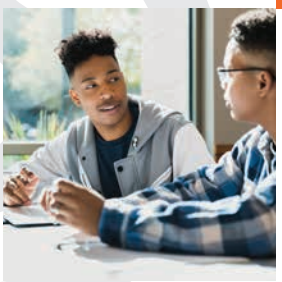
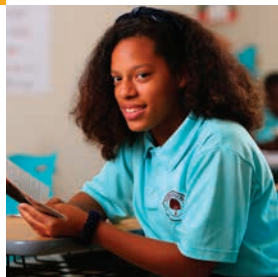
Helios Education Foundation | WestEd

RESEARCH BRIEF

How Accelerated Coursework Contributes to Increased Postsecondary Attainment in Florida

MAY 2023





About Helios Education Foundation

Helios Education Foundation exists to support postsecondary attainment for low-income and under-represented communities in Arizona and Florida. Driven by our fundamental beliefs of Community, Equity, Investment, and Partnership, Helios has invested more than $300 million in partnerships and initiatives focused on improving education outcomes in the two states we serve.

We take a multi-pronged approach—working across four domains, including performance-based community investments, systemic public policy efforts, research and data, and impact-driven communications—that together support the significant changes required to foster equitable progress across the education continuum.

About WestEd

WestEd is a nonpartisan, nonprofit research, development, and service agency that partners with education and other communities throughout the United States and abroad to promote excellence, achieve equity, and improve learning for children, youth, and adults. WestEd has more than a dozen offices nationwide. More information about WestEd is available at WestEd.org.

Helios Education Foundation Board of Directors

Authors

Kimberly Lent Morales, Helios Education Foundation
Paul Perrault, Helios Education Foundation
Jenna Terrell, WestEd
Angela Estacion, WestEd
Diana Roldan-Rueda, WestEd
Aaron Soo Ping Chow, WestEd
Ian Hickox, Collaborative Communications

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RESEARCH BRIEF

How Accelerated Coursework Contributes to Increased Postsecondary Attainment in Florida

Introduction

For individual Floridians, a postsecondary education can pave the way for economic stability and greater prosperity throughout their lifetimes. Higher lifetime earnings, more economic opportunities, and better health are among the many benefits Floridians stand to gain by earning a postsecondary degree.

At the same time, these benefits aggregate for communities and Florida as a whole. Communities and states with higher levels of postsecondary attainment experience dramatic economic gains from higher GDPs, more tax revenue, lower crime rates, and lower participation in public assistance programs. These gains can potentially transform local, regional, and state economies.

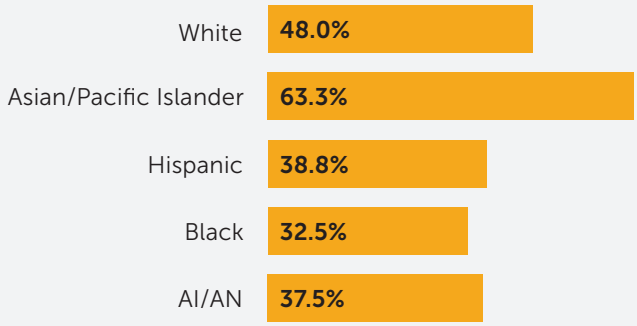
Only 44.7 percent of working-age adults in Florida hold an associate degree or higher.[1] Significant racial and ethnic disparities compound this low attainment rate. Attainment rates (associate degree or higher) for Asian and white Floridians are higher than the state average; Hispanic, American Indian/Alaskan Native, and Black residents have the lowest attainment rates. Most notably, when comparing rates across groups, there is a double-digit percentage point gap separating white and Black Floridians.

Purposeful efforts to narrow or eliminate such gaps will be fundamental to increasing overall postsecondary attainment in Florida.

Accelerated coursework represents one important means of increasing attainment. Throughout the country, states and districts have increasingly recognized the impact accelerated coursework—Advanced Placement (AP), International Baccalaureate (IB), and Dual Enrollment (DE) courses—can have in enabling students to access and succeed in education after high school.

[1]Lumina Foundation. (2023). 2023 Florida Report—A Stronger Nation: Learning Beyond High School Builds American Talent.

Overview of Postsecondary Degree Attainment in Florida by Race/Ethnicity



Data source: Lumina Foundation
Note: Associate degree or higher

A substantial body of research shows that participating in accelerated courses increases the likelihood that students will complete high school, enroll in college, achieve a higher GPA, and complete a postsecondary degree. And beyond the impact on student success, accelerated courses present tremendous postsecondary cost-savings to Florida students and families. The College Board estimates that the class of 2021 earned AP credits equivalent to almost 560,000 college credits, representing $119 million in potential tuition and fee savings.

About This Research

In previous research, Helios Education Foundation and WestEd have studied the role of AP and DE courses on postsecondary outcomes in Arizona and found a positive relationship between AP and DE course participation and college-going.

The research described in this brief complements those projects and explores the impact of accelerated coursework in Florida. Using data provided by Florida Department of Education, we examined the availability of accelerated coursework in Florida communities, participation rates, and the relationship between accelerated course taking—specifically, AP and DE—and college-going and success at institutions in the Florida College and State University systems, for public high school graduates. The brief centers on the following research questions:

1. What percentage of Florida public school students participated in accelerated courses?
2. How does participation vary among student populations, specifically for Black and low-income students?
3. How does participation in accelerated courses influence college-going?
4. How does participation in accelerated courses influence college persistence?
5. How does participation in accelerated courses influence degree completion?

Based on the findings, the brief also presents policy considerations for Florida with respect to increasing and sustaining participation in accelerated coursework statewide.

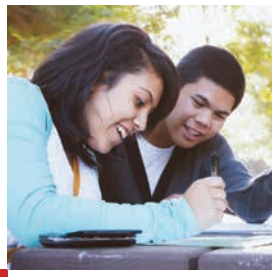
Accelerated Coursework Participation in Florida

KEY PARTICIPATION TAKEAWAYS

1. Florida has strong policies to incentivize participation in accelerated coursework, and these policies likely positively affect availability and participation.

2. More than half of Florida public high school students participated in at least one accelerated course between 2015-2016 and 2018-2019.

3. Florida public high school students were more likely to take AP courses than any other type of accelerated coursework. Dual enrollment courses were the next most popular type.



Overview of Accelerated Coursework in Florida

Florida schools offer a variety of accelerated courses, including AP, DE, IB, Cambridge AICE, and industry certifications. However, AP consistently ranks as the most popular accelerated course type among students, followed by DE and IB. These programs vary in structure. AP and IB courses are taught through high schools (in-person or virtual) and use a standardized curriculum that meets both high school graduation requirements and equivalent college course learning objectives. While students receive a standard high school grade for these courses, the ability to earn college credit relies on a single cumulative exam at the end of the school year (and the amount of college credit a student may receive for passing the exam varies by the postsecondary institution).

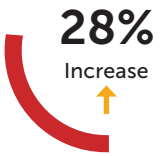
By contrast, DE course curriculum and credit achievement follow the traditional college structure. High school students are immersed in college courses that use the same curriculum as their postsecondary peers. Unlike AP and IB, where college credit is determined by one exam, in DE, students' final semester letter grade determines if they receive college credit.

In Florida, DE has three delivery mechanisms: on their high school campuses with a DE-certified K-12 teacher, on their high school campuses taught by college faculty, or on a college campus (e.g., Florida College System, State University System, or Independent Colleges and Universities of Florida institution) with college faculty. Most students take DE courses at their local Florida College System institution alongside enrolled postsecondary students.

