College and Career Ready: How Well Does 8th Grade MAP Performance Predict Post-Secondary Educational Attainment?

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May 2024

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Abstract

Like most other states, Missouri uses assessments intended to measure whether students are on a pathway to "college and career readiness." The state longitudinal data system now has the capacity to directly test that claim. We make use of 8th-grade assessment (MAP) scores in Math, Science, and Communication Arts for roughly 260,000 first-time Missouri freshmen who began high school between Fall, 2009 and Fall, 2012. These students were tracked through high school and for five years following on-time high school graduation. We find a strong positive association between MAP performance scores in 8th grade Math, Science, and Communication Arts and post-secondary college attendance and degree completion. This is true overall and for White, Black, and Hispanic students disaggregated by gender. Proficiency on all three exams matters even more. Based on a logistic forecasting model, if all students who scored below Proficient on the 8th-grade MAP raised their scores to Proficient, the number earning post-secondary degrees would increase by roughly 50 percent. Black and Hispanic students earning post-secondary degrees would increase by roughly 150 and 75 percent, respectively. We conclude that 8th-grade MAP proficiency scores are highly informative about whether students are on a pathway to college and career readiness.

1. Introduction

The higher stakes federal consequences of the No Child Left Behind Act (NCLB) have given way to weaker nudges in the 2015 Every Student Succeeds Act (ESSA). Nonetheless, ESSA requires that all states have accountability systems that make use of early grade assessments in English, Math, and Science intended to measure student progress toward "college and career readiness" (Every Student Succeeds Act, 2015).

A substantial literature has examined the relationship between measures of high school academic achievement and economic mobility.[1] However, few papers have examined the link between NCLB grade 3-8 state assessments in state longitudinal data systems (SLDS) and post-secondary achievement. Some have used state assessment data to identify "at risk" students (e.g., Li, et.al., 2017; Fazlul, Koedel, Parsons, 2022). However, rather than using a SLDS to identify downside risk, in the paper we use it to identify the association between 8th grade performance and later college achievement. This is similar in spirit to Austin, et.al. (2023), who examine academic mobility of students in grades K-12 in seven states (including Missouri). However, in our case, we examine the relationship between student performance levels on all three 8th-grade state assessments (Missouri Assessment of Progress, or MAP) and subsequent educational attainment for Missouri public school students.

Performance levels are the typical way that state assessment results are reported to students, parents, school staff and the general public. They are also the measures that enter state accountability systems. This is the case with MAP as well. Based on their reported scale scores

[1] For a recent survey see Chingos and Furtado (2024).

students are placed into one of four performance levels – Below Basic, Basic, Proficient, or Advanced – all intended to track the "college and career readiness" of the student. [2]

These cutoffs are set by panel members who make judgements regarding the appropriate cuts for the various levels. They base these on the state standards for the subject and grade, and their own experience and knowledge of the field. They are also informed by data on the distribution of scores for current test-takers. Although the intent of the exercise is to assess progress toward "college and career readiness," these panel members are making informed guesses as to how student performance on these assessments will translate into post-secondary outcomes such as college attendance and degree completion many years in the future. However, with the development of State Longitudinal Data Systems (SLDS), heavily subsidized by the U.S. Department of Education, state policymakers can now assess the relationship between performance on state assessments and post-secondary education attainment.

Missouri's SLDS, first implemented in 2006, now makes it possible to track multiple cohorts of students through the public K-12 system and into post-secondary education and training. This permits researchers to empirically examine the relationship between students' performance on the 8th-grade standardized assessment and post-secondary education achievement.

This paper contributes to the research literature on NCLB by examining the long-run association between the performance levels on pre-high school assessments, in the form these are

[2] "Student performance on the total test can be reported in terms of four performance levels that describe a pathway to proficiency and **college and career readiness**. Each performance level represents standards of performance for English Language Arts, Mathematics, and Science. Panels drawn from education, business, and professional communities determined the performance standards." (Emphasis added) https://dese.mo.gov/media/pdf/map-grade-level-assessment-spring-2023-guide-interpreting-results

reported to parents and to the general public and which inform the state accountability system, and post-secondary educational attainment. We find strong positive relationships between performance and educational attainment in the overall population and for race-by-gender groups. Given the strength of these relationships, we estimate a statistical model that predicts post-secondary educational attainment based on 8^{th}-grade performance scores on all of the NCLB tested areas (i.e., Communication Arts, Math, Science). We use the model to simulate the effect of reaching the NCLB target of moving all students who score below Proficient to Proficient on all of the assessments. The model forecasts large increases in post-secondary degree attainment in the overall population, driven by very large increases for Black and Hispanic students.

2. Data

The data for this study comes from the State Longitudinal Data System (SLDS) maintained by the Missouri Department of Elementary and Secondary Education (DESE). We use four cohorts of first-time 9^{th}-grade students who began public high school in Fall 2009 – Fall 2012. There are approximately 70,000 students per cohort attending 545 public high schools. The analytic population is restricted to White, Black, and Hispanic students. The three racial/ethnic groups constitute 96.1% of the total first-time 9^{th}-grade students yielding a total sample size of 264,590 students. The racial/ethnic composition of the analytic population is 78.2% White, 17.5% Black, and 4.3% Hispanic.

We examine three post-secondary outcomes plus high school graduation. High school graduation information uses the SLDA data. The post-secondary outcomes make use of a link between DESE SLDS student records and data from the National Student Clearinghouse (NCS). The NCS tracks student enrollment by semester and covers 97 percent of public and private higher education institutions across the country. Missouri high school student data are linked to five years of the NSC data following expected on-time high school graduation. NSC data provides information on college enrollment (e.g., start and end date, full-time or half-time status, majors), institution types (e.g., two-year vs four-year and private vs public), and degree completion. Note that the NSC data includes post-secondary enrollment in Missouri as well as out-of-state institutions.[3]

3. 8th Grade MAP Performance Levels

Missouri 8th graders took three state assessments: Math, Science, and Communication Arts.[4] As noted above, based on test performance, students are placed into one of four performance levels, ranked low to high: Below Basic, Basic, Proficient and Advanced.

Figure 1 reports the overall distribution of students in our student population by the four performance levels on the three assessments. The distribution of students varies across the three assessments. For example, 14.8 and 16.2 percent of students score Below Basic on the Math and Science exams, respectively. However, only 4.6 percent score in this bottom category in Communication Arts. Overall, the Science exam seems to be the toughest, with relatively fewer students scoring Advanced and more scoring Below Basic. Figure 2 shows a wide disparity in test performance across the eight race and gender groups considered in this study. White female students receive the highest scores on Communication Arts and White male students score highest on Math and Science. Black male students have the largest share of Below Basic scores on all of the assessments. Hispanic students of either gender generally fall between Black and White students in performance.

4. 8th Grade MAP Performance and Educational Attainment

In Figure 3 we show the relationship between these 8th-grade MAP scores and educational attainment. For each exam, we show the share of students at each MAP performance

[3] https://www.studentclearinghouse.org/about/how-we-serve-the-k-20-to-workforce-continuum/
[4] Communication Arts has since been renamed as English Language Arts

level who reach the education attainment milestone. The association is positive for all of the exams and educational milestones. The strength of the association is stronger for higher levels of education attainment. For example, the share of Math Below Basic students who attend college is .189 versus .74 for Advanced – a ratio of 3.9. The share of Math Below Basic students who earn a four-year degree is .015 versus .445 for Advanced – a ratio of 29.7.

The previous calculations illustrate one way to characterize the strength of the association between MAP performance levels and educational outcomes. These are called odds ratios, and are simply the ratio of probabilities of a given educational outcome for students in a higher and lower 8th-grade performance level on a given MAP exam. In Figure 4, we report the odds ratios for various levels of educational attainment for a student scoring Advanced versus a student scoring Below Basic on the MAP exams. For example, as compared to a Below Basic student, a student scoring Advanced on the 8th grade Math MAP exam is 1.4 times as more likely to graduate from high school, 3.9 times more likely to attend college, 13.5 times more likely to earn a post-secondary degree, and 29.7 times more likely to earn a four-year degree. While higher scores on all three exams are associated with improved odds of educational attainment, the Communication Arts exam has the strongest positive association. For example, the Advanced to Below Basic odds ratio for earning a four-year college degree is 29.7 for the Math exam but 61.6 for the Communication Arts exam.[5]

5. MAP Scores and Educational Attainment by Race/Ethnicity and Gender

In the previous section, we found a strong association between 8th-grade MAP scores and subsequent educational attainment. In this section, we examine whether this association holds for

[5] To simplify exposition, we have suppressed information on standard errors in the text. In the Appendix we report standard errors for all of the statistics reported in the text. In the example above, the odds ratio for Communication Arts is significantly larger than the similar odds ratio for Math or Science.

race and gender groups. As noted in the Data section, our analytic population includes all students identified as White, Black or Hispanic in the SLDS data system (96 percent of Missouri public school enrollment). In this analysis, students are classified into six groups: White, Black, and Hispanic by gender. We will consider the same four educational attainment outcomes: high school graduation, college attendance, degree completion (any), and four-year degree completion. Hence, we have 24 relationships (four outcomes by six groups) to examine. Figures 5-7 report results for each of the three MAP exams. The same strong positive relationship between the performance levels and educational attainment observed in the overall population is also found for each of the six groups.

Figure 8 provides simple summary measures of the association between educational attainment and MAP performance measures by race/ethnicity and gender. Here we report the odds ratio of various outcomes for students who score Proficient versus Basic on the 8th-grade exam. We see that the association is very strong within all of the six groups. The odds of earning a post-secondary degree roughly double for a student who moves from Basic to Proficient on any of the exams. The odds of earning a four-year degree roughly triple for the same achievement gain.[6]

6. Moving All Students to Proficiency in 8th Grade

The goal of federal legislation such as No Child Left Behind (NCLB) and the Every Student Succeeds Act (ESSA) is to raise the performance of all students to at least Proficient on their state assessment. This is the aim of state accountability systems as well. The SLDS data allow us to simulate the effect of 100 percent proficiency on educational attainment. In order to do this, we estimate a simple logit probability model for the various educational attainment

[6] Given the small cell sizes for some of the groups, it was not possible to reliably estimate the odds ratio for Advanced versus Below Basic reported earlier for all students.

outcomes we have considered (e.g., college attendance, degree completion). The model is estimated at the student level, where the attainment outcome for student i (Y_i) is specified as a function of the performance levels of the 8th grade MAP assessment in three subjects. Vectors of categorical indicators for performance levels and the FRL indicator are entered in the following statistical model, and this is estimated separately for each of the six groups:

$$logit(Y_i) = \ln\left(\frac{P(Y_i = 1)}{1 - P(Y_i = 1)}\right) = \beta_0 + \beta_1 MathPL_i + \beta_2 SciencePL_i + \beta_3 CAPL_i + \beta_4 FRL$$

Consistent with the graphical analysis discussed in the previous section, we find large, significant positive effects of each exam on educational outcomes. In addition, the model overall demonstrates good performance in predicting educational attainment for individuals and for each subgroup. Concordance rates rise from 75 percent for college attendance, to 80 and 82 percent for any degree completion and four-year degree completion. Details are presented in the Statistical Appendix.

We used the estimated coefficients from the probability model to examine the following scenario. We simulate the increase in overall educational attainment if all students who currently score Below Basic and Basic raised their scores to Proficient. Figure 9 presents the results at the population level and for each of the race/ethnicity by gender groups.

Two points are worth noting. First, increases in educational attainment are much larger as a result of raising the performance level for all three assessments rather than a single assessment, hence the much larger proportionate impacts in these as compared to the earlier figures. Second, these effects are much more pronounced for Hispanic students, and especially Black students, as compared to White students, because the boost to 100 percent Proficient and above is proportionately much larger given their lower initial starting point (Figure 2).

Figure 9 reports results on two levels of post-secondary degree attainment: any degree and four-year degree. If all students who are below Proficient reached Proficient our estimate is that the number students earning a post-secondary degree would grow by 52.2 percent. Students earning a four-year degree would grow by 55.4 percent. The range of impacts among the groups, however, is very large. Focusing on the any degree results, the gains for White male students and female students are 37.5 and 41.7 percent respectively. For Black female and male students the corresponding gains are much larger – 152.3 and 154.3 percent respectively.

