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Access to Academic Intensity through Advanced Placement and Concurrent Enrollment: Statewide Evidence from Colorado

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Abstract: *Advanced placement (AP) is traditionally used to provide rigorous secondary coursework and provide potential postsecondary credit for secondary education students. One of the criticisms of AP is the difference in access across schools. Concurrent enrollment (CE) offers similar opportunities to AP but has been theorized to provide greater access. This study explores the probability of a high school in Colorado offering any AP or CE courses or a given AP or CE course using multiple years of statewide, school level data. The likelihood of a school offering AP is largely driven by having a sufficiently large population of high achieving students and the affluence of the surrounding community. In contrast, schools are more likely to offer CE if they are less wealthy, distant from urban centers, or charter. By serving schools traditionally unlikely to offer AP, CE expands access to advanced academic opportunities.*

Key Words: dual enrollment, concurrent enrollment, Advanced Placement, access

INTRODUCTION

Districts and schools across the United States seeking to maximize advantages for high school students planning to attend postsecondary institutions frequently choose to offer Advanced Placement (AP) and concurrent enrollment (CE). Both offer rigorous courses, hone academic skills, and offer potential for postsecondary credit to high school students—predominantly during the junior and senior years. Their value is reflected in additional grade points while in high school (Klopfenstein & Lively, 2016; Sadler & Tai, 2007) and in the possibility of university credit and increased consideration during admissions decisions (Evans, 2019; Geiser & Santelices, 2004).

The strength of advanced academic opportunities has long been considered a predictor of postsecondary success with AP frequently noted as a tool to provide advanced academic options to students (Adelman, 1999). Despite their purported benefits, access to AP and CE varies both within and between districts (Iatarola et al., 2011; Xu et al., 2019). The elite origins and relative prestige of AP frequently lead to criticism about access especially for non-White, low income, and rural students (Kalogrides & Loeb, 2013; Klopfenstein, 2004a, 2004b; Klugman, 2013; Kolluri, 2018). Central to these criticisms is that access to AP courses is restricted through various forms of tracking (Clotfelter et al., 2002; Klopfenstein, 2004a; Lucas, 2001).

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More recently, scholars have identified CE as an additional method for increasing advanced academic opportunities with the added benefit that CE may reach students not typically targeted for AP (Bailey & Karp, 2003; Hugo, 2001; Smith, 2007). Advocates for CE see it as potentially more inclusive in terms of the types of students served (Bailey et al., 2002; Hoffman et al., 2008) with special attention to those historically viewed as non-traditional college students such as low SES. Indeed, Klopfenstein and Lively (2012) described CE and AP as "serving different populations with different goals" (p. 59). Although CE and AP students share some similarities, Speroni (2011) found important differences in Florida between AP and CE students with CE students more likely to attend college after graduation, but less likely to attend four-year institutions. We know increasingly more about the descriptive characteristics of schools that offer AP (Burns & Leu, 2019; Xu et al., 2019) and the factors that predict AP course offerings (Gagnon & Mattingly, 2016; Iatarola et al., 2011). We know comparatively less about the school level characteristics that predict CE course participation (Pretlow & Wathington, 2013, 2014). Much of the knowledge base from descriptive statewide reports (Henneberger et al., 2015; Vente et al., 2016) or district level analyses (Xu et al., 2019) suggest differing levels of access to AP and CE based on the characteristics of the community. Researchers who examined AP and CE offerings often do so in separate analyses, leaving open the question how these programs may serve different types of schools within the same state. If indeed CE serves a different population of students than AP, then the expansion of CE may help to increase access to advanced academics for students and schools not typically captured in AP programs. The present study expands the body of knowledge surrounding access to advanced academics by examining statewide course participation for both CE and AP. Specifically, we use multiple years of statewide, school level data from Colorado to examine what are the characteristics of schools that predict participation in AP and CE by course type? Secondarily, do the characteristics that predict AP and CE participation systematically differ?