Florida Policies Have a Positive Impact on Participation

Florida has made strides to close equity gaps for students. Any public-school student, including virtual and homeschooled students, can take an AP course and subsequent exam, or DE course, at no cost to them or their families. Instead, the state, districts, and colleges subsidize the associated costs as outlined in the Florida Education Finance Program (FEFP) and state statute.

This removes a significant barrier for students and families. Because of Florida's efforts to make participation possible at no cost, annual DE participation in Florida has increased significantly in recent years. One report from the Florida Department of Education showed a 28 percent (14,000 students) increase in DE participation among Florida high schoolers between 2011 and 2017.[2] Additionally, Florida DE students take almost half the time to complete postsecondary degrees compared to non-DE students, and immediately after completing high school, DE students enroll in college at higher rates than students enrolled in other accelerated programs.[3]



In DE participation among Florida high schoolers between 2011 and 2017

In addition to the no-cost incentive for student participation, other incentives are in place that target schools, districts, and teachers. These incentives seek to increase practices that lead to student success in accelerated courses. For AP courses, districts receive "bonus funding" under FEFP for students who achieve a three or higher on each AP Subject exam attempted. An additional district incentive exists for students who received a College Board Advanced Placement Capstone Diploma. To support the teaching workforce and instruction, AP teachers are eligible for bonuses. A teacher may receive a $50 bonus for each student who successfully passes an AP exam. Teachers who teach AP at a "D" or "F" rated school are eligible for an additional $500 bonus if at least one of their students passes the AP subject exam.

Similar incentives exist for DE courses. Districts receive "bonus funding" for students who receive an "A" or better in a DE course that meets college general education requirements. There are further bonuses for students who are successful in a DE course through an early college program—a structured dual enrollment model with the goal of associate degree completion simultaneous with high school completion. In some cases, colleges are required to subsidize the cost of DE programming to students and families. To support colleges in paying these costs, the state established the Dual Enrollment Scholarship Program in 2021.

[2]Florida. (2018). Dual Enrollment in the Florida College System. 2018.
[3]Florida. (2018). Dual Enrollment in the Florida College System. 2018.; Speroni, C. (2011). Determinants of students' success: The role of advanced placement and dual enrollment programs. National Center for Postsecondary Research, November.

What Percentage of Public-School Students Participate in Accelerated Courses?

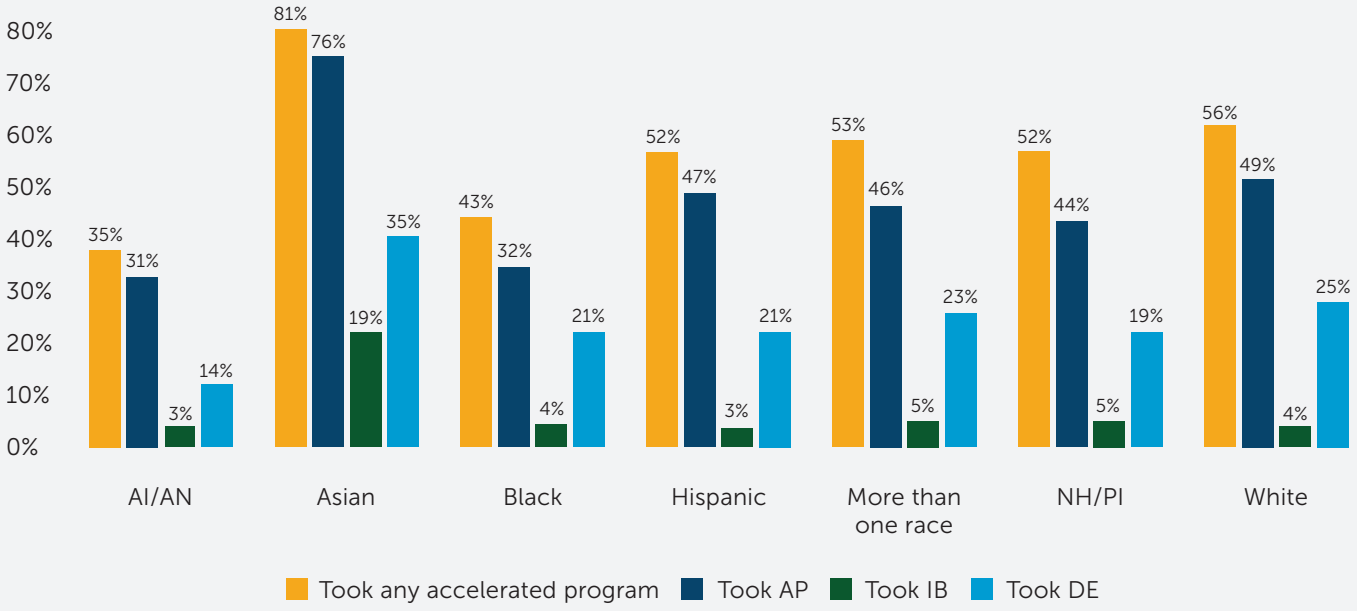
For Florida students who entered 9th grade in the 2015-16 school year, 53 percent participated in at least one accelerated course. Among these participants, AP was the most popular type of course (47 percent participation). Additionally, 23 percent participated in DE, and 4 percent participated in an IB course. Twenty percent of students took more than one type of accelerated course. The most common combination of courses that Florida students enrolled in was AP and DE (17 percent), followed by AP and IB (4 percent).

How Does Participation in Accelerated Courses Vary Among Student Populations, Specifically for Black and Low-income Students?

While 53 percent of students participated in at least one accelerated course, participation varied among racial/ethnic subgroups and by student designations (e.g., Special Education, English as a Second Language, or Free Reduced-Price Lunch).

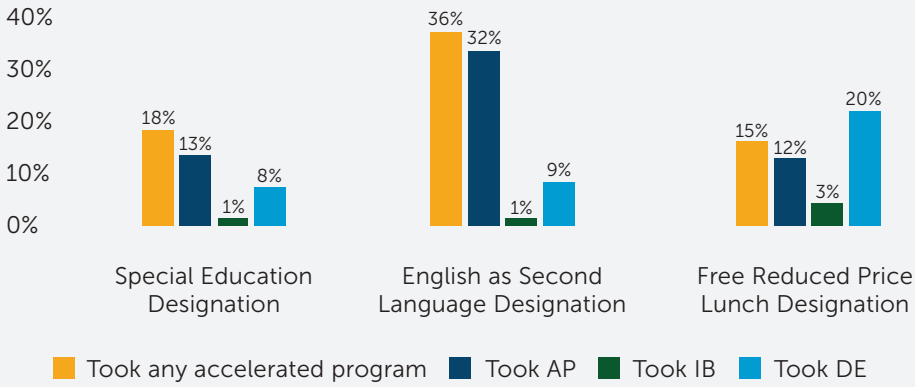
Among racial and ethnic student population subgroups, Asian students had the highest participation rates in all types of accelerated courses. There was little difference among students who identified as Hispanic, more than one race, Native Hawaiian/Pacific Islander, or white. The lowest participation rates were for American Indian/Alaskan Native and Black students.

Accelerated Coursework Participation Rates in Florida by Race/Ethnicity



Participation in accelerated courses also varied when analyzed in terms of student designation. Special education and English language learners were most likely to have taken an AP course. Low-income students (students who were designated as eligible for Free or Reduced-Price Lunch) were most likely to participate in DE compared to other accelerated courses. On the whole, special education, low-income, English language learner students participated in accelerated coursework at lower rates than the overall student population.