7. Conclusion

Missouri, like most other states, uses assessments in its accountability system that are intended to indicate whether students are on a pathway to "college and career readiness." The state longitudinal data system (SLDS) now has the capacity to assess directly the strength of the association between 8th-grade MAP scores in Communication Arts, Science, or Math and post-secondary educational attainment. Using data for four cohorts of high school freshman, we find a very strong association between 8th-grade MAP performance levels on each of the assessments and post-secondary degree completion, overall and by race/ethnic and gender groups. Odds ratios, commonly used in reporting biomedical findings, are a useful way to summarize the association between performance levels and post-secondary achievement. We find that a student scoring Proficient on any of the 8th grade assessments is roughly twice as likely to earn a post-secondary degree and three times as likely to earn a four year degree as a student scoring Basic.

We used the SLDS data to estimate a student level model of educational attainment linking 8th-grade MAP performance levels and post-secondary attainment. Using this model, we simulated the effect of attaining the NCLB goal of 100 percent Proficient or higher for all students. We find that, if all Missouri students who currently score Below Basic and Basic are raised to Proficient, the number of 9th-grade students who earn post-secondary degrees would increase by more than fifty percent. Black and Hispanic students, who start at much lower levels of MAP performance, have expected gains of 152 and 75 percent, respectively.

There is considerable controversy about the role of standardized tests in state accountability systems. Critics have argued that the tests are inadequate measures of school performance and may exhibit racial bias (e.g., Koretz, 2017; Jiminez and Mondaffari, 2021; Long, 2023). However, our examination of the Missouri experience finds that the NCLB-mandated 8th-grade assessments are strongly associated with post-secondary educational attainment – overall and by subgroup. We also note that many students who do not reach Proficient attend college. For example, 37% of all students who score Basic in Math attend college, with the highest percentages (45%) for Black female and White female students. However, most of these students do not complete a degree. Thus, attainment of the NCLB goal of universal 8th-grade proficiency as measured by these assessments would improve degree completion rates not just by increasing college attendance, but also by increasing their degree completion rates once in college. Importantly, moving students to proficiency would produce exceptionally large gains for Black and Hispanic as compared to White students and thus considerably narrow post-secondary educational attainment gaps.

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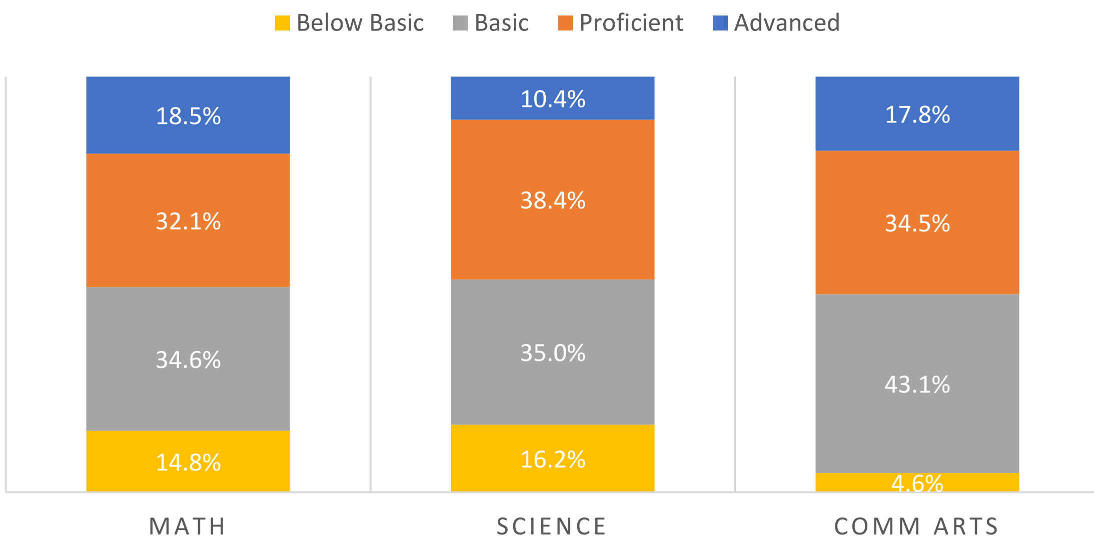
Figures

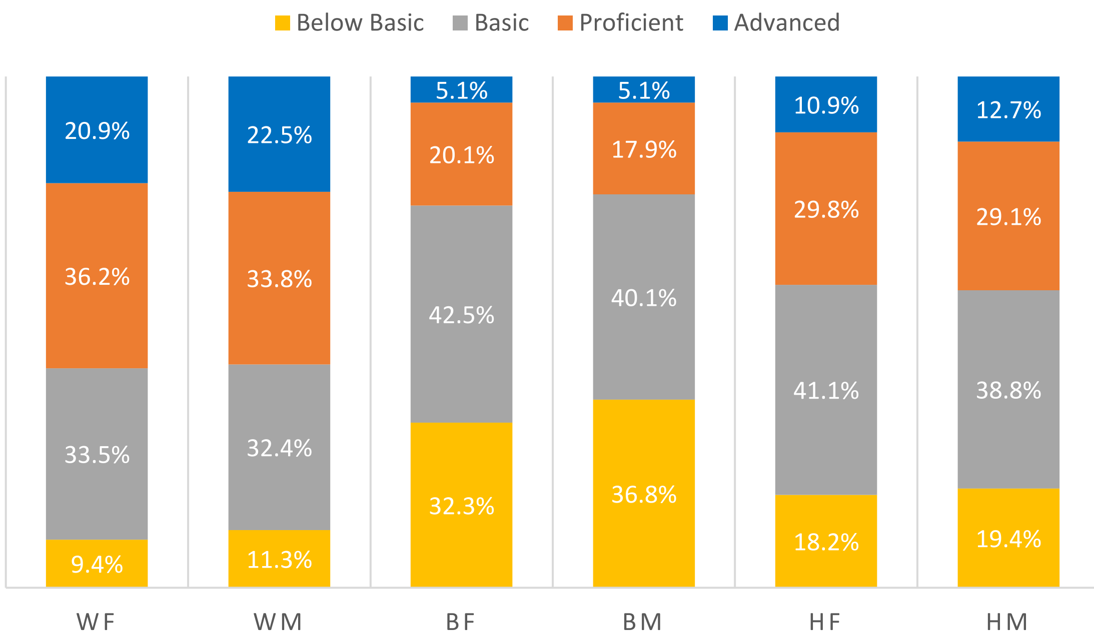
Figure 1. Population Distribution of 8th Grade MAP Scores by Performance Level



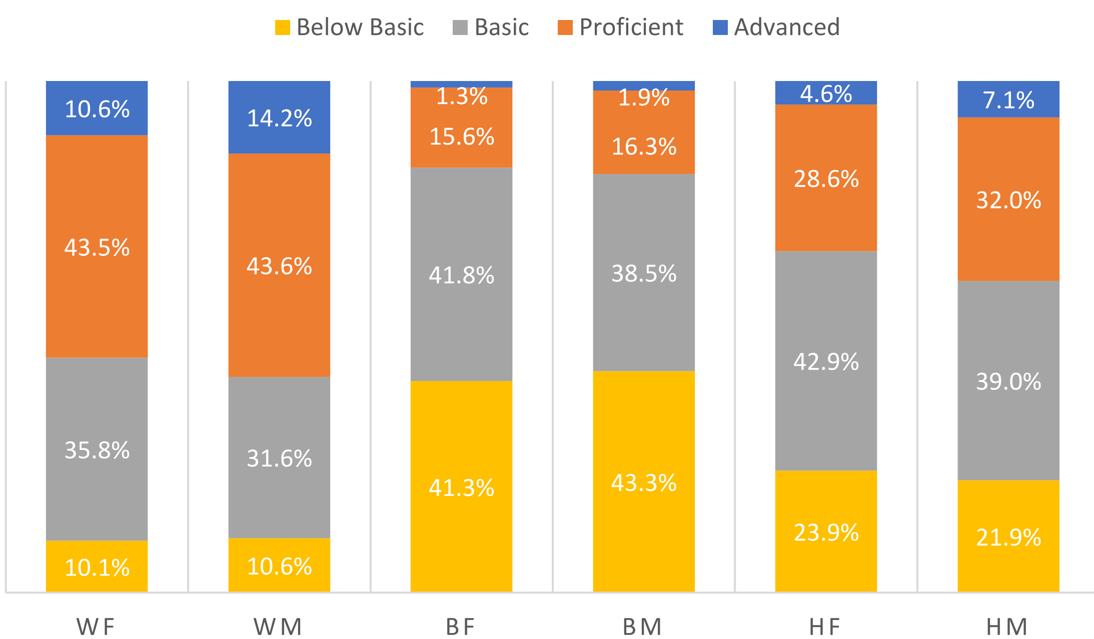
Notes: Fall 2009-Fall 2012 First Time Fall Missouri High School Freshman