Access and Equity in Advanced Academics

Segregation both between and within schools contributes to uneven access to high academically intense courses such as AP and CE. Variation in access between schools is often reflected by community type, wealth, and race/ethnicity with wealthier, suburban, and Whiter schools being more likely to have robust AP programs (Kalogrides & Loeb, 2013; Klopfenstein, 2004a; Klugerman, 2013; Lucas & Barends, 2007). Within school variation of AP and CE courses can be explained in part by how students are tracked based on prior achievement with prior performance on standardized tests or grades often acting as gatekeeper. One of the primary factors predicting AP course offerings is having a sufficiently large population of prepared students (Conger et al., 2009) although some schools have disproportionate participation based on race/ethnicity or wealth in honors track courses (Clotfelter et al., 2002; Gamoran, 1992). Even within racially diverse schools, AP participation often favors White students at the expense of Black and Hispanics despite increases in the number of AP courses (Lucas & Barends, 2007; Rodriguez & McGuire, 2019). Beyond the characteristics of the school and students, states often create financial and policy incentives for schools to offer AP and CE courses and for students to participate in them.

AP INCENTIVES At least twenty states have incentives for schools to add or expand AP including requiring districts or high schools to offer AP (Education Commission of the States, 2021a). Notable among them are Texas, Arkansas, and Oklahoma which provide payments to schools for each student passing an AP exam (Jeong, 2009). States create further incentives including subsidizing teacher training (Holstead et al., 2010; Jackson, 2008; Lerner & Brand, 2008), and subsidies for low-income students in conjunction with the US Department of Education (Klopfenstein & Thomas, 2010). The state of Colorado created the Advanced Placement Incentives Pilot Program which targeted 23 rural districts across the state for additional financial support (Colorado Department of Education [CDE], 2020). Unlike other states, Colorado maintains few other incentives other than published cut-scores (Colorado Department of Higher Education [CDHE], 2020; Education Commission of the States, 2021b).

CE INCENTIVES

The Education Commission of the States (2020) lists 47 states that have CE statutes with at least ten requiring all high schools to provide CE. Further, 25 states require CE courses to count for both high school and postsecondary credit or mandate access to courses in addition to funding tuition for CE courses. In Colorado, the state passed the Concurrent Enrollment Programs Act of 2009, which paid for CE courses up to the community college rate and in 2019, expanded the eligible CE population to all high school students with unlimited number of credit hours (Concurrent Enrollment Programs Act, 2009; Concurrent Enrollment Programs Act, 2019). The change reduced the CE cost to zero for students —with the exception of districts that required families to pay for books.

PREDICTORS OF AP COURSE OFFERINGS

SCHOOL LEVEL MODELS

Researchers investigating AP participation at the school level often examined the probability of an AP course offering based on a vector or school and group level student demographic characteristics. Common demographic characteristics included race/ethnicity, free/reduced price lunch participation, and gender. When possible, authors included measures of prior achievement such as 8th grade test scores. School level characteristics frequently included enrollment, student/teacher ratio, urbanicity, and teacher education level. Differences in model specifications and data sources produced a complex picture of predictors of AP course offerings. We explore the nuances in depth below.

In an early work, Klopfenstein (2004a) examined the expansion of AP in Texas in the 1990s with a concentration on disparities in the growth and opportunities of AP for traditionally underrepresented students. Specifically, she examined the number of AP courses available and the growth in AP courses. In addition to race/ethnic composition and geographic location of the school, she included the district property value per pupil as a proxy for wealth in addition to percent low income. The only significant predictors were enrollment, percentage of students in special education, and district property value per pupil.

Larger, wealthier high schools continued to add AP courses faster than smaller, less wealthy ones. When examining the growth in the number of courses available, the percentage of Black and Hispanic students was significant, but largely not practically meaningful. Overall access for small, rural schools did not keep pace with their larger, more affluent peers. Klopfenstein used a disparity index to examine differences in AP participation by race/ethnicity relative to their

percentage of the school's population from 1994 to 2000. Although there were increases in participation for Black, Hispanic, and low-income students, they failed to reach parity with their overall representation of their school. Thus, White and Asian students continued to be overrepresented.

Iatarola, Conger, and Long (2011) examined the determinants of AP and International Baccalaureate (IB) course offerings in math, science, English, and social studies for a panel of Florida high schools. Their model included teacher, school, and group level student characteristics including percentages of race/ethnicity, enrollment, staff characteristics, and state standardized test performance. The use of prior test scores as a proxy for students ready to take AP was predictive for students far above the average of their school in most subjects as was school size and number of teachers. The percentage of non-White students was also positively correlated with AP course offering while poverty, as measured by free/reduced price lunch participation, was negative for AP science and social studies. Informative to the present study, they also included a separate analysis for small enrollment schools where a one standard deviation change in the number of far above average students—about 100—corresponded to the probability of increases in AP course offerings by as much as 26%. To emphasize the importance of having a sufficient population of prepared students, they summarized their findings by stating, "the perceived, created, or actual demands of the students (as proxied by their prior achievement) are the largest drivers of a school's likelihood of offering advanced courses" (p. 350).