Accelerated Coursework Participation Rates in Florida by Student Designation



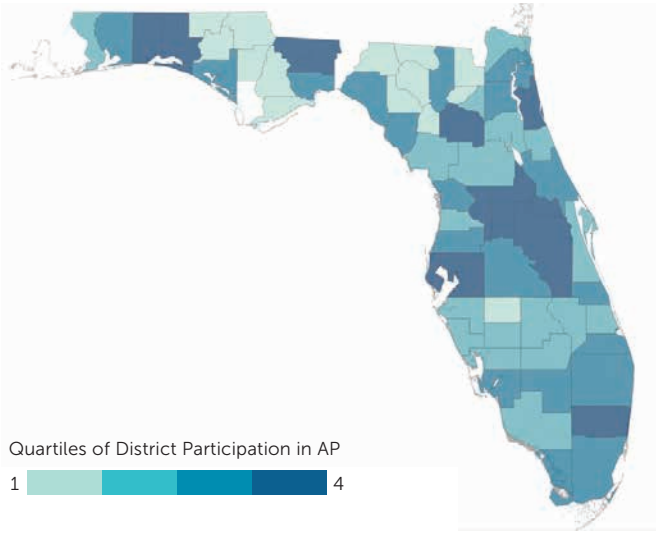
Course-taking Patterns by Florida Districts

The size and geographic location of a high school or district is associated with variations in accelerated coursework participation. For AP programs, districts with higher participation were clustered around larger suburban districts in the central and southern regions of the state (as well as select, smaller districts).

Thirty-one percent of the schools with the highest AP participation rates were in cities and 56 percent were in suburban areas; by contrast, 37 percent of the schools with the lowest AP participation rates were in rural areas or towns. This disparity suggests that students who live in smaller districts have fewer opportunities to participate in AP.

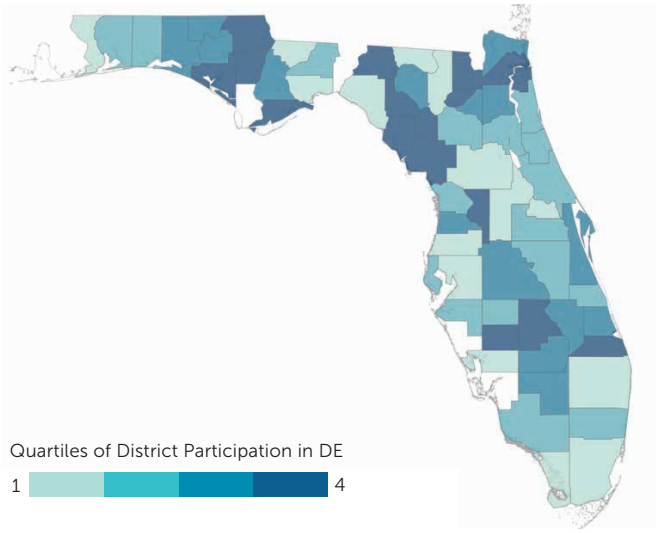
Compared to AP, DE participation was more common in smaller districts across the state. At the school level, 37 percent of schools with the highest rates of DE participation were in cities; 43 percent were in suburban areas; and 21 percent were in rural areas and towns.

AP Course-taking Across Florida Districts



Notes: The source is the authors' analysis of Florida Department of Education, Bureau of PK-20 Education Reporting and Accessibility data. The colors shown in the graphic represent quartiles based on AP participation in each Florida district. The first quartile are districts with 1%-27% of students participating; the second quartile are districts with 28%-41% participation; the third quartile are districts with 42%-55% participation; and the fourth quartile are districts with greater than 55% participation in AP. Districts with no AP participation are denoted in white.

DE Course-taking Across Florida Districts



Notes: The source is authors' analysis of Florida Department of Education data. The colors shown in the graphic represent quartiles based on DE participation in each Florida district. The first quartile are districts with 1%-16% of students participating; the second quartile are districts with 17%-21% participation; the third quartile are districts with 22%-28.6% participation; and the fourth quartile are districts with greater than 28.6% participation in DE. Districts without DE participation are denoted in white.

The Influence of Accelerated Coursework on College-Going and Attainment in Florida

KEY TAKEAWAYS

1. Taking either an AP or DE course increases the likelihood that Florida public school students enroll in college.

2. Taking either an AP or DE course increases the likelihood that students will persist in college beyond two semesters.

3. All students were substantially more likely to attain a bachelor's degree—more so than an associate degree—if they participated in AP or DE.

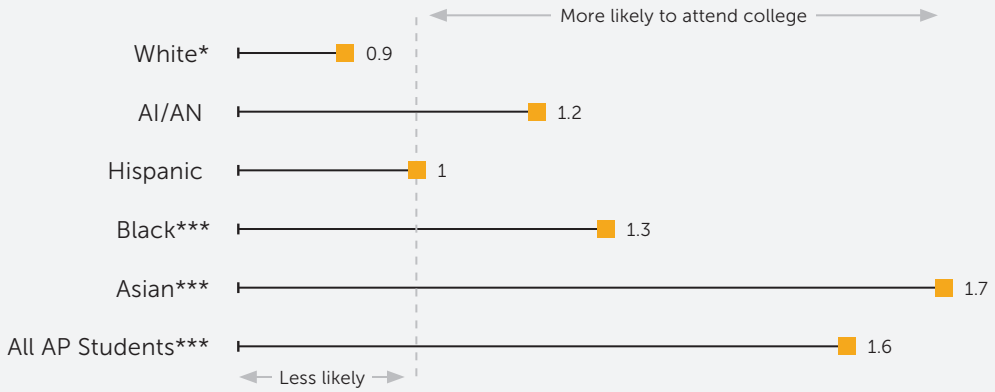
How Does Participation in Accelerated Courses Influence College-Going?

Among students who were 9th graders in Florida public schools in the 2008-09 school year, those who took at least one AP or DE course were more likely to enroll in a Florida College System or State University System institution than their peers who did not participate in AP or DE.

Approximately one-third of Florida public high school graduates enrolled in AP courses continued on to enroll in Florida public universities within one year of graduating high school. Additionally, Florida AP students are more likely than DE students to enroll in a four-year institution after high school.

These outcomes were not consistent among all students. A significantly increased likelihood of going to college was found for AP students who identified as Asian (1.7 times as likely) or Black (1.3 times as likely).

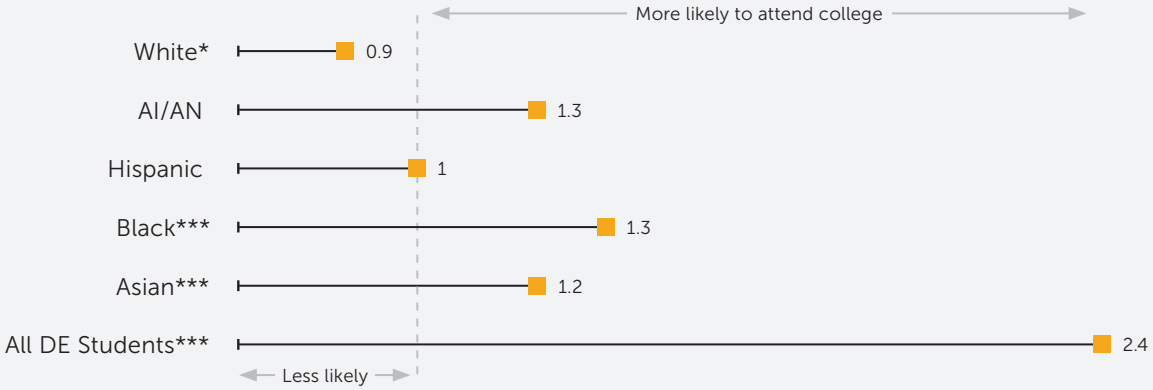
The Likelihood of AP Students Attending College vs. Non-AP Students



*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

DE students were 2.4 times more likely to enroll in a Florida College System or State University System institution than their non-DE peers. As with AP participation, Asian and Black identifying students who took a DE course were more likely to enroll in a postsecondary institution than their non-DE peers (1.2 and 1.3 times more likely, respectively).