Figure 2. MAP Scores by Racial/Ethnic and Gender Groups

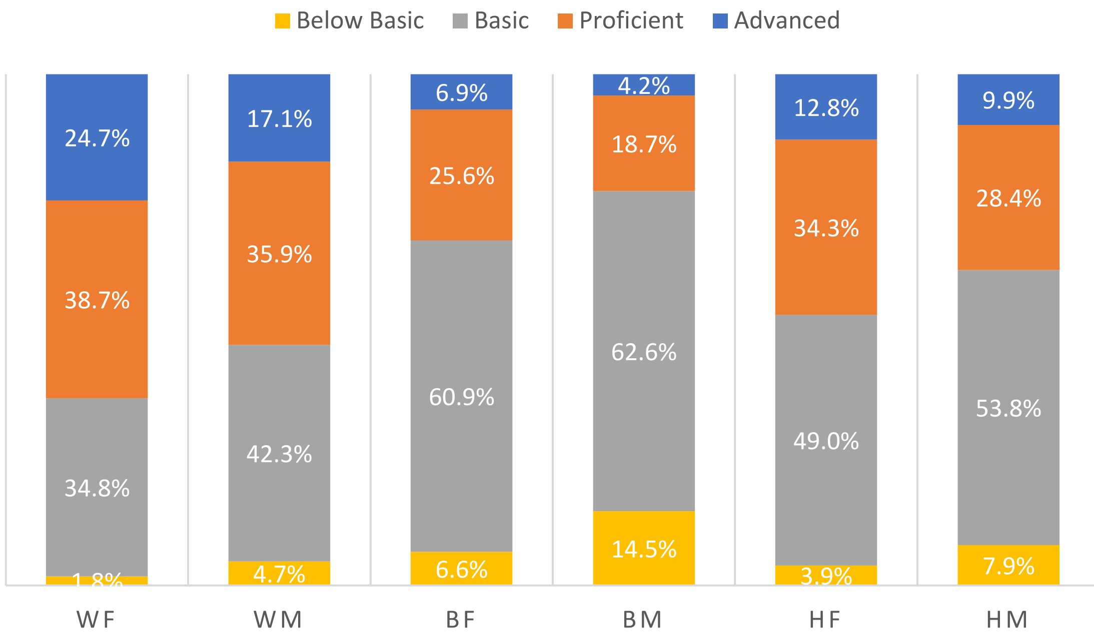
a. Math



b. Science



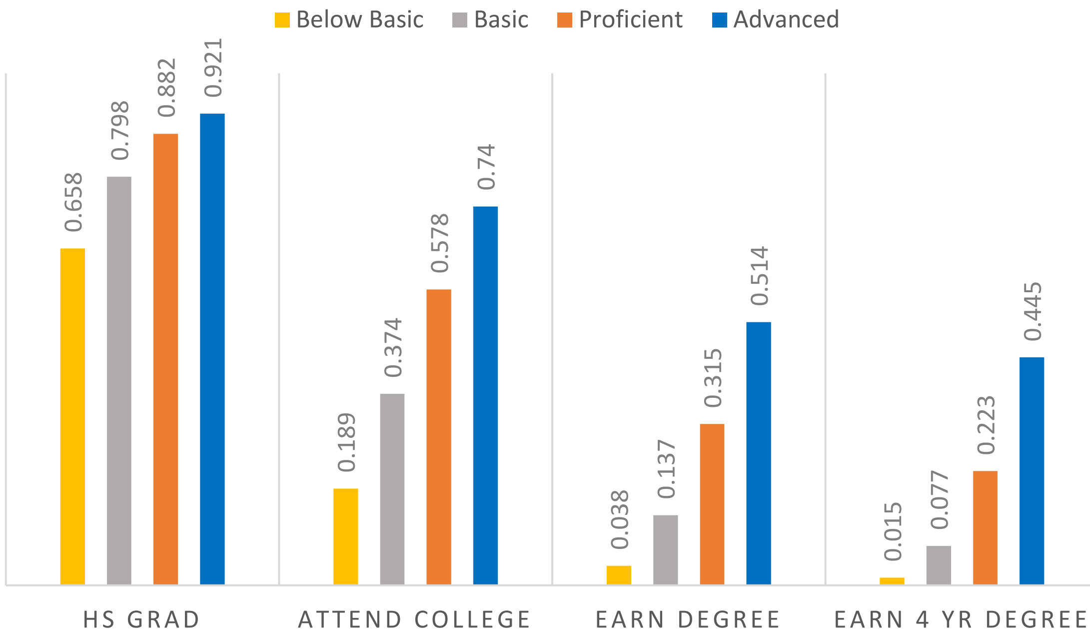
c. Communication Arts



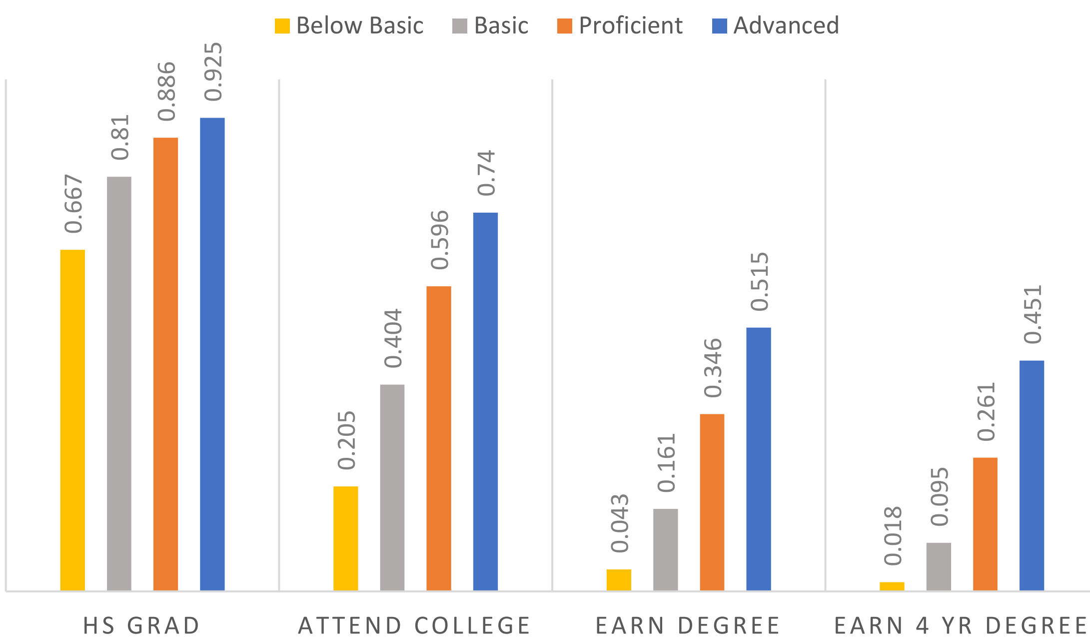
Note: Fall 2009-Fall 2012 First Time Fall Missouri High School Freshman. WF=White Female; WM=White Male; BF=Black Female; BM=Black Male; HF=Hispanic Female; HM=Hispanic Male

Figure 3. 8th Grade MAP Performance Levels and Educational Attainment in the Population

a. Math MAP



b. Science MAP



c. **Communication Arts MAP**

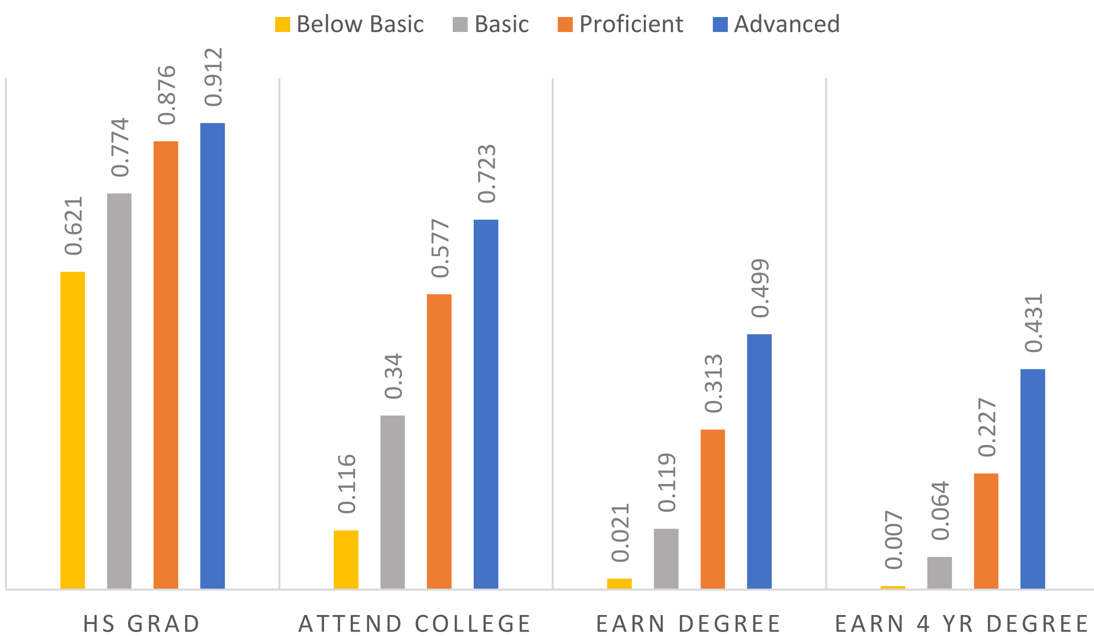
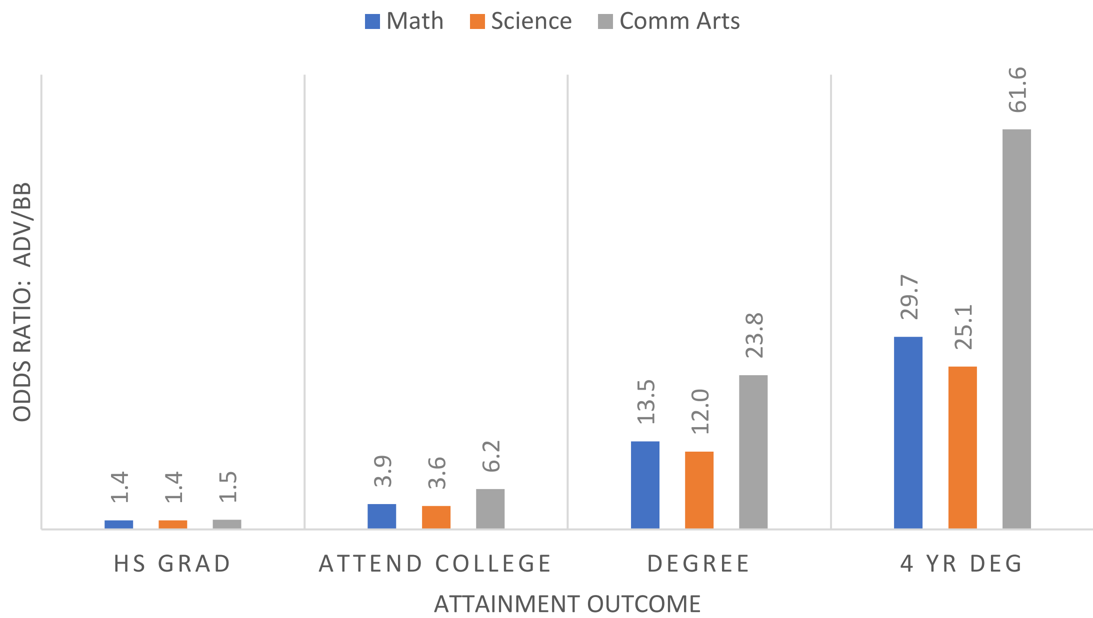
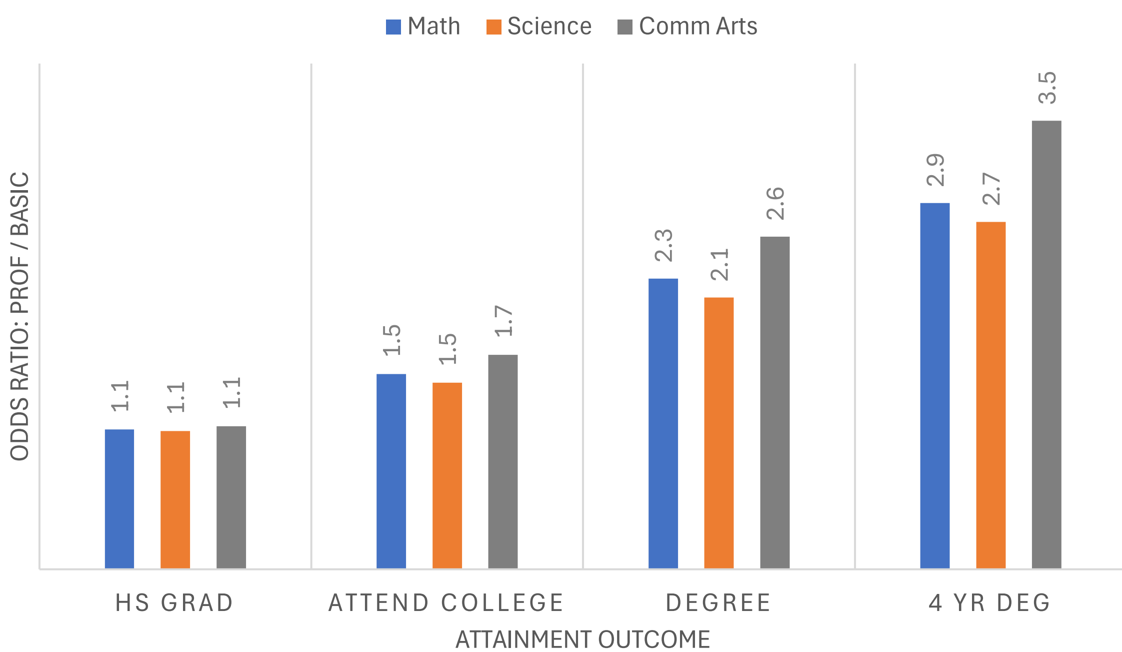


