure for math preparation and is based on students MPE results. However, there are 828 students, about 20% of the FA14 FTFT cohort, that do not have an MPE score. Among these students, 91% do not have an MPE score because they transferred in the course credit (e.g. AP/IB, another institution); therefore, 9% (76 students) did not complete or transfer in any math courses during their first year. Among these 76 students, FG, minority, and Pell students are overrepresented (33%, 29%, and 38%; respectively). Thirty-two of these 76 students are retained to the second-fall and might be a group to target for intervention.

First-year math completion is measured by whether or not the student completes their AUCC math requirement within the first year. This outcome includes transfer courses that can be submitted at any point prior to graduation and transferability is assessed on an ongoing basis. Because of this ongoing transfer process, the overall rate of first year AUCC math completion within students' first-year increases for several years following the cohort semester. The current overall rate of AUCC completion is 71.2%, which most likely increase to about 80% within the next few years. This analysis is limited by the time-lag of this outcome; however, the gaps among this preliminary data will certainly persist and warrant attention.



## Math Outcomes by Demographic Group

This section discusses the gaps in both algebra placement and meeting the math AUCC requirement in the first year by demographic group.

### Algebra Placement by Demographic Group

The majority of new freshman complete the MPE which places them into the appropriate math course. This analysis focuses on categorizing students by grouping those who place into college algebra or higher compared to those who do not among the 80% of students who took the exam. Math placement outcome is a measure of CSU student math readiness. Table 1, below, displays the distribution of math placement for the overall cohort and by demographic attribute.

**Table 1.**

Rate of Placing into College Algebra on MPE by Demographic Group

	Overall	First Generation	Minority	Pell Eligible
Testing into College Algebra or higher	84.6%	79.2%	79.0%	78.7%
Not ready for College Algebra	15.4%	20.8%	21.0%	21.3%

Overall among the FA14 cohort, about 85% of students with an MPE score place into college algebra. First generation, minority and Pell eligible students all have a lower rate of testing into the college algebra compared to their peers. Only about 79% of first generation, minority, and Pell eligible students place into college algebra. The association between algebra placement and student demographic is statistically significant for each demographic group ( $p < .000$ ). The gap between college algebra placements for FG students (compared to the overall rate) is about 5 percentage points and the gap for Pell eligible and minority students is about 6 percentage points. For instance, 79.2% of FG students place into college algebra compared to 84.6% of all students, which is a 5.4 percentage point difference.

### AUCC Completion within First-Year by Demographic Group

The second math outcome measures whether or not students complete their math AUCC requirement within their first year at CSU. This outcome is a measure of first year math completion. All FTFT students in the FA14 cohort are evaluated for this outcome regardless of whether they complete their MPE. Table 2, below, displays the distribution of math placement for the overall cohort and by demographic attribute.

**Table 2.**

Rate of Completing AUCC Math Requirement within First Year by Demographic Group

	Overall	First Generation	Minority	Pell Eligible
Completed Math AUCC Requirements within 1st Year	71.2%	64.6%	64.1%	63.1%
Did not complete Math AUCC in 1st Year	28.8%	35.4%	35.9%	36.9%

Overall among the FA14 cohort, about 71% of students complete their math AUCC requirement within their first year compared to 65% of first generation, 64% of minority, and 63% Pell eligible students. The association between AUCC math completion and student attribute is statistically significant for each demographic group ( $p < .000$ ). The gap between AUCC completion for FG and minority students (compared to the overall rate) is about 7 percentage points and the gap for Pell eligible students is about 8 percentage points. For instance, 63.1% of Pell eligible students complete their math AUCC requirement within their first year compared to 71.2% of all students, which is an 8.1 percentage point difference. The differences in first year math success are slightly larger than the differences in math preparation.



### Significance of Math Outcomes

Prior multivariate analyses of FTFT cohorts at CSU reveal a substantially important association between first-year math completion and future retention and graduation. Table 3, below, displays the freshman retention rates by AUCC completion status and demographic group for all FTFT students at CSU. Regardless of demographic group, there is a strong positive association between freshman retention and first year math completion.

**Table 3.**

Freshman Retention by First-Year AUCC Status and Demographics

	Overall	First Generation	Minority	Pell Eligible
Completed Math AUCC Requirements within 1st Year	92.4%	86.9%	90.9%	90.0%
Did not complete Math AUCC in 1st Year	72.4%	66.6%	72.6%	70.4%

There is a 20 percentage point difference in the freshman retention rate for students who complete the AUCC math requirement in the first year compared to those who don't (92.4% & 72.4%; respectively). The difference in retention rates by demographic group is similar (20.4, 18.3, & 19.6 percentage points for FG, minority, and Pell eligible students; respectively). The similarity of percentage point differences in retention rates for diverse students compared to the overall difference at CSU indicates that the association between first year math success and freshman retention is equivalent regardless of demographic. In other words, first year math completion has a strong positive association with freshman retention for all students.