Gagnon and Mattingly (2016) examined the United States, but chose to aggregate their examination of AP access, enrollment, and success to the district rather than school level. They used data from the 2011-2012 Civil Rights Data Collection for AP outcomes to report on over 11,000 school districts nationally. For many rural districts there is often only one high school and their aggregation to the district level likely had little difference from school level estimates in those cases. Their findings on access showed the negative effects of low enrollment, poverty, and remote rural status on AP offerings. Even within districts that offered AP, the percentage of students enrolled was negatively affected by remote rurality and poverty. Curiously, they found the NCES town designation to lower AP participation relative to rural districts. They concluded with a discussion of alternatives for schools unable to offer AP and highlight the advantages of concurrent enrollment for districts.

Student Level Models

A few studies had sufficient granularity of data to examine AP participation on the student instead of the school level. Conger, Long, and Iatarola (2009) used a multi-year panel of Florida data to model student level participation in AP and IB courses. Their unconditional descriptive group-level data mirror other descriptive analyses showing Asian and White students as more likely to take AP/IB than Black or Hispanic students. Notable in their robust set of school and individual covariates was the inclusion of 8th grade state test scores as measure of prior achievement. Utilizing those scores revealed large differences in achievement along racial/ethnic and gender lines. Controlling for prior achievement reversed the descriptive trend and showed Black and Hispanic as more likely than similar White students to take AP. School characteristics had largely small or insignificant effects in predicting student level AP participation. Larger schools lowered participation in AP math and science by approximately 1% although the marginal effect to do so was a one standard deviation increase in enrollment—approximately 900 students. Similarly, a one standard deviation increase in the percentage of teachers with advanced degrees was significant only for AP social studies. Their study highlighted the importance of student

preparation prior to entering high school on the ability to take advantage of AP courses later. Further noteworthy were the large regional differences in the prevalence of AP. By 2000 in Florida, 89% of Black and White students and 95% of Hispanics in the sample attended a school offering AP math with similar trends in English and social studies while Klopfenstein (2004a) showed only 53% of schools in Texas at the same time had an AP program.

Klopfenstein (2004b) examined student-level AP participation in Texas for the 1998-1999 academic school year using a vector of school and demographic characteristics. The results showed the primary factors lowering AP course participation were low-income status, small enrollment high schools, limited English proficiency, and rurality. Baseline participation for average seniors in the model showed low-income, Black, male students participating at approximately half the rate as their White peers. Substituting the coefficients of White students for Black and Hispanics reduced but did not close the participation gaps. Substituting White characteristics with the addition of the marginal effect of non-low-income, reduced participation gaps by 90% for Hispanic students and 98% for Black students emphasizing the pernicious effects of poverty. Overall, Klopfenstein's results indicated that Black and Hispanic students do not have equal access to AP programs, even with courses offered. The consistent positive effect, especially for Black and Hispanic students, of the Dallas school district's AP incentive program sheds light on the importance of incentives and school level factors on participation.

The school level predictor (Gagnon & Mattingly, 2016; Klopfenstein, 2004a; Iatarola et al., 201) and student level predictors studies Conger et al., 2009; Klopfenstein, 2004b) outlined above remain the guiding methodology for predictors of AP and continue to inform subsequent research. More recent studies extend these predictors to other areas such as the effects of AP mandates and school accountability (Arce-Trigatti, 2018; Beach et al., 2019) and racial/ethnic disparities in AP access (Price, 2021; Xu et al., 2019) but the core covariates remain largely unchanged.