Figure 4. Odds Ratios by Educational Attainment in the Population

a. Advanced / Below Basic



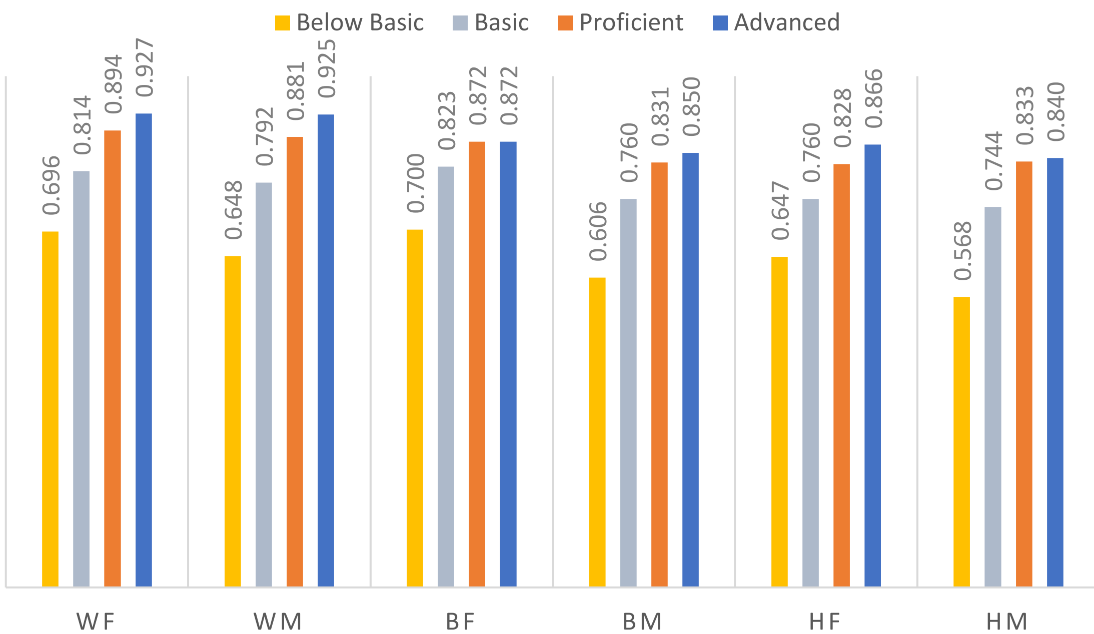
b. Proficient / Basic



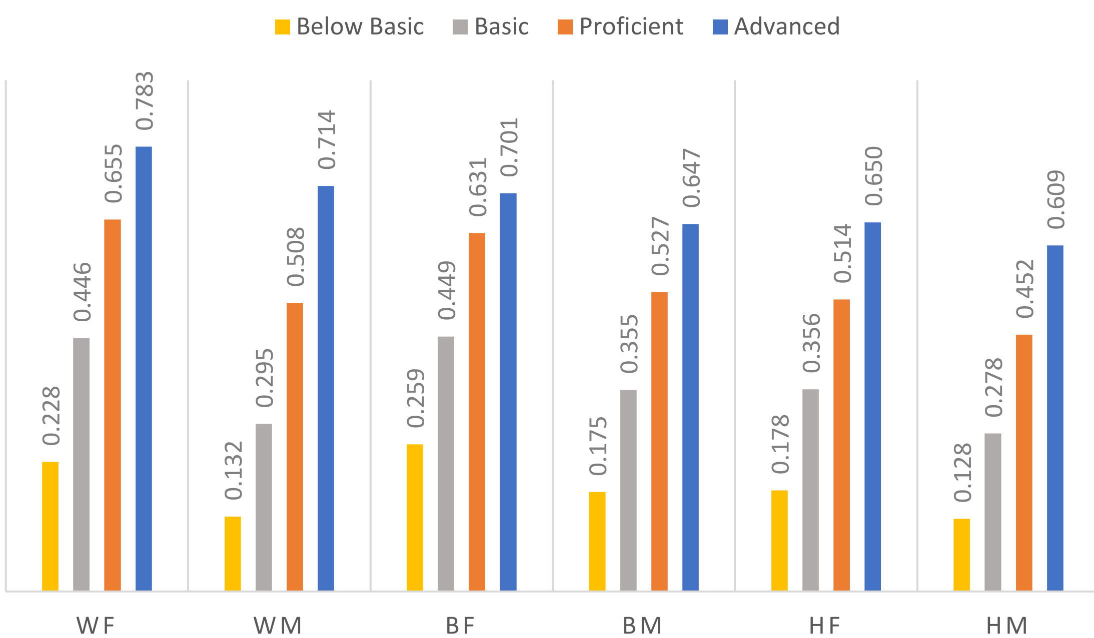
Notes: Odds Ratios computed from data in Figure 3.

Figure 5. 8th Grade Math MAP and Educational Attainment by Subgroup

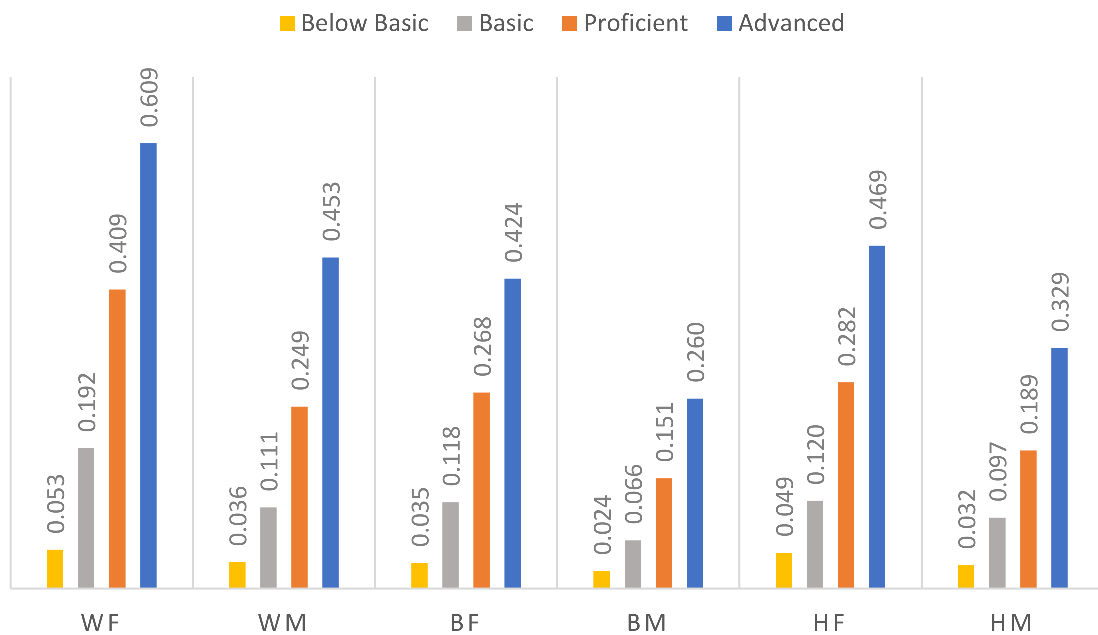
a. High School Graduation



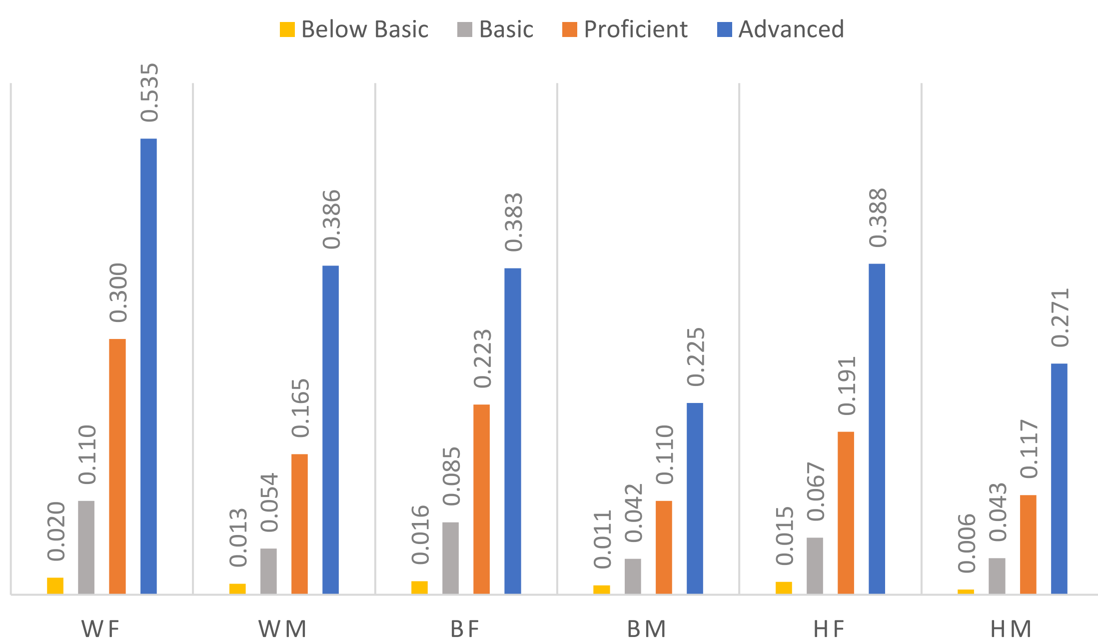
b. College Attendance



c. Degree Completion



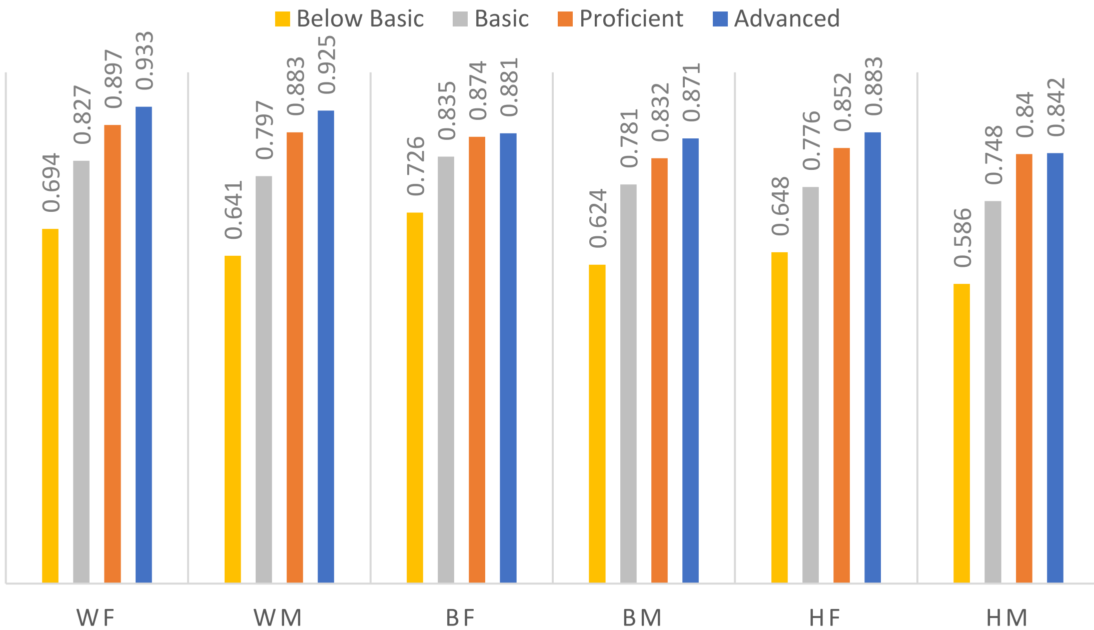
d. Four-Year Degree Completion



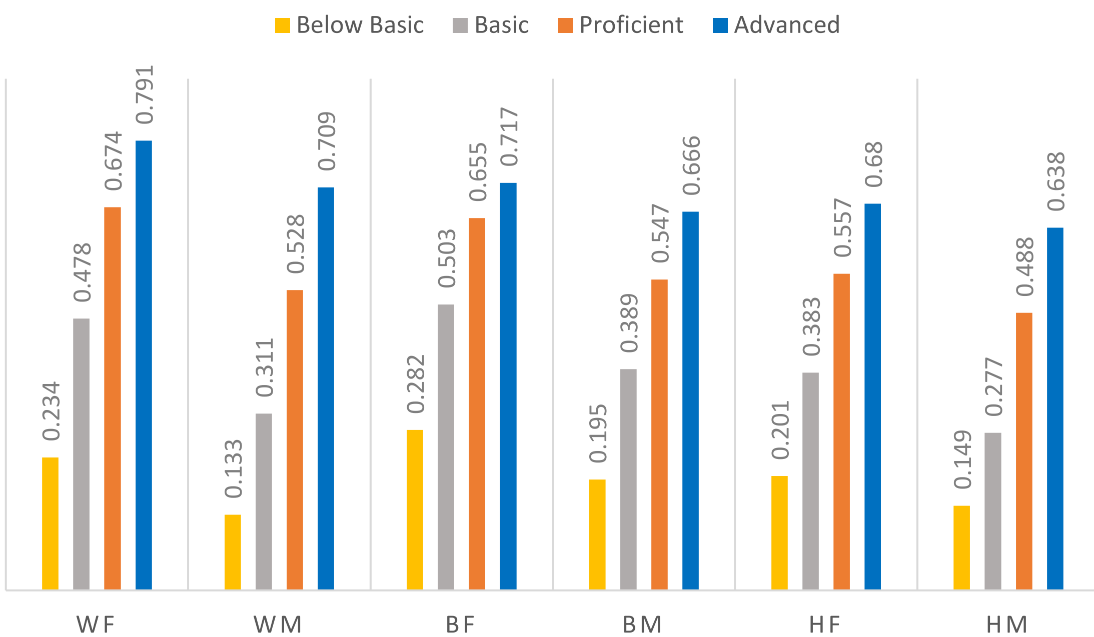
Notes: WF=White Female; WM=White Male; BF=Black Female; BM=Black Male; HF=Hispanic Female; HM=Hispanic Male