The Likelihood of DE Students Attending College vs. Non-DE Students

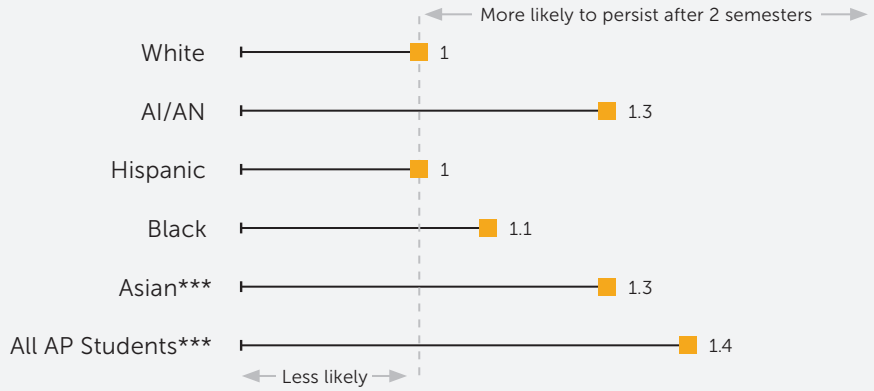


*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

How Does Participation in Accelerated Courses Influence College Persistence?

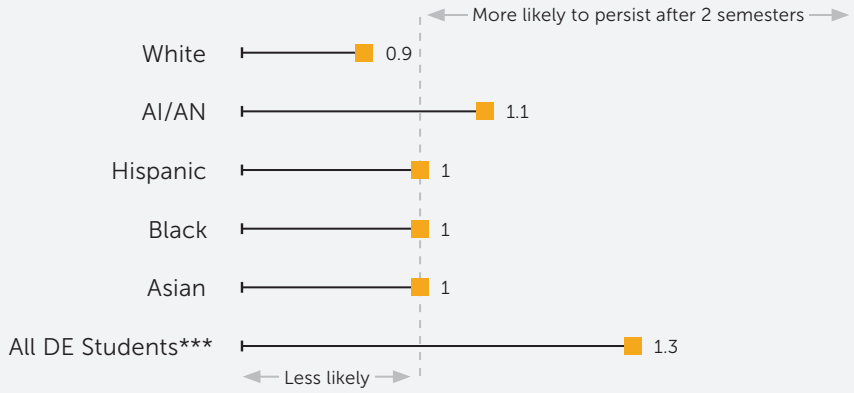
Taking either an AP or DE course increases the likelihood that students will persist in college beyond two semesters. AP students overall were 1.4 times more likely to persist in a Florida College System or State University System institution, while DE students were 1.3 times more likely to persist. Notably, within each subgroup, there were no significant AP and DE effects on persistence.

The Likelihood of AP Students Persisting in College After Two Semesters vs. Non-AP Students



*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

The Likelihood of DE Students Persisting in College After Two Semesters vs. Non-DE Students



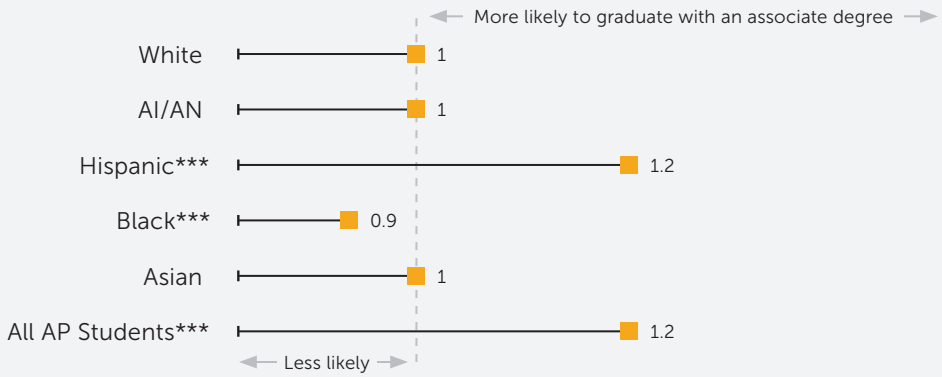
*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

How Does Participation in Accelerated Courses Influence Degree Completion?

Participating in AP and DE increases the odds that students in Florida will earn a degree from an institution in the Florida State College or State University System.

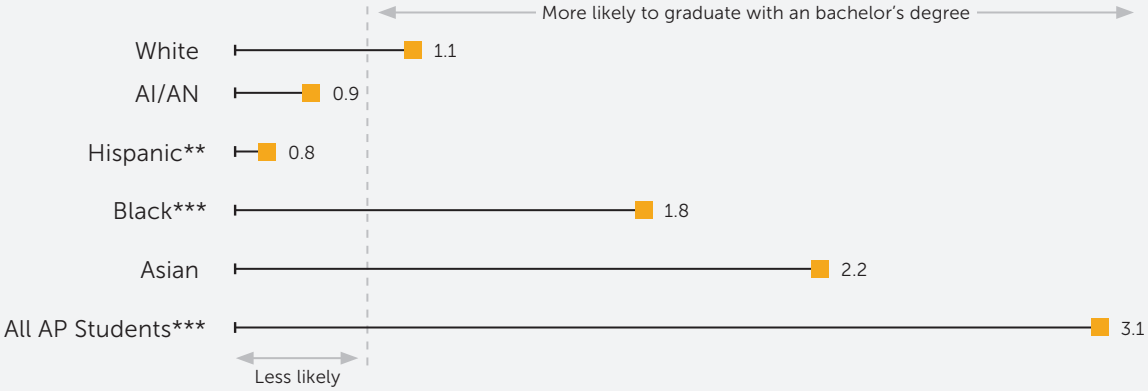
Overall, students who took an AP course were 1.2 times more likely to attain an associate degree and three times more likely to earn a bachelor's degree at a Florida College System or State University System institution compared to similar non-AP students. Students who took a DE course were 1.8 times more likely to complete an associate degree and 1.7 times more likely to complete a bachelor's degree. There were differences by subgroup. Notably, Black students were substantially more likely to attain a bachelor's degree—more so than an associate degree—if they participated in AP or DE.