PREDICTORS OF CE COURSE OFFERING

Unlike AP, there is considerably less research on the factors predicting CE participation and course offerings. Much of the recent expansion of CE is often driven by statutory changes with 47 states having statewide CE policies (Education Commission of the States, 2020). Even in the presence of statewide policies, there is often large within-state variation as to the number and types of courses available. Research into the characteristics of students participating as well as the types of students who participate are largely descriptive in nature (Museus et al., 2007; Pierson et al., 2017). Two studies by Pretlow and Wathington (2013; 2014) examined the effects of a policy change in Virginia using school level analyses. Together they provide a strong descriptive analysis of CE participation. In the first, they utilized a chi square (Pretlow & Wathington, 2013) to examine any CE participation before and after the policy change. After the policy shift, they found increases in both the absolute number of high schools and number of students participating. They also found rural schools overrepresented and suburban schools underrepresented. Schools with higher percentages of underrepresented students disproportionately offered less CE. The authors' stated limitation was the data did not allow them to see anything beyond a school offering CE in that the types or number of CE courses remained unknown. Descriptively they showed the percentage of Black and Hispanic students in CE increased by 25.6% and 56.3% respectively although their participation rates fell well below their percentage of high school graduates during the same period (Pretlow & Wathington, 2014). Although not predictive of CE course offerings, Johnson and Brophy (2006) examined CE participation in rural Washington state using a survey.

They identified four factors, academics, financial, social, and choice, as important to high school juniors and seniors when considering CE. Overall, they found CE offered an opportunity to expand academic choices, sample college level work while in high school, and to save money by reducing overall college costs. These factors may be reflected in more remote schools functioning differently than in the present study.

METHODS

DATA

We merged multiple sources of data—both public and proprietary— from Colorado for the 2011-2012 and the 2013-2014 academic years. The Colorado Department of Education (CDE) provided school level data for AP exam participation by subject and year. CDE provides publicly available data on ACT test scores by school and year. The Colorado Department of Higher Education provided student level data for CE participation by subject and year, which we aggregated to the school level. We merged these data with school level characteristics from the National Center for Education Statistics (NCES) Common Core of Data such as race/ethnic composition of schools, charter status, and urbanicity—which we collapsed to suburban, urban, rural, and town. We obtained International Baccalaureate (IB) participation from the Rocky Mountain Association of IB World Schools membership directory. Finally, we obtained median income data from NCES Edge files, which aggregates American Community Survey data to the ZIP code of the school. Median income data provides a proxy of the income for the high school and provides greater granularity than Title I participation—which we viewed as a school level characteristic.

We excluded online, alternative, and juvenile justice high schools from the dataset. Although AP is often offered online and is utilized by small and rural schools that often cannot support AP otherwise (Hendrix & Denger, 2016; Irvin et al., 2009), we exclude online schools from our analyses as we seek to model school level covariates such as urbanicity, median income, and 11th and 12th grade enrollment which cannot be linked to online schools. We acknowledge this as a possible limitation. Further, we excluded schools that closed during this time period or did not offer the 11th and 12th grades. The final group included 315 high schools observed twice covering 97% of the traditional public high schools in Colorado.

ANALYTIC APPROACH We extend the work of Iatarola et al., (2011) who examined the likelihood of offering AP courses in Florida, to include the growing CE sector in Colorado. Further, our analysis examines a smaller, western state with more geographically remote schools and a widespread four-day school week (Anderson & Walker, 2015). Formally, we ask

1. What is the probability of a school offering *any* AP or CE courses?
2. What is the probability of a school offering *only* AP or CE courses?
3. What is the probability of offering a *given* CE or AP course type?

We specify three versions of the following model:

$$C_{st} = \beta_0 + \beta_1 X'_{st} + \beta_2 Y'_{st} + \text{median income}_{st} + \delta_t + \varepsilon_{st}$$

Where C is a dichotomous indicator coded to 1 if a school *s* reported either an AP exam or CE course completion in year *t*; X' is a vector of school level variables including the number of 11th and 12th graders, Title I participation, charter status, student/teacher ratio, free/reduced price lunch participation, urbanicity, and IB program membership; Y' is a vector of group demographic characteristics including mean ACT score, percentages of race/ethnicity; median income of the

ZIP code where the school is located, δ_t is a year fixed effect, ε_{st} is a robust error term clustered on the school level. School population is restricted to 11th and 12th graders as they represent the overwhelming majority of AP test takers and CE course participants (College Board, 2014). As a result, analyses for AP social studies do not include two subjects, AP World History and Human Geography, because published data show these courses are not typically taken by juniors and seniors but rather by underclassmen (College Board, 2014). In 2014, for example, approximately only 12% of examinees in AP Human Geography and 25% of World History were juniors and seniors. For the second question, C is equal to one when a school reports participation for only AP or CE in a given year. Finally, question three uses the same model described earlier where C is a specific AP or CE subject area. For ease of interpretation, we utilize a linear probability model rather than the probit in previous work (Iatarola et al., 2011). Robustness checks utilizing a probit model are not qualitatively different, however.

The model includes both free/reduced price lunch (FRL) participation data