Figure 6. 8th Grade Science MAP and Educational Attainment by Subgroup

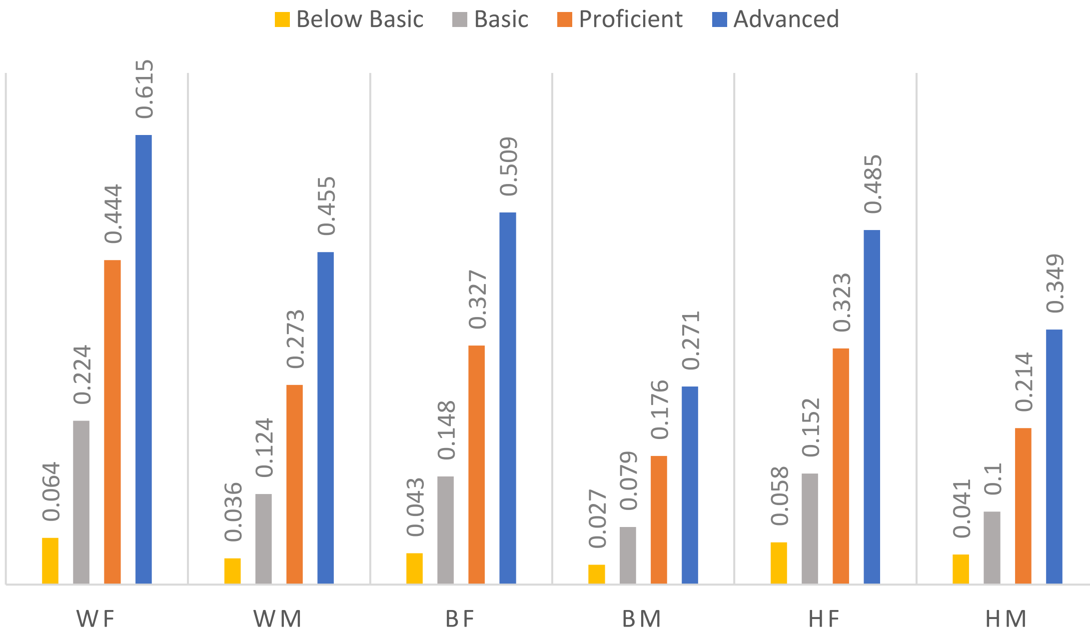
a. High School Graduation



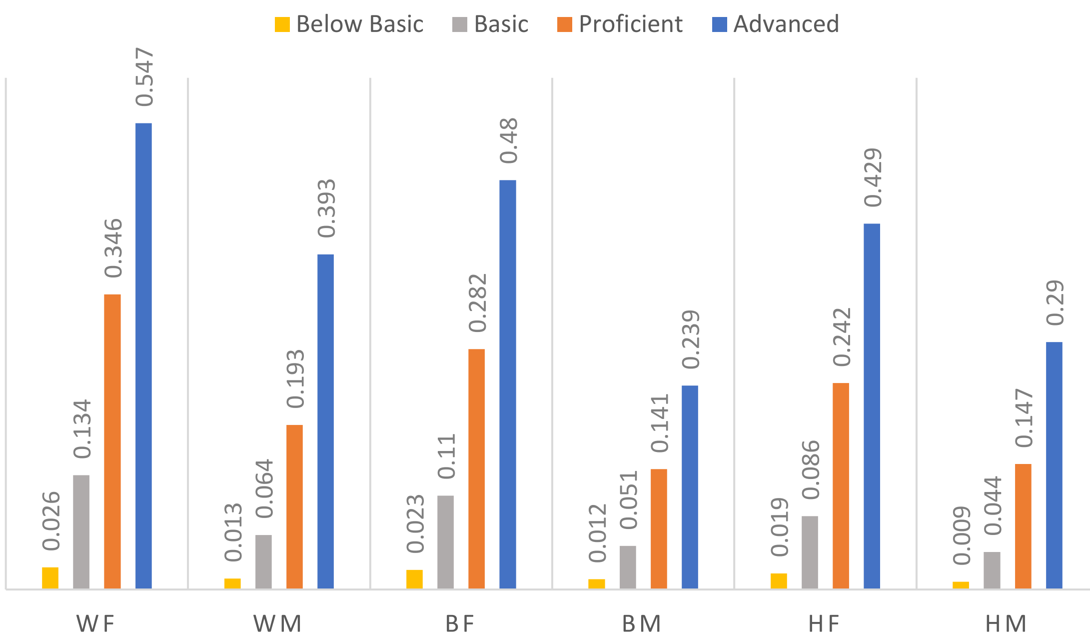
b. College Attendance



c. Degree Completion



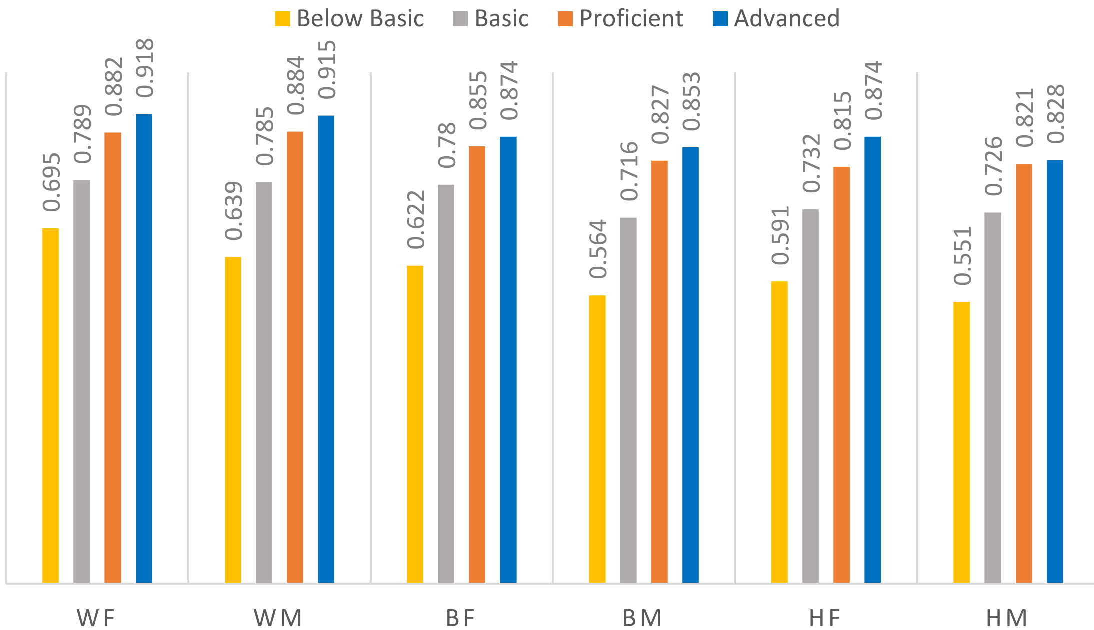
d. Four-Year Degree Completion



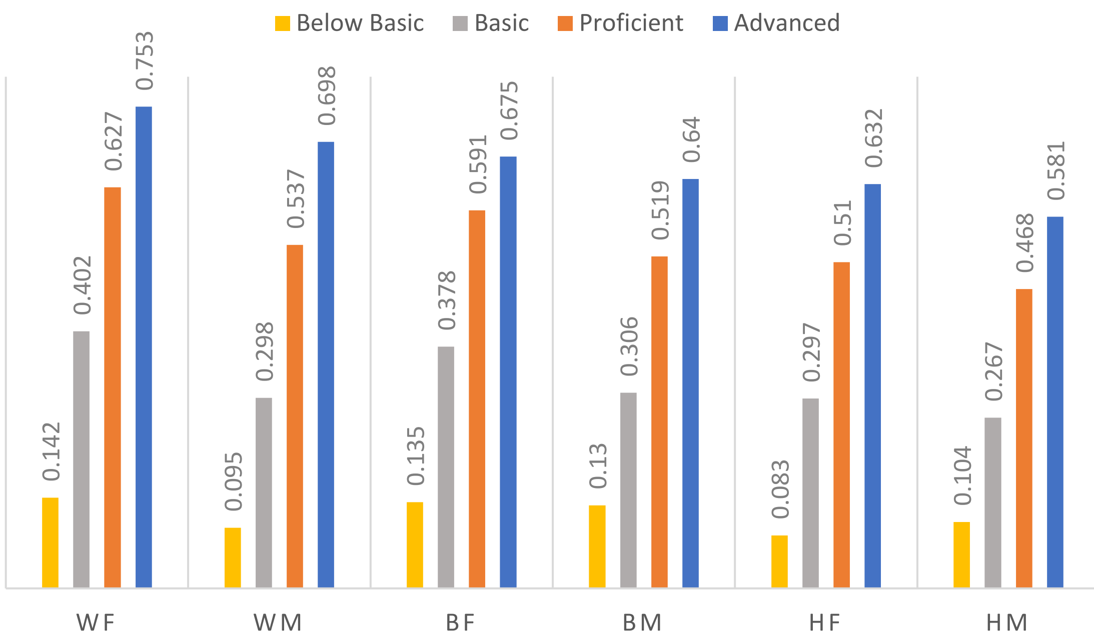
Notes: WF=White Female; WM=White Male; BF=Black Female; BM=Black Male; HF=Hispanic Female; HM=Hispanic Male

Figure 7. 8th Grade Communication Arts MAP and Educational Attainment by Subgroup