The Likelihood of AP Students Graduating with an Associate Degree vs. Non-AP Students



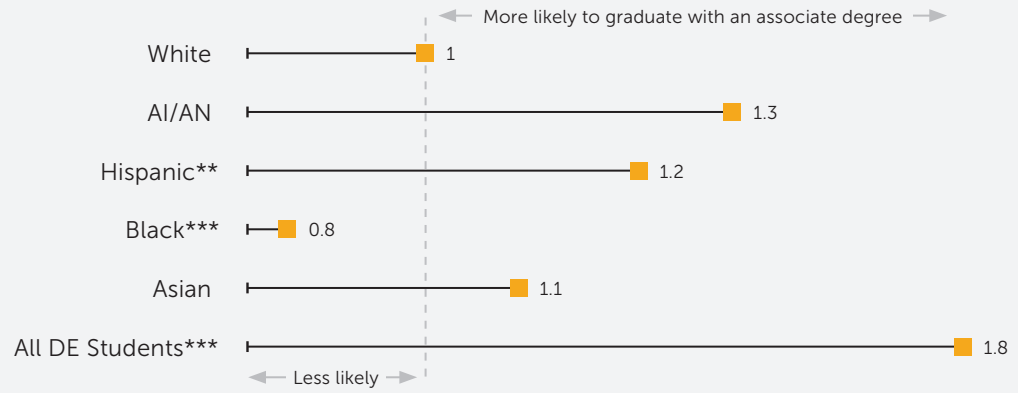
*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

The Likelihood of AP Students Graduating with an Bachelor's Degree vs. Non-AP Students



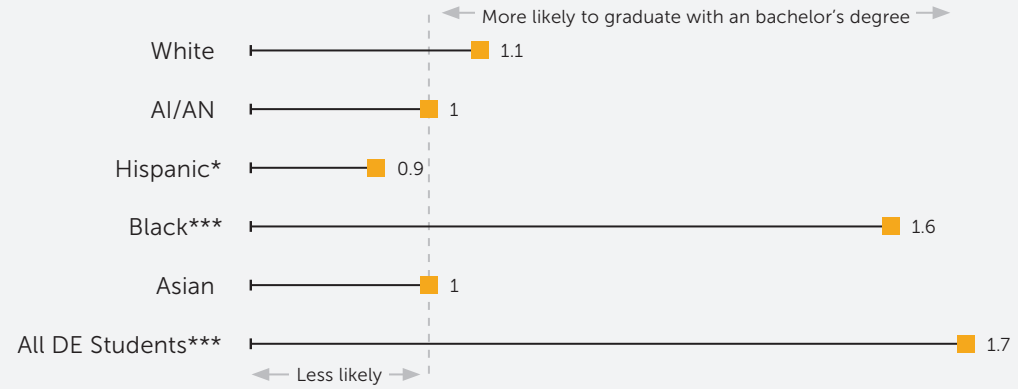
*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

Degree vs. Non-DE Students



*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

The Likelihood of DE Students Graduating with an Bachelor's Degree vs. Non-DE Students



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What Florida Can Do To Ensure More Students Can Participate in Accelerated Coursework?

These research findings show promising results supporting increased access to accelerated coursework. While AP and DE have clear positive impacts on Florida students' postsecondary outcomes, it is critical to ensure that all students have equitable opportunities to participate in AP and DE.

This imperative is exemplified by the low rates of AP and DE participation among Black students, who are among the least likely to participate in accelerated courses. At the same time, Black students who participate are much more likely to earn a bachelor's degree than those who do not participate in accelerated courses. This is especially noteworthy given that Florida residents who identify as Black have the lowest rates of postsecondary degree attainment.

As such, it is essential that Florida examine strategies to increase equitable access to advanced placement and dual enrollment.

Additionally, while strong policies exist to eliminate barriers for students, these must be reinforced with quality advising, especially for priority student groups. Efforts to increase awareness of these opportunities to students and their families and the state supports already in place can help students determine their available options and which courses are the best fit for them.

Florida should also continue to incentivize—for districts, schools, and teachers—accelerated course offerings and student success.

To ensure students have access to accelerated course offerings and the instructional support to be successful, it is important that the state continue incentives (discussed on page 8), and that districts and teachers continue taking advantage of these opportunities to expand access.

APPENDIX

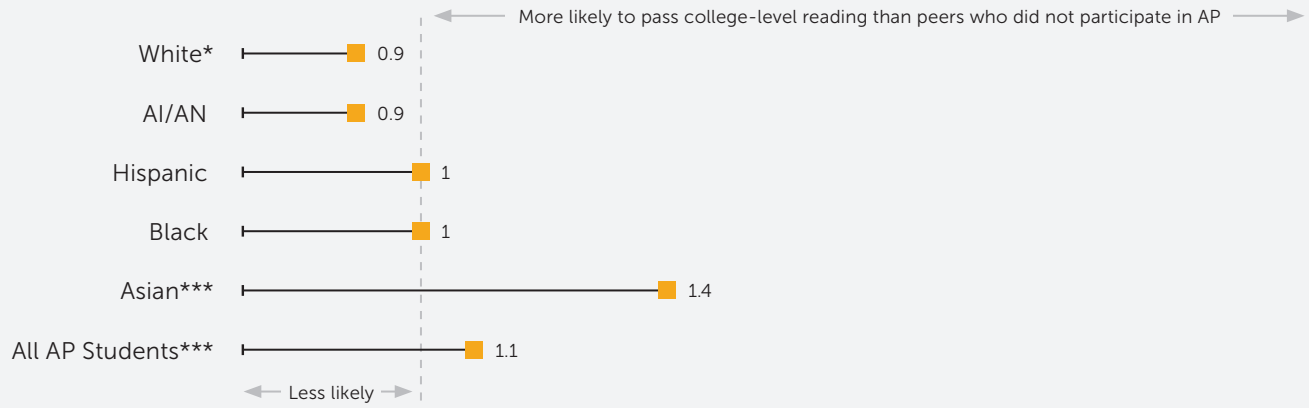
Supplementary Data Tables and Methodological Notes

APPENDIX

Supplementary Research Question: How do accelerated courses influence completion of core degree requirements, such as college-level reading and math?

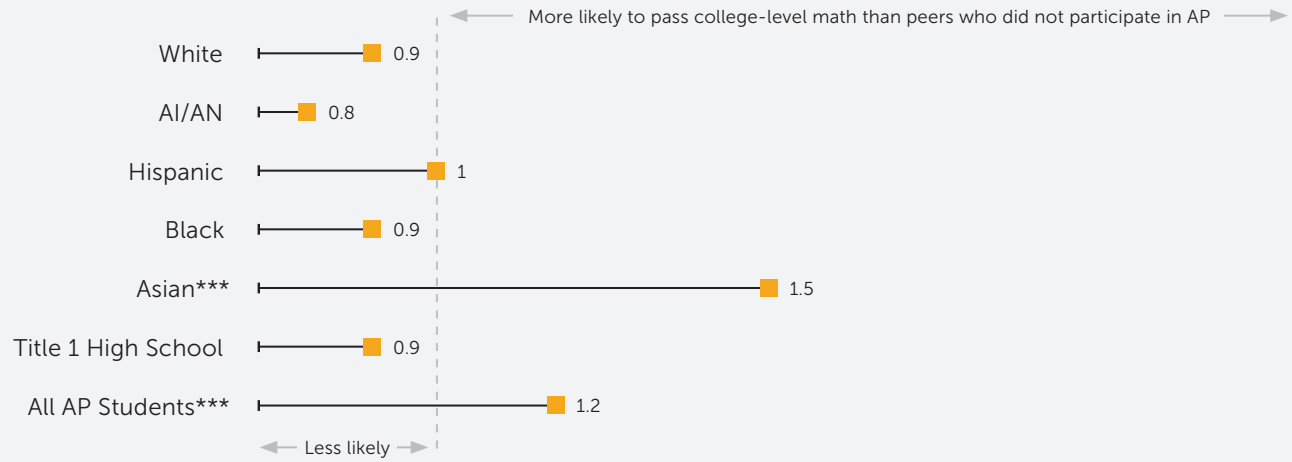
In this question, we examined the impact of AP and DE on success in college-level reading (ENC1101) and math (MAC1105) courses. Overall, AP and DE participation led to significantly increased likelihoods of students passing college-level reading and math.