### Association between Time Spent Preparing for MPE and Algebra Placement

Students that take the MPE during the summer complete a survey that includes a question that asks how long the student spends preparing for the MPE. Table 4, below, shows the results of a logistic regression model that has college algebra placement as the outcome variable with index score and time spent studying as input variables. Index score is a composite score of high school GPA and ACT/SAT test score. This analysis is only completed among those students with MPE survey data (about 70% of the FTFT cohort).

**Table 4.**

Association between Study Time and Algebra Placement after Controlling for Index		
	Odds Ratio	P-Value
Index	1.10	0.000
0 to 2 Hours (compared to 0 hours)	1.06	0.738
2 to 5 Hours (compared to 0 hours)	1.78	0.002
5 to 10 Hours (compared to 0 hours)	3.10	0.000
More than 10 Hours (compared to 0 hours)	3.37	0.003

Results from this study show that there is a strong positive association between time spent studying (over 2 hours) and college algebra placement even after controlling for index. For instance, a student that reports spending 0 to 2 hours studying has very similar odds of placing into college algebra compared to a student who didn't spend any time preparing; however, a student who spends 2 to 5 hours has 78% higher odds of placing into college algebra compared to the student who didn't study at all and a student who spends 5 to 10 hours studying has 10% higher odds of placing into college algebra compared to the student who didn't study at all (after index is controlled for).

### Time Spent Preparing for MPE by Demographic Group

A possible explanation for the lower rate of placing into college algebra for diverse students could be that these students are studying less than their peers. Table 5, below, shows the distribution of time spent studying overall at CSU and by demographic group.

**Table 5.**

Amount of Time Spent Studying for MPE by Demographic Group				
	Overall	First Generation	Minority	Pell Eligible
None	12.1%	12.1%	11.0%	13.5%
Less than 2 Hours	41.5%	42.5%	40.5%	39.3%
2 to 5 Hours	32.2%	30.7%	32.3%	33.4%
5 to 10 Hours	9.8%	9.4%	11.0%	9.8%
More than 10 Hours	4.3%	5.3%	5.3%	4.1%

The amount of time spent studying for the MPE does not differ by demographic group. The association between time studying and each demographic group is not statistically significant.



## Math Outcomes by Demographic Group Controlling for Academic Preparation

One possible explanation for the differences in math preparation and first year math success for FG, minority, and Pell students is that they have lower levels of academic preparation in high school. The following section explores the association between demographic group and math outcome while controlling for CDHE index score. Table 6, below, shows the association between demographic attribute and each math outcome after controlling for high school academic preparation.

**Table 6.**

Associations by Demographic Group for Math Outcomes after Controlling for Index

	Algebra Placement		AUCC Completion	
	Odds Ratio	P-Value	Odds Ratio	P-Value
Index	1.10	0.000	1.06	0.000
Minority Status	0.77	0.024	0.82	0.017
First Generation	0.72	0.003	0.78	0.003
Pell Eligible	0.75	0.013	0.75	0.001

Each demographic group has a negative association with both math outcomes after controlling for index. This negative association after controlling for index indicates that other factors besides academics could be contributing to the lower rates of success for FG, minority, and Pell eligible students. For instance, a minority student with an average index (115) has 23% lower odds of placing into college algebra compared to a non-minority student with a 115 index. This same minority student also has 18% lower odds of completing their math AUCC requirement compared to the same non-minority student. This association is even stronger for FG and Pell eligible students. A FG student with an average index has 28% lower odds of placing into college algebra compared to a non-FG student and this same FG student has 22% lower odds of completing their AUCC requirements for math in the first year compared to a non-FG student with the same index score.

## Conclusions

There are significant differences in math placement and first year math completion by demographic group. FG, minority, and Pell students are significantly less likely to place into college algebra or to complete their AUCC math requirement within the first year. These significant differences persist even after controlling for CCHE score.

First-year math completion is strongly associated with retention to the second-fall. This strong positive association is the same for each demographic group. This indicates that completing the AUCC requirement within the first year is important for all students regardless of demographics.

Additionally, self-reported data indicates that there are not differences in the amount of time FG, minority and Pell students spend preparing for the MPE. Analysis indicated that students should expect to spend two or more hours preparing for the MPE in order to place into college algebra or higher regardless of CCHE index score.

These results suggest that the math success is important for all students and that lower rates of MPE placement and first-year math completion maybe the result of something other than academic preparation/time spent studying for FG, minority, and Pell students. Further inquiry into institutional strategies that enhance MPE performance and encourage first-year AUCC completion specifically for FG, minority, and Pell students is recommended.