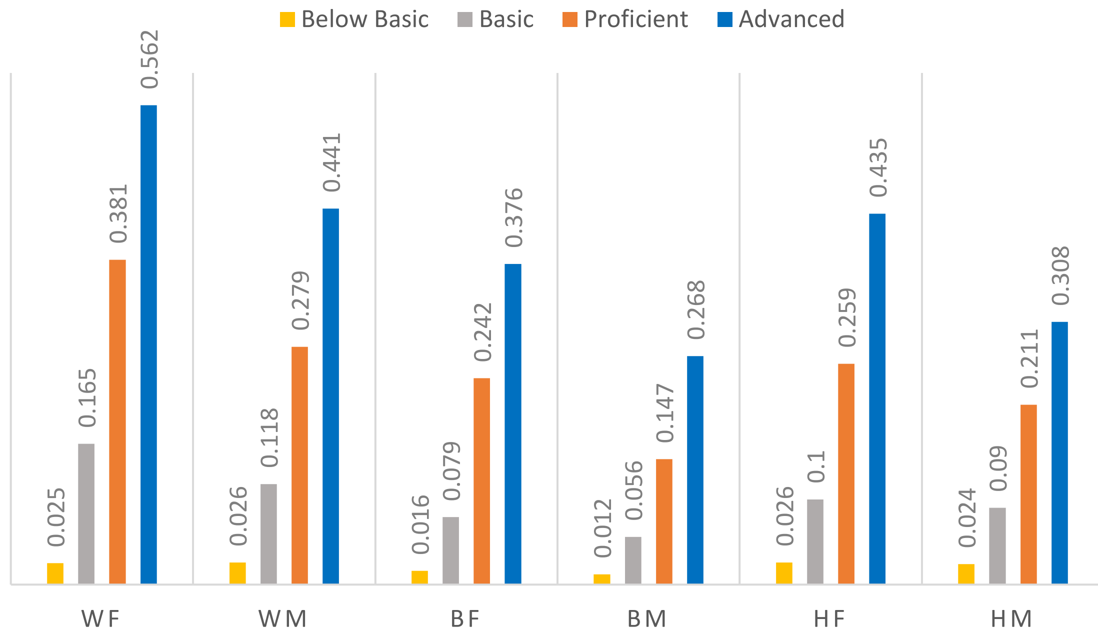
a. High School Graduation



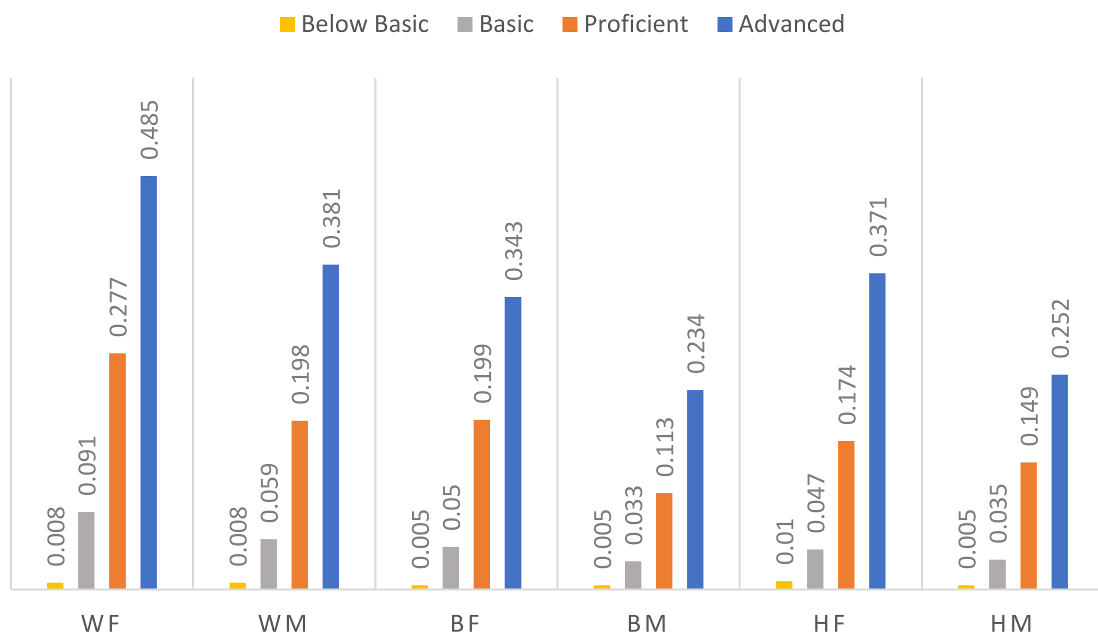
b. College Attendance



c. Degree Completion



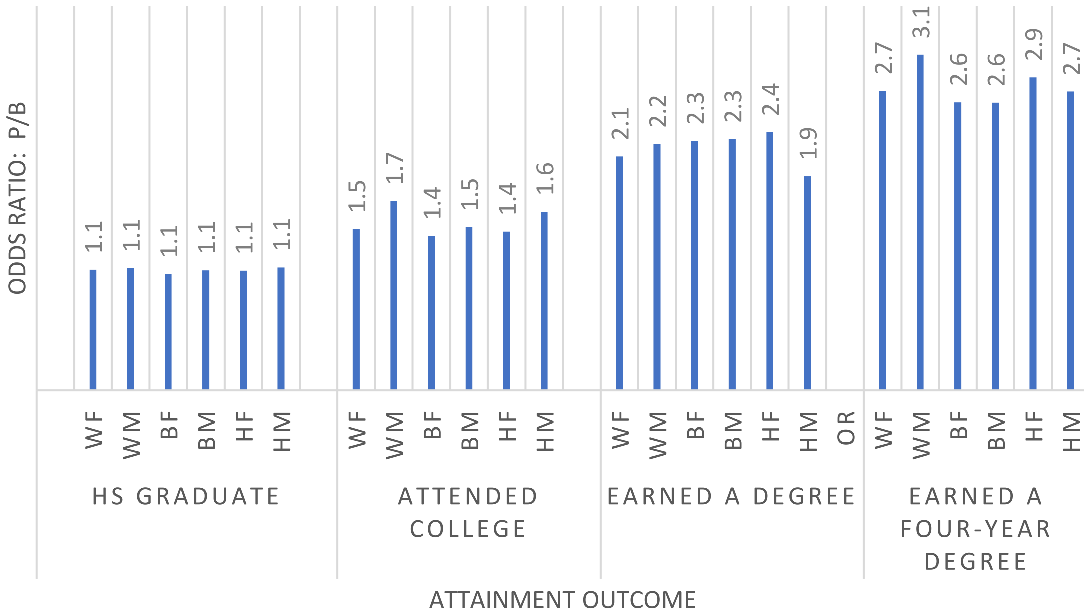
d. Four-Year Degree Completion



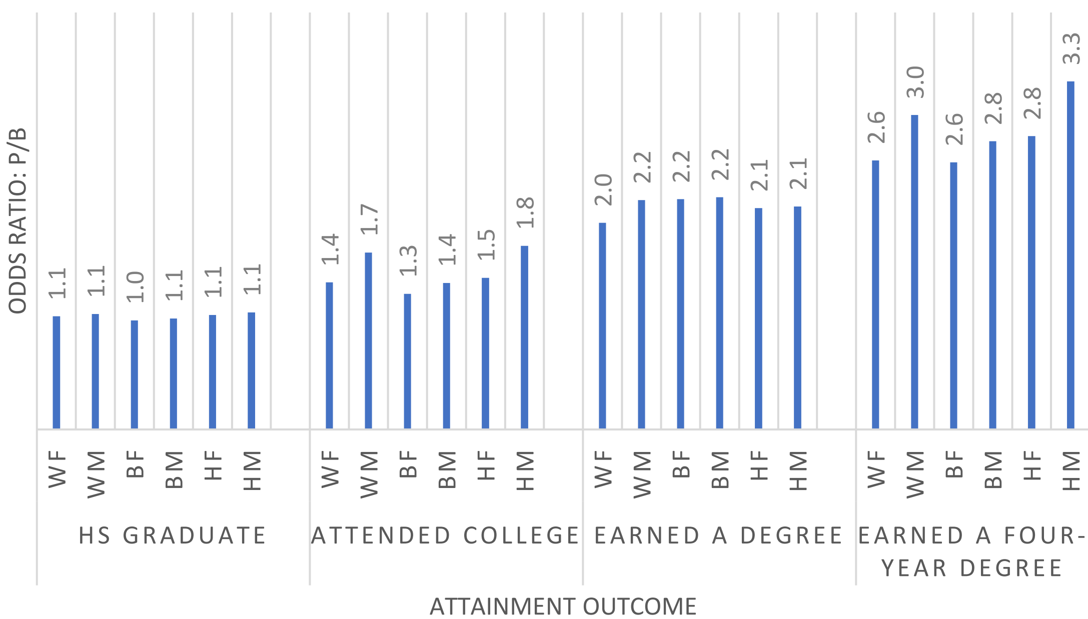
Notes: WF=White Female; WM=White Male; BF=Black Female; BM=Black Male; HF=Hispanic Female; HM=Hispanic Male

Figure 8. Proficient/Basic Odds Ratios by Subgroup and Exam

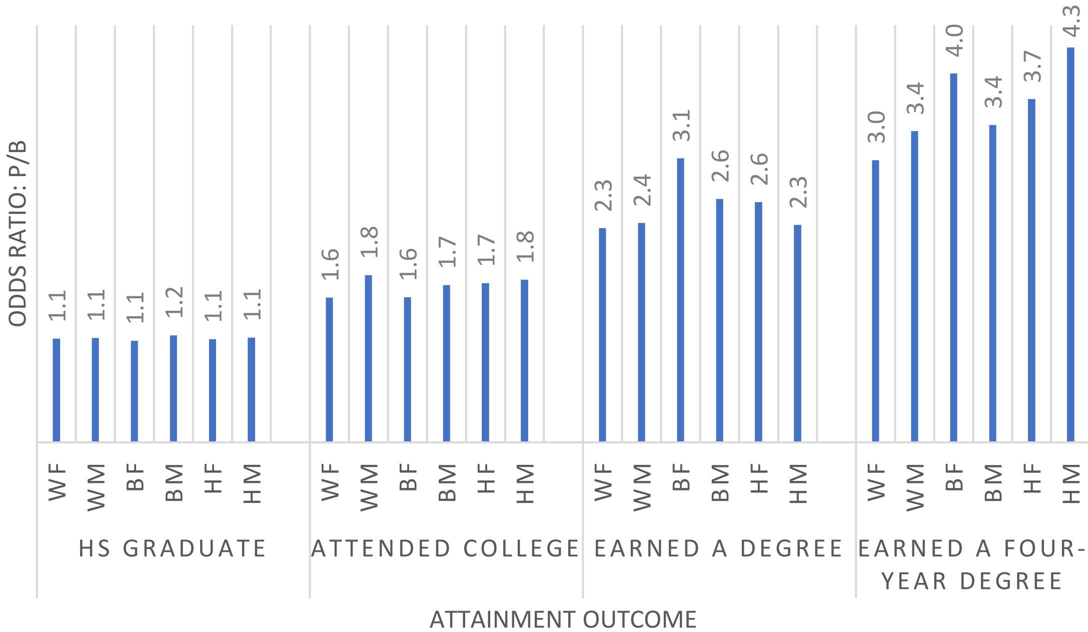
a. Math



b. Science

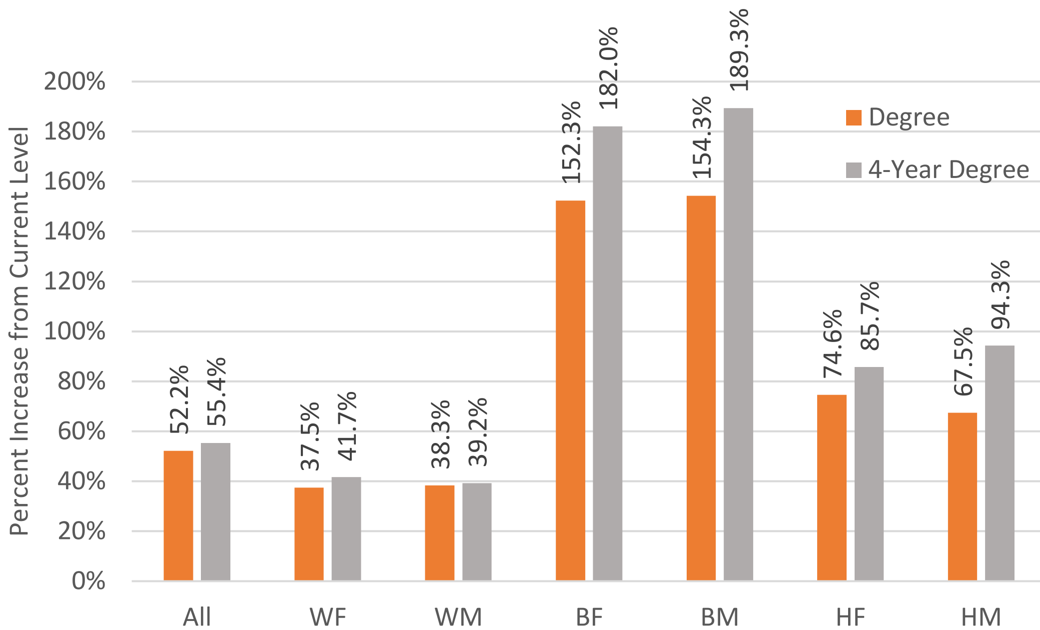


c. **Communication Arts**



Notes: WF=White Female; WM=White Male; BF=Black Female; BM=Black Male; HF=Hispanic Female; HM=Hispanic Male

Figure 9. Percent Change in Achievement if all Students Are Proficient or Above by 8th Grade



Notes: WF=White Female; WM=White Male; BF=Black Female; BM=Black Male; HF=Hispanic Female; HM=Hispanic Male

Statistical Appendix

Table 1. Distribution of MAP proficiency levels overall and by Race/Gender Group

a. Mathematics

	BF	BM	HF	HM	WF	WM
Below Basic	32.27	36.80	18.18	19.40	9.43	11.30
Basic	42.49	40.13	41.09	38.78	33.49	32.37
Proficient	20.11	17.94	29.79	29.09	36.19	33.81
Advanced	5.13	5.13	10.94	12.74	20.88	22.52
%	100.00	100.00	100.00	100.00	100.00	100.00
N	20,432	20,683	4,989	5,243	94,889	99,872

b. Science

	BF	BM	HF	HM	WF	WM
Below Basic	41.34	43.29	23.85	21.94	10.13	10.63
Basic	41.76	38.54	42.92	38.98	35.77	31.57
Proficient	15.58	16.32	28.59	31.95	43.48	43.63
Advanced	1.32	1.85	4.64	7.12	10.62	14.18
%	100.00	100.00	100.00	100.00	100.00	100.00
N	20,432	20,683	4,989	5,243	94,889	99,872

c. Communication Arts

	BF	BM	HF	HM	WF	WM
Below Basic	6.56	14.51	3.90	7.91	1.77	4.71
Basic	60.94	62.63	49.02	53.78	34.83	42.32
Proficient	25.57	18.67	34.26	28.41	38.73	35.87
Advanced	6.93	4.19	12.82	9.90	24.67	17.10
%	100.00	100.00	100.00	100.00	100.00	100.00
N	20,432	20,683	4,989	5,243	94,889	99,872

Notes: BF=Black Female; BM=Black Male; HF=Hispanic Female; HM=Hispanic Male WF=White Female; WM=White Male

Table 2. Average Outcomes vs. Math MAP Proficiency Levels by Race-by-Gender Group