The Likelihood of AP Students Passing College-Level Reading vs. Non-AP Students



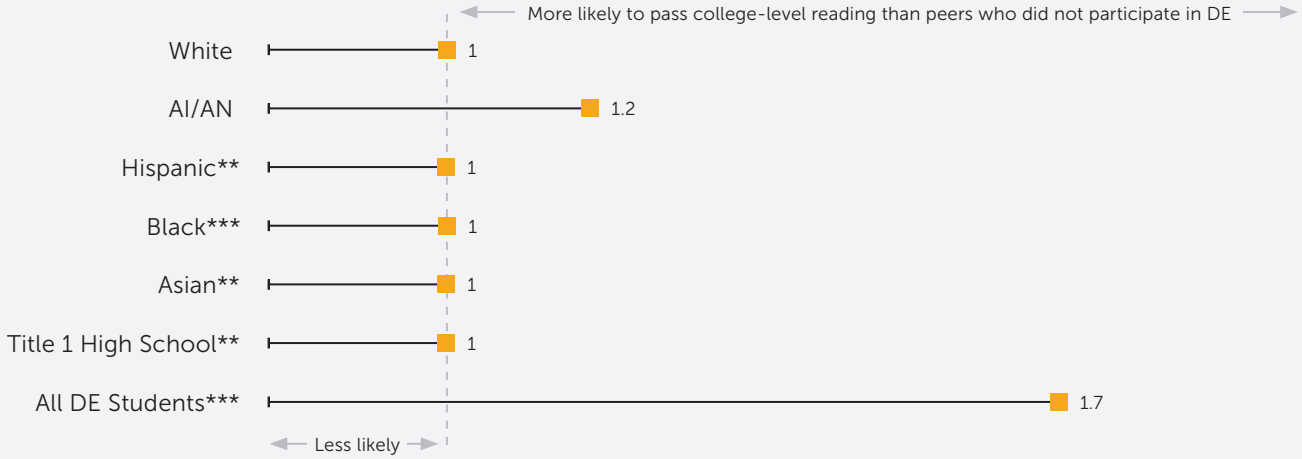
*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

The Likelihood of AP Students Passing College-Level Math vs. Non-AP Students



*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

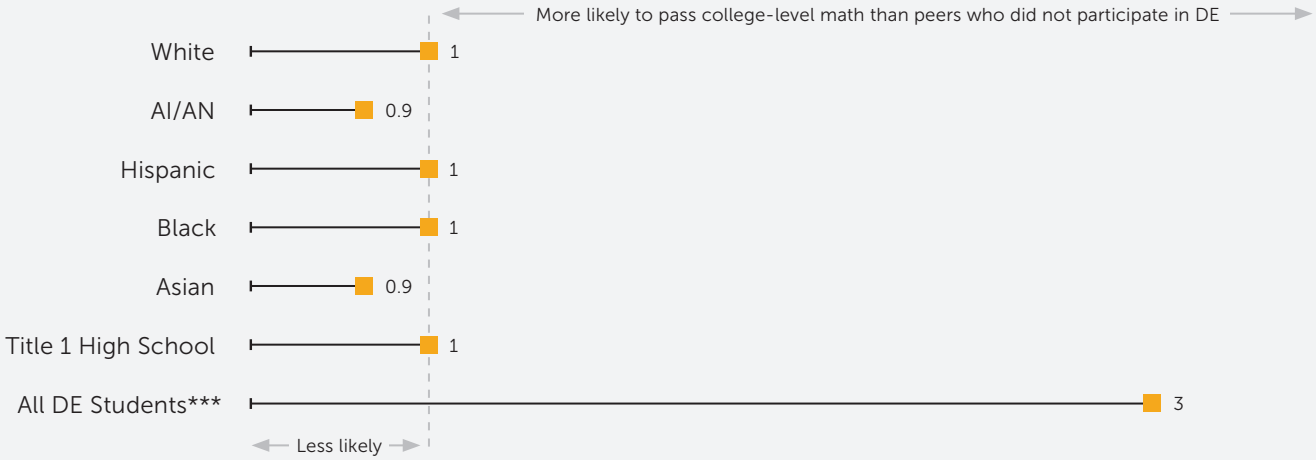
The Likelihood of DE Students Passing College-Level Reading vs. Non-DE Students



*Odds ratio. Statistical significance is noted in the following way: *** p < 0.01, ** p < 0.05, and * p < 0.1 NH/PI sample sizes were not sufficiently large to include in the impact analysis.*

APPENDIX

The Likelihood of DE Students Passing College-Level Math vs. Non-DE Students



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Research Sample

The research team used two sample groups from data provided by the Florida Department of Education.

Research Question(s)	Sample	Dependent Variable	Purpose
(1) What percentage of public-school students participated in accelerated courses?	Students enrolled as 9th graders in a Florida public school in the 2015-16 school year	Enrolled in at least one accelerated course during high school.	Examine participation and access in accelerated courses
(2) How does participation vary among student populations, specifically for Black and low-income students?	Students enrolled as 9th graders in Florida public schools in the 2008-09 school years	Enrolled in at least one AP course during 10th, 11th, or 12th grade Enrolled in at least one DE course in 11th or 12th grade	Examine the impact of accelerated course participation on postsecondary success outcomes
(3) How do accelerated courses influence college-going?	Students enrolled as 9th graders in Florida public schools in the 2008-09 school years	Attended any FCS or SUS institution	Examine the impact of accelerated course participation on postsecondary success outcomes
(4) How do accelerated courses influence college persistence?	Students enrolled as 9th graders in Florida public schools in the 2008-09 school years	Remained enrolled in any FCS or SUS institution after two semesters	Examine the impact of accelerated course participation on postsecondary success outcomes
(5) How do accelerated courses influence degree completion?	Students enrolled as 9th graders in Florida public schools in the 2008-09 school years	Completed an associate or bachelor's degree at any FCS or SUS institution	Examine the impact of accelerated course participation on postsecondary success outcomes

Note: The dataset included students who participated in IB programs; however, those students were excluded from the featured analyses in Research Questions 2-5 due to small sample sizes.

A.1 Research Sample: Student Characteristics (2015-2016 Cohort)

Data source: Florida Department of Education, PK-20 Education Reporting and Accessibility data.

	Student Sample N	Student Sample %
Overall	168,171	100
Female	84,076	50.0
Male	84,095	50.0
American Indian/Alaskan Native	673	0.4
Asian	5,084	3.0
Black	32,156	19.1
Hispanic	52,935	31.5
More than one race	4,938	2.9
Native Hawaiian/Pacific Islander	206	0.1
White	72,179	43.0
Special Education Designation	19,222	11.4
English Second Language Designation	10,162	6.0
Free or Reduced-Price Lunch	104,570	62.2

A.2 Characteristics of Students Participating in an AP Course (2015-2016 Cohort)

	AP Participation N	AP Participation %
Overall	77,042	100
Female	44,023	57.1
Male	33,019	42.9
American Indian/Alaskan Native	207	0.3
Asian	3,853	5.0
Black	10,382	13.5
Hispanic	24,790	32.2
Multiple	2,261	2.9
Native Hawaiian/Pacific Islander	91	0.1
White	35,458	46.0
Special Education Designation	2,579	3.4
English Second Language Designation	3,220	4.2
Free or Reduced-Price Lunch	41,220	53.5

Data source: Florida Department of Education, PK-20 Education Reporting and Accessibility data.