		MAP Proficiency Levels										Odds Ratios			
		All		Below Basic		Basic		Proficient		Advanced		Prof / Basic		Adv / Basic	
		Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	OR	SD	OR	SD
HS Graduate	Black Female	0.795	0.003	0.700	0.006	0.823	0.004	0.872	0.005	0.872	0.010	1.060	0.008	1.061	0.014
	Black Male	0.721	0.003	0.606	0.006	0.760	0.005	0.831	0.006	0.850	0.011	1.094	0.010	1.117	0.016
	Hispanic Female	0.771	0.006	0.647	0.016	0.760	0.009	0.828	0.010	0.866	0.015	1.090	0.018	1.140	0.024
	Hispanic Male	0.748	0.006	0.568	0.016	0.744	0.010	0.833	0.010	0.840	0.014	1.121	0.020	1.130	0.024
	White Female	0.855	0.001	0.696	0.005	0.814	0.002	0.894	0.002	0.927	0.002	1.098	0.004	1.139	0.004
	White Male	0.836	0.001	0.648	0.004	0.792	0.002	0.881	0.002	0.925	0.002	1.112	0.004	1.168	0.004
	All Students	0.827	0.001	0.658	0.002	0.798	0.001	0.882	0.001	0.921	0.001	1.105	0.002	1.154	0.003
Attended College	Black Female	0.437	0.003	0.259	0.005	0.449	0.005	0.631	0.008	0.701	0.014	1.405	0.023	1.563	0.036
	Black Male	0.334	0.003	0.175	0.004	0.355	0.005	0.527	0.008	0.647	0.015	1.488	0.032	1.820	0.047
	Hispanic Female	0.403	0.007	0.178	0.013	0.356	0.011	0.514	0.013	0.650	0.020	1.447	0.056	1.826	0.079
	Hispanic Male	0.342	0.007	0.128	0.010	0.278	0.010	0.452	0.013	0.609	0.019	1.630	0.073	2.191	0.104
	White Female	0.571	0.002	0.228	0.004	0.446	0.003	0.655	0.003	0.783	0.003	1.469	0.011	1.756	0.013
	White Male	0.443	0.002	0.132	0.003	0.295	0.003	0.508	0.003	0.714	0.003	1.721	0.017	2.420	0.023
	All Students	0.480	0.001	0.189	0.002	0.374	0.002	0.578	0.002	0.740	0.002	1.546	0.008	1.978	0.011
Earned a Degree	Black Female	0.137	0.002	0.035	0.002	0.118	0.003	0.268	0.007	0.424	0.015	2.270	0.087	3.598	0.160
	Black Male	0.076	0.002	0.024	0.002	0.066	0.003	0.151	0.006	0.260	0.013	2.310	0.131	3.960	0.270
	Hispanic Female	0.194	0.006	0.049	0.007	0.120	0.007	0.282	0.012	0.469	0.021	2.339	0.169	3.898	0.294
	Hispanic Male	0.141	0.005	0.032	0.006	0.097	0.007	0.189	0.010	0.329	0.018	1.954	0.165	3.389	0.308
	White Female	0.345	0.002	0.053	0.002	0.192	0.002	0.409	0.003	0.609	0.003	2.135	0.028	3.174	0.040
	White Male	0.226	0.001	0.036	0.002	0.111	0.002	0.249	0.002	0.453	0.003	2.256	0.044	4.101	0.069
	All Students	0.249	0.001	0.038	0.001	0.137	0.001	0.315	0.002	0.514	0.002	2.293	0.023	3.747	0.038
Earned a Four-Year Degree	Black Female	0.106	0.002	0.016	0.002	0.085	0.003	0.223	0.006	0.383	0.015	2.645	0.120	4.545	0.234
	Black Male	0.052	0.002	0.011	0.001	0.042	0.002	0.110	0.005	0.225	0.013	2.650	0.188	5.407	0.436
	Hispanic Female	0.130	0.005	0.015	0.004	0.067	0.006	0.191	0.010	0.388	0.021	2.861	0.283	5.799	0.572
	Hispanic Male	0.087	0.004	0.006	0.002	0.043	0.005	0.117	0.008	0.271	0.017	2.736	0.334	6.337	0.807
	White Female	0.259	0.001	0.020	0.001	0.110	0.002	0.300	0.002	0.535	0.004	2.734	0.049	4.887	0.084
	White Male	0.161	0.001	0.013	0.001	0.054	0.001	0.165	0.002	0.386	0.003	3.063	0.083	7.186	0.180
	All Students	0.183	0.001	0.015	0.001	0.077	0.001	0.223	0.001	0.445	0.002	2.914	0.039	5.812	0.074

Table 3. Average Outcomes vs. Science MAP Proficiency Levels by Race-by-Gender Group

		MAP Proficiency Levels										Odds Ratios			
		All		Below Basic		Basic		Proficient		Advanced		Prof / Basic		Adv / Basic	
		Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	OR	SD	OR	SD
HS Graduate	Black Female	0.796	0.003	0.726	0.005	0.835	0.004	0.874	0.006	0.881	0.020	1.047	0.009	1.055	0.024
	Black Male	0.723	0.003	0.624	0.005	0.781	0.005	0.832	0.006	0.871	0.017	1.065	0.011	1.116	0.022
	Hispanic Female	0.772	0.006	0.648	0.014	0.776	0.009	0.852	0.009	0.883	0.021	1.098	0.018	1.138	0.031
	Hispanic Male	0.749	0.006	0.586	0.015	0.748	0.010	0.840	0.009	0.842	0.019	1.124	0.019	1.125	0.029
	White Female	0.856	0.001	0.694	0.005	0.827	0.002	0.897	0.001	0.933	0.002	1.084	0.003	1.127	0.004
	White Male	0.836	0.001	0.641	0.005	0.797	0.002	0.883	0.002	0.925	0.002	1.107	0.004	1.161	0.004
	All Students	0.828	0.001	0.667	0.002	0.810	0.001	0.886	0.001	0.925	0.002	1.094	0.002	1.143	0.003
Attended College	Black Female	0.438	0.003	0.282	0.005	0.503	0.005	0.655	0.008	0.717	0.028	1.303	0.022	1.425	0.057
	Black Male	0.336	0.003	0.195	0.004	0.389	0.005	0.547	0.009	0.666	0.024	1.403	0.030	1.712	0.066
	Hispanic Female	0.403	0.007	0.201	0.012	0.383	0.011	0.557	0.013	0.680	0.031	1.460	0.052	1.782	0.095
	Hispanic Male	0.342	0.007	0.149	0.011	0.277	0.010	0.488	0.012	0.638	0.025	1.767	0.078	2.306	0.117
	White Female	0.572	0.002	0.234	0.004	0.478	0.003	0.674	0.002	0.791	0.004	1.410	0.010	1.654	0.013
	White Male	0.443	0.002	0.133	0.003	0.311	0.003	0.528	0.002	0.709	0.004	1.699	0.016	2.283	0.023
	All Students	0.480	0.001	0.205	0.002	0.404	0.002	0.596	0.002	0.740	0.003	1.476	0.007	1.831	0.011
Earned a Degree	Black Female	0.137	0.002	0.043	0.002	0.148	0.004	0.327	0.008	0.509	0.031	2.218	0.077	3.455	0.226
	Black Male	0.076	0.002	0.027	0.002	0.079	0.003	0.176	0.007	0.271	0.023	2.227	0.122	3.443	0.326
	Hispanic Female	0.194	0.006	0.058	0.007	0.152	0.008	0.323	0.012	0.485	0.033	2.136	0.136	3.208	0.273
	Hispanic Male	0.141	0.005	0.041	0.006	0.100	0.007	0.214	0.010	0.349	0.025	2.148	0.178	3.495	0.338
	White Female	0.345	0.002	0.064	0.002	0.224	0.002	0.444	0.002	0.615	0.005	1.986	0.023	2.753	0.036
	White Male	0.227	0.001	0.036	0.002	0.124	0.002	0.273	0.002	0.455	0.004	2.214	0.038	3.688	0.067
	All Students	0.250	0.001	0.043	0.001	0.161	0.001	0.346	0.002	0.515	0.003	2.142	0.021	3.190	0.032
Earned a Four-Year Degree	Black Female	0.106	0.002	0.023	0.002	0.110	0.003	0.282	0.008	0.480	0.031	2.564	0.105	4.363	0.305
	Black Male	0.052	0.002	0.012	0.001	0.051	0.002	0.141	0.006	0.239	0.022	2.740	0.177	4.682	0.490
	Hispanic Female	0.130	0.005	0.019	0.004	0.086	0.006	0.242	0.011	0.429	0.033	2.849	0.240	5.045	0.535
	Hispanic Male	0.087	0.004	0.009	0.003	0.044	0.005	0.147	0.009	0.290	0.024	3.368	0.420	6.608	0.862
	White Female	0.259	0.001	0.026	0.002	0.134	0.002	0.346	0.002	0.547	0.005	2.584	0.038	4.085	0.069
	White Male	0.162	0.001	0.013	0.001	0.064	0.001	0.193	0.002	0.393	0.004	3.002	0.071	6.123	0.149
	All Students	0.183	0.001	0.018	0.001	0.095	0.001	0.261	0.001	0.451	0.003	2.740	0.033	4.742	0.060

Table 4. Average Outcomes vs. Communication Arts MAP Proficiency Levels by Race-by-Gender Group

		MAP Proficiency Levels										Odds Ratios			
		All		Below Basic		Basic		Proficient		Advanced		Prof / Basic		Adv / Basic	
		Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	Mean	SEM	OR	SD	OR	SD
HS Graduate	Black Female	0.795	0.003	0.622	0.013	0.780	0.004	0.855	0.005	0.874	0.009	1.095	0.008	1.121	0.013
	Black Male	0.721	0.003	0.564	0.009	0.716	0.004	0.827	0.006	0.853	0.012	1.154	0.011	1.191	0.018
	Hispanic Female	0.773	0.006	0.591	0.035	0.732	0.009	0.815	0.009	0.874	0.013	1.113	0.019	1.192	0.023
	Hispanic Male	0.749	0.006	0.551	0.025	0.726	0.008	0.821	0.010	0.828	0.017	1.130	0.018	1.141	0.027
	White Female	0.855	0.001	0.695	0.011	0.789	0.002	0.882	0.002	0.918	0.002	1.117	0.004	1.163	0.004
	White Male	0.836	0.001	0.639	0.007	0.785	0.002	0.884	0.002	0.915	0.002	1.126	0.004	1.166	0.004
	All Students	0.827	0.001	0.621	0.005	0.774	0.001	0.876	0.001	0.912	0.001	1.131	0.002	1.178	0.003
Attended College	Black Female	0.437	0.003	0.135	0.009	0.378	0.004	0.591	0.007	0.675	0.012	1.561	0.026	1.785	0.04
	Black Male	0.334	0.003	0.130	0.006	0.306	0.004	0.519	0.008	0.640	0.016	1.696	0.034	2.091	0.062
	Hispanic Female	0.405	0.007	0.083	0.020	0.297	0.009	0.510	0.012	0.632	0.019	1.719	0.066	2.129	0.095
	Hispanic Male	0.342	0.007	0.104	0.015	0.267	0.008	0.468	0.013	0.581	0.022	1.753	0.072	2.180	0.102
	White Female	0.571	0.002	0.142	0.009	0.402	0.003	0.627	0.003	0.753	0.003	1.559	0.013	1.871	0.014
	White Male	0.443	0.002	0.095	0.004	0.298	0.002	0.537	0.003	0.698	0.004	1.801	0.015	2.340	0.023
	All Students	0.480	0.001	0.116	0.003	0.340	0.001	0.577	0.002	0.723	0.002	1.695	0.009	2.125	0.011
Earned a Degree	Black Female	0.137	0.002	0.016	0.003	0.079	0.002	0.242	0.006	0.376	0.013	3.057	0.119	4.750	0.212
	Black Male	0.076	0.002	0.012	0.002	0.056	0.002	0.147	0.006	0.268	0.015	2.626	0.135	4.779	0.330
	Hispanic Female	0.195	0.006	0.026	0.011	0.100	0.006	0.259	0.011	0.435	0.020	2.600	0.187	4.365	0.338
	Hispanic Male	0.141	0.005	0.024	0.008	0.090	0.005	0.211	0.011	0.308	0.020	2.357	0.186	3.444	0.310
	White Female	0.344	0.002	0.025	0.004	0.165	0.002	0.381	0.003	0.562	0.003	2.304	0.032	3.398	0.046
	White Male	0.226	0.001	0.026	0.002	0.118	0.002	0.279	0.002	0.441	0.004	2.365	0.038	3.748	0.062
	All Students	0.249	0.001	0.021	0.001	0.119	0.001	0.313	0.002	0.499	0.002	2.624	0.025	4.175	0.039
Earned a Four-Year Degree	Black Female	0.106	0.002	0.005	0.002	0.050	0.002	0.199	0.006	0.343	0.013	3.967	0.187	6.801	0.364
	Black Male	0.052	0.002	0.005	0.001	0.033	0.002	0.113	0.005	0.234	0.014	3.453	0.219	7.170	0.575
	Hispanic Female	0.130	0.005	0.010	0.007	0.047	0.004	0.174	0.009	0.371	0.019	3.73	0.393	7.939	0.832
	Hispanic Male	0.087	0.004	0.005	0.003	0.035	0.003	0.149	0.009	0.252	0.019	4.243	0.497	7.228	0.869
	White Female	0.259	0.001	0.008	0.002	0.091	0.002	0.277	0.002	0.485	0.003	3.064	0.061	5.349	0.099
	White Male	0.161	0.001	0.008	0.001	0.059	0.001	0.198	0.002	0.381	0.004	3.35	0.074	6.477	0.145
	All Students	0.183	0.001	0.007	0.001	0.064	0.001	0.227	0.001	0.431	0.002	3.566	0.050	6.763	0.085