A.3 Characteristics of Students Participating in a DE Course (2015-2016 Cohort)

	DE Participation N	DE Participation %
Overall	38,926	100
Female	23,991	61.6
Male	14,935	38.4
American Indian/Alaskan Native	93	0.2
Asian	1,774	4.6
Black	6,833	17.6
Hispanic	10,986	28.2
Multiple	1,127	2.9
Native Hawaiian/Pacific Islander	40	0.1
White	18,073	46.4
Special Education Designation	1,495	3.8
English Second Language Designation	947	2.4
Free or Reduced-Price Lunch	20,974	53.9

Data source: Florida Department of Education, Bureau of PK-20 Education Reporting.

Methodology

Propensity Score Matching

The research team employed propensity score matching (PSM) to create a treatment and control group, for each of the accelerated programs, that are balanced on specific baseline characteristics, thereby reducing the bias of the estimated "treatment" effects. For this approach, we used gender, race/ethnicity, achievement on the reading exam of the 9th grade Florida Comprehensive Assessment Test (FCAT), and achievement on the 9th grade FCAT mathematics exam to create the matched treatment and control groups. While this matching procedure helps reduce systematic differences between the treatment and control groups on these specified variables, it does not necessarily remove all potential biases that might occur due to variables that were not considered during the matching procedure. As a result, we also matched students within the same district to control for some of the unobserved district-level characteristics that might impact a student's participation in each of the accelerated programs.

For this analysis, we selected a caliper value of 0.06, which represents the maximum permitted difference between matched students. We chose our caliper by starting at 0.15 and reducing it by 0.05 until we reached a caliper size that allowed us to reach baseline equivalence on our matching variables while also retaining a sufficient sample size. We found that dropping below 0.06 did not yield any additional value in attaining baseline equivalence or a reduction in bias. We elected to perform a one-to-one matching without replacement in creating the treatment and control groups, which allowed us to create equal treatment and control samples that still matched on important variables.

A.4 AP Participation Post-Matching Baseline Equivalence Testing (N = 47,852)

Student Characteristic	Control Mean	Treatment Mean	Difference	Effect Size[4]
Female	0.47	0.46	-0.01	0.03
Hispanic	0.25	0.24	-0.01	0.02
Asian	0.02	0.01	-0.01	0.09**
American Indian/Alaskan Native/Native Hawaiian/Pacific Islander[5]	0.003	0.003	0.0	0.00
Black	0.21	0.21	0.0	-0.02
White	0.48	0.49	0.01	-0.03
Multiple	0.03	0.03	0	0.01
FCAT Math	1944.1	1938.9	-5.2	0.04
FCAT Reading	1912.0	1898.2	-13.8	0.06**

[4]*The What Works Clearinghouse Standards requires that the effect size difference between the treatment and control groups be less than 0.05 to meet baseline equivalence. Effect sizes greater than 0.05 and less than 0.25 require statistical adjustment in the outcomes analysis (**) & effect sizes greater than 0.25 do not meet baseline equivalence (***).*

[5]*These demographic characteristics are presented in a combined category due to the way they were reported at the time of data collection. After 2010, the reporting changed to allow the differentiation between these characteristics.*

A.5 DE Participation Post-Matching Baseline Equivalence Testing (N = 47,852)

Student Characteristic	Control Mean	Treatment Mean	Difference	Effect Size
Female	0.53	0.52	-0.01	0.01
Hispanic	0.24	0.24	0.00	0.00
Asian	0.02	0.03	0.01	0.00
American Indian/Alaskan Native/Native Hawaiian/Pacific Islander	0.003	0.003	0.00	0.01
Black	0.16	0.15	-0.01	0.02
White	0.52	0.53	0.01	-0.01
Multiple	0.03	0.03	0	-0.01
FCAT Math	1972.8	1975.4	2.6	-0.02
FCAT Reading	1964.4	1967.6	3.2	-0.01

Multilevel Logistic Regression Framework

Following creation of the matched samples for AP and DE programs, a multilevel logistic regression framework was used[6] to evaluate the impact of participation in each of the accelerated programs on the following outcomes: 1) matriculation into a postsecondary institution (i.e., enrollment), 2) persistence in a postsecondary institution, 3) levels of college-level writing and college-level math completion, and 4) graduation from a postsecondary institution.[7]

Given the impact of school- and district-level policies, one might expect the average correlation between variables measured on students in the same district to be higher, as well as the correlation at the school-within-district level. This inherent nesting structure justifies the consideration of a multilevel model with random intercepts at the school and district levels to mitigate the potential bias that might occur as a consequence of failing to account for the hierarchical structure. We used the enrollment outcome variable to create a single multilevel model per accelerated program. If computational issues arose during the use of the model for any of the outcome variables, the model was adjusted for that specific outcome variable.

The researchers considered student-, school-, and district-level covariates in the development of the multilevel framework. We received longitudinal (2008-2009 to 2019-2020), student-level administrative data from the Florida Department of Education (including gender, race/ethnicity, and academic achievement), as well as school- and district-level data from the Common Core of Data (CCD) to provide additional context and possible second- and third-level covariates for the model. These variables included school locale, Title I status, school enrollment size, district enrollment size, number of schools per district, and district-level proportion of English Language Learner (ELL) students.[8] The potential covariates represented data from the 2008-09 academic year as we elected to use 9th grade characteristics as our baseline values for the model.

[6]*Giani, M., Alexander, C., & Reyes, P. (2014). Exploring Variation in the Impact of Dual-Credit Coursework on Postsecondary Outcomes: A Quasi-Experimental Analysis of Texas Students. The High School Journal, 97(4), 200–218. https://doi.org/10.1353/hsj.2014.0007; Guo, G., & Zhao, H. (2000). Multilevel Modeling for Binary Data. Annual Review of Sociology, 26, 441–462. http://www.jstor.org/stable/223452*

[7]*Cross-classified multilevel models, where the two higher-level units are high school and college/university, were initially considered for the impact analysis. Due to computational issues with the cross-classified model, the multilevel logistic regression framework was adopted as it has been utilized in similar contexts (Giani, 2014).*

[8]*In the analysis, school locale is defined to be a nominal variable with three possible categories (city, suburb, and town/rural); and school enrollment size, district enrollment size, and number of schools per district were modified to be ordinal variables by splitting the data into quartiles.*

Deriving the Multilevel Framework

In deriving the multilevel framework, we first estimated the intercept-only model (as shown below) to partition the total variance into its within- and between-group components and make a formal determination as to whether a multilevel approach is warranted.[9]

Level 1: logit (πijk)= β0jk + $e$ijk

Level 2: β0jk= δ00k + u0jk

Level 3: δ00k= γ000+ν00k

Where the outcome is the log odds of student i in school j in district k experiencing the outcome (in this case, enrollment), γ000 is the population grand mean, ν00k is the residual error term at the district level, u0jk is the residual error term at the school level, and $e$ijk is the residual error term at the student level. Decomposing the total variance across the levels of the intercept-only model allows us to estimate the proportion of variance at the school and district levels, through the intraclass correlation coefficient (ICC). Researchers have commonly used an ICC value of 0.05 as a rule of thumb to justify the use of a multilevel framework.[10]

The ICC values at the district-level, when considering a three-level multilevel framework, are below the rule of thumb of 0.05 for each of the accelerated programs, suggesting that a two-level multilevel model is sufficient. However, as a likelihood ratio test of the significance of the between-group variance at the district-level yielded significant results, we elected to continue considering a three-level multilevel framework for the analysis.