Table 5. Odds Ratios by Mathematics MAP Proficiency Levels for all Students

Outcome		Below Basic	Basic	Proficient
HS Graduate	Advanced	1.399	1.153	1.044
	(SD)	(0.006)	(0.003)	(0.002)
	Proficient	1.34	1.105	-
	(SD)	(0.005)	(0.002)	-
	Basic	1.213	-	-
	(SD)	(0.005)	-	-
		Below Basic	Basic	Proficient
Attended College	Advanced	3.924	1.978	1.28
	(SD)	(0.045)	(0.010)	(0.005)
	Proficient	3.065	1.546	-
	(SD)	(0.034)	(0.008)	-
	Basic	1.982	-	-
	(SD)	(0.023)	-	-
		Below Basic	Basic	Proficient
Earned a Degree	Advanced	13.627	3.748	1.632
	(SD)	(0.373)	(0.036)	(0.011)
	Proficient	8.353	2.293	-
	(SD)	(0.232)	(0.023)	-
	Basic	3.636	-	-
	(SD)	(0.099)	-	-
		Below Basic	Basic	Proficient
Earned a Four-Year Degree	Advanced	30.262	5.812	1.994
	(SD)	(1.358)	(0.074)	(0.017)
	Proficient	15.153	2.914	-
	(SD)	(0.667)	(0.039)	-
	Basic	5.194	-	-
	(SD)	(0.230)	-	-

Note: Rows are the numerator and the column is the denominator

Table 6. Odds Ratios by Science MAP Proficiency Levels for all Students

Outcome		Below Basic	Basic	Proficient
HS Graduate	Advanced	1.387	1.143	1.044
	(SD)	(0.005)	(0.003)	(0.002)
	Proficient	1.329	1.094	-
	(SD)	(0.005)	(0.002)	-
	Basic	1.214	-	-
	(SD)	(0.005)	-	-
		Below Basic	Basic	Proficient
Attended College	Advanced	3.61	1.831	1.24
	(SD)	(0.038)	(0.010)	(0.006)
	Proficient	2.912	1.476	-
	(SD)	(0.030)	(0.007)	-
	Basic	1.973	-	-
	(SD)	(0.021)	-	-
		Below Basic	Basic	Proficient
Earned a Degree	Advanced	11.97	3.191	1.489
	(SD)	(0.289)	(0.031)	(0.012)
	Proficient	8.045	2.142	-
	(SD)	(0.190)	(0.021)	-
	Basic	3.751	-	-
	(SD)	(0.096)	-	-
		Below Basic	Basic	Proficient
Earned a Four-Year Degree	Advanced	24.9	4.743	1.73
	(SD)	(0.962)	(0.057)	(0.016)
	Proficient	14.391	2.74	-
	(SD)	(0.532)	(0.033)	-
	Basic	5.229	-	-
	(SD)	(0.201)	-	-

Note: Rows are the numerator and the column is the denominator

Table 7. Odds Ratios by Communication Arts MAP Proficiency Levels for all Students

Outcome		Below Basic	Basic	Proficient
HS Graduate	Advanced	1.468	1.178	1.041
	(SD)	(0.011)	(0.003)	(0.002)
	Proficient	1.409	1.131	-
	(SD)	(0.010)	(0.002)	-
	Basic	1.246	-	-
	(SD)	(0.010)	-	-
		Below Basic	Basic	Proficient
Attended College	Advanced	6.219	2.125	1.254
	(SD)	(0.163)	(0.012)	(0.005)
	Proficient	4.962	1.695	-
	(SD)	(0.131)	(0.009)	-
	Basic	2.926	-	-
	(SD)	(0.079)	-	-
		Below Basic	Basic	Proficient
Earned a Degree	Advanced	24.164	4.175	1.592
	(SD)	(1.585)	(0.041)	(0.011)
	Proficient	15.182	2.624	-
	(SD)	(0.984)	(0.025)	-
	Basic	5.778	-	-
	(SD)	(0.378)	-	-
		Below Basic	Basic	Proficient
Earned a Four-Year Degree	Advanced	64.277	6.768	1.898
	(SD)	(7.383)	(0.089)	(0.016)
	Proficient	33.908	3.566	-
	(SD)	(3.987)	(0.050)	-
	Basic	9.487	-	-
	(SD)	(1.112)	-	-

Note: Rows are the numerator and the column is the denominator

No Child Left Behind (NCLB) Simulation

Logit Model:

$$logit(Y_i) = \ln\left(\frac{P(Y_i = 1)}{1 - P(Y_i = 1)}\right) = \beta_0 + \beta_1 MathPL_i + \beta_2 SciencePL_i + \beta_3 CAPL_i + \beta_4 FRL$$

$P(Y_i$=1) refers to the probability that student *i* achieves the outcome, *Y_i*; *Math*, *Science*, and *CA* refer to the three MAP exams; *PL* refers to students' performance level on each MAP score (Below Basic; Basic; Proficient; Advanced). In this specification the omitted performance level for each test is Below Basic. Thus, β_0 represents the outcome for a student who scores Below Basic on all three assessments.

Samples: The model was estimated across all students and then by race-by-gender group. Because the models were estimated independently, each will have their own values for the goodness of fit tests.

Table 8. NCLB Simulation Results

	All	BF	BM	HF	HM	WF	WM
Attended College							
Raw Mean	0.547	0.521	0.379	0.483	0.412	0.644	0.509
Simulation Mean (Logits)	0.887	1.035	0.502	0.620	0.423	1.219	0.683
Simulation Standard Error	0.007	0.045	0.040	0.060	0.056	0.012	0.011
Simulation Mean (Prob)	0.708	0.738	0.623	0.650	0.604	0.772	0.665
Probability Upper 95% CI	0.711	0.755	0.641	0.676	0.630	0.776	0.669
Probability Lower 95% CI	0.705	0.720	0.605	0.623	0.578	0.768	0.660
Simulation Prob - Raw Mean	0.162	0.217	0.244	0.167	0.192	0.128	0.156
Percent Increase	0.295	0.416	0.645	0.346	0.466	0.198	0.306
Earned a Degree							
Raw Mean	0.241	0.127	0.068	0.182	0.132	0.340	0.221
Simulation Mean (Logits)	-0.544	-0.755	-1.570	-0.767	-1.256	-0.133	-0.821
Simulation Standard Error	0.008	0.045	0.055	0.065	0.069	0.011	0.012
Simulation Mean (Prob)	0.367	0.320	0.172	0.317	0.222	0.467	0.306
Probability Upper 95% CI	0.371	0.339	0.188	0.345	0.246	0.472	0.311
Probability Lower 95% CI	0.364	0.301	0.158	0.290	0.199	0.462	0.301
Simulation Prob - Raw Mean	0.126	0.193	0.105	0.135	0.089	0.127	0.085

Percent Increase	0.523	1.523	1.543	0.746	0.675	0.375	0.383
Earned a Four-Year Degree							
Raw Mean	0.177	0.098	0.047	0.122	0.082	0.256	0.158
Simulation Mean (Logits)	-0.967	-0.970	-1.861	-1.232	-1.669	-0.565	-1.269
Simulation Standard Error	0.008	0.047	0.061	0.074	0.080	0.011	0.013
Simulation Mean (Prob)	0.276	0.275	0.135	0.226	0.159	0.363	0.220
Probability Upper 95% CI	0.279	0.294	0.149	0.252	0.181	0.368	0.224
Probability Lower 95% CI	0.272	0.257	0.121	0.202	0.139	0.357	0.215
Simulation Prob - Raw Mean	0.098	0.178	0.088	0.104	0.077	0.107	0.062
Percent Increase	0.554	1.820	1.893	0.857	0.943	0.417	0.392
Earned STEM Degree							
Raw Mean	0.030	0.010	0.007	0.014	0.023	0.030	0.041
Simulation Mean (Logits)	-3.292	-3.282	-3.963	-4.025	-3.218	-3.354	-3.114
Simulation Standard Error	0.021	0.116	0.155	0.227	0.161	0.032	0.029
Simulation Mean (Prob)	0.036	0.036	0.019	0.018	0.039	0.034	0.043
Probability Upper 95% CI	0.037	0.045	0.025	0.027	0.052	0.036	0.045
Probability Lower 95% CI	0.034	0.029	0.014	0.011	0.028	0.032	0.040
Simulation Prob - Raw Mean	0.006	0.026	0.012	0.004	0.016	0.004	0.002
Percent Increase	0.193	2.625	1.811	0.279	0.686	0.116	0.049
Earned STEM Degree / Still Enrolled in Year 5							
Raw Mean	0.059	0.027	0.023	0.030	0.049	0.054	0.081
Simulation Mean (Logits)	-2.431	-2.511	-2.669	-3.015	-2.448	-2.622	-2.188
Simulation Standard Error	0.014	0.080	0.084	0.145	0.108	0.022	0.019
Simulation Mean (Prob)	0.081	0.075	0.065	0.047	0.080	0.068	0.101
Probability Upper 95% CI	0.083	0.087	0.076	0.061	0.097	0.071	0.104
Probability Lower 95% CI	0.079	0.065	0.056	0.036	0.065	0.065	0.098
Simulation Prob - Raw Mean	0.022	0.048	0.042	0.016	0.031	0.014	0.020

Percent Increase	0.370	1.786	1.776	0.539	0.622	0.259	0.250
Majored in STEM							
Raw Mean	0.125	0.076	0.070	0.068	0.098	0.119	0.157
Simulation Mean (Logits)	-1.525	-1.519	-1.579	-1.900	-1.581	-1.660	-1.343
Simulation Standard Error	0.010	0.055	0.054	0.091	0.076	0.015	0.014
Simulation Mean (Prob)	0.179	0.180	0.171	0.130	0.171	0.160	0.207
Probability Upper 95% CI	0.182	0.196	0.187	0.152	0.193	0.164	0.211
Probability Lower 95% CI	0.176	0.164	0.157	0.111	0.151	0.156	0.203
Simulation Prob - Raw Mean	0.054	0.104	0.101	0.062	0.073	0.041	0.050
Percent Increase	0.436	1.374	1.447	0.921	0.750	0.342	0.322

Notes: BF=Black Female; BM=Black Male
HF=Hispanic Female; HM=Hispanic Male
WF=White Female; WM=White Male

NCLB Simulation Goodness-of-Fit

For the following examination on each logit model's goodness of fit, we rely on the area under the Receiver Operating Characteristic (ROC) curve, often referred to as the concordance statistic (C-Statistic). The C-Statistic can also be interpreted as the proportion of pairs of individuals whose observed and predicted outcomes agree (i.e., are concordant) among all possible pairs in which one individual experiences the outcome of interest and compares their predicted values to all individuals who did not experience the outcome. Values range from 0 to 1 and the closer to one, the more concordance and the better fit.

Table 8. NCLB Simulation Logit Goodness of Fit: C-Statistics

	Group	C-Statistic
AttenCol_5Y	BF	0.678
	BM	0.691
	HM	0.719
	HF	0.697
	WF	0.744
	WM	0.772
	All	0.745
Deg_5Y	BF	0.776
	BM	0.766
	HM	0.738
	HF	0.760
	WF	0.782
	WM	0.781
	All	0.795
Deg4Y_5Y	BF	0.811
	BM	0.808
	HM	0.817
	HF	0.814
	WF	0.811
	WM	0.822
	All	0.826

Notes: BF=Black Female; BM=Black Male
HF=Hispanic Female; HM=Hispanic Male
WF=White Female; WM=White Male