A.6 Intraclass Correlation Coefficients for Random-Intercept Models

Accelerated Program	School-Level ICC	District-Level ICC
Advanced Placement	0.046	0.034
Dual Enrollment	0.056	0.029

We used a forward selection approach as the variable selection strategy to choose appropriate covariates at each level, beginning with student-level covariates and then proceeding to school- and district-level covariates.[11, 12] In this approach, each variable is added one at a time[13] to examine whether the additional covariate significantly improves the model. Three metrics were used to determine whether a covariate was retained. First, we compared models using a likelihood ratio test to examine the difference in deviance of the models and perform a formal chi-square test of whether inclusion of the additional predictor significantly improves the model. We also consulted Akaike's Information Criterion[14] and the Bayesian Information Criterion[15] as they include penalty functions, based on the number of estimated parameters, to help yield a more parsimonious model.

The procedure led to the same multilevel model for AP and DE programs. The AP and DE multilevel frameworks included all student-level covariates considered (i.e., gender, race/ethnicity, 9th grade FCAT reading scores, 9th grade FCAT math scores, and 9th grade GPA), as well as two predictors at the school level (i.e., Title I status and school enrollment size). No district level variables were selected for any of the accelerated programs.

The multilevel framework developed using the forward selection approach was used for all outcome variables except for the college-level writing and math analyses. As the model failed to converge for these outcome variables, we elected to use a simpler model with the same student- and school-level covariates but with no random intercept at the district-level.

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[9] *The recorded school and district during the 2011-12 academic year (senior year for students not previously retained) were used to group students.*

[10] *Heck, R. H., Thomas, S. L., & Tabata, L. N. (2014). Multilevel and longitudinal modeling with IBM SPSS (2nd ed.). Routledge/Taylor & Francis Group.*

[11] *Random slopes and cross-level interactions between higher- and lower-level covariates were not considered in the analysis.*

[12] *Hox, J., Moerbeek, M., & van de Schoot, R. (2017). Multilevel Analysis: Techniques and Applications, Third Edition (3rd ed.). Routledge. https://doi.org/10.4324/9781315650982.*

[13] *The student-level variables related to race/ethnicity were included as a group during the forward selection procedure.*

[14] *Schwarz, G. (1978) Estimating the Dimension of a Model. Annals of Statistics, 6, 461-464. http://dx.doi.org/10.1214/aos/1176344136*

[15] *Akaike, H. (1987). Factor analysis and AIC. Psychometrika, 52(3), 317–332.*

Sensitivity Analyses

Account for Students Switching Schools/Districts

The impact analysis included students who switched schools and/or districts, as well as students who did not complete high school in Florida. To examine how these students impacted the results, we restricted the sample to students who remained in the same school between the 2008-09 and 2011-12 academic years, corresponding to grade 9 through grade 12 for most students. This leads to a substantial drop in the number of "treatment" cases for each of the accelerated programs. For example, in the matched dataset for AP programs the number of "control" cases drops by about 5% while the number of "treatment" cases drops by about 45%.

Although restricting the sample leads to a significant change in the matched samples, the results are relatively similar to the results previously discussed. However, the estimated impact of the accelerated programs on each of the outcome variables, as shown by the odds ratios, is generally lower when using the restricted sample.

A.7 Regression Results for Students in Same School from 2008-09 to 2011-12

Outcome	AP	DE
Enrollment		
Enrollment in any FCS/SUS Institution	1.652*** (0.035)	2.375*** (0.080)
Persistence		
Persist after 1 Semester	1.705*** (0.036)	2.588*** (0.088)
Persist after 2 Semesters	1.357*** (0.025)	1.301*** (0.030)
Persist after 3 Semesters	1.325*** (0.029)	1.198*** (0.032)
Persist after 4 Semesters	1.337*** (0.039)	1.211*** (0.042)
Graduation		
Graduated with a Bachelor's Degree	3.060*** (0.089)	1.701*** (0.051)
Graduated with an Associate's Degree	1.165*** (0.025)	1.743*** (0.048)
Graduated with any Degree	1.897*** (0.037)	2.187*** (0.055)
Graduated within 2 Years	2.113*** (0.060)	2.063*** (0.062)
Graduated within 4 Years	1.747*** (0.036)	1.910*** (0.048)
College-Level Courses		
Passed College-Level Reading	1.054*** (0.020)	2.644*** (0.069)
Passed College-Level Math	1.155*** (0.023)	2.996** (0.080)

*Notes: Estimates presented in (1) and (2) are the odds ratios from the multi-level logistic regression. Standard errors are presented in parentheses. Statistical significance is noted as follows: *** p<0.01, ** p<0.05, * p<0.1.*

Control for Participation in Multiple Accelerated Programs

As anticipated, some students participated in multiple accelerated programs during their high school studies. For example, in the matched sample for AP programs, approximately 31 percent of the students also participated in DE programs, respectively, with most of these students being considered as "treatment" cases (i.e., students who participated in AP programs). In other words, students who participated in AP programs were more likely to also participate in DE programs than students who did not participate in AP programs. As participation in multiple programs can affect the outcomes of students after high school, we repeated the analyses with the addition of indicator variables to control for participation in other accelerated programs.

The estimated impact of each of the accelerated programs, after controlling for participation in multiple programs, is very similar to the initial results. For AP and DE programs, the estimated impact is generally slightly lower after controlling for participation in multiple programs.

A.8 Regression Results for Students who Participate in Multiple Accelerated Programs

Outcome	AP	DE
Enrollment		
Enrollment in any FCS/SUS Institution	1.629*** (0.034)	2.307*** (0.078)
Persistence		
Persist after 1 Semester	1.692*** (0.035)	2.509*** (0.085)
Persist after 2 Semesters	1.352*** (0.024)	1.285*** (0.029)
Persist after 3 Semesters	1.335*** (0.029)	1.185*** (0.031)
Persist after 4 Semesters	1.346*** (0.039)	1.200*** (0.041)
Graduation		
Graduated with a Bachelor's Degree	3.009*** (0.087)	1.679*** (0.050)
Graduated with an Associate's Degree	1.191*** (0.026)	1.712*** (0.047)
Graduated with any Degree	1.904*** (0.038)	2.141*** (0.053)
Graduated within 2 Years	2.133*** (0.060)	2.019*** (0.060)
Graduated within 4 Years	1.758*** (0.036)	1.866*** (0.046)
College-Level Courses		
Passed College-Level Reading	1.049** (0.020)	2.619*** (0.068)
Passed College-Level Math	1.147*** (0.023)	2.957*** (0.078)

*Notes: Estimates presented in (1) and (2) are the odds ratios from the multi-level logistic regression. Standard errors are presented in parentheses. Statistical significance is noted as follows: *** p<0.01, ** p<0.05, * p<0.1.*

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4747 N 32nd St.
Phoenix, AZ 85018
602-636-1850

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101 E Kennedy Blvd.
Suite 2050
Tampa, FL 33602
813-387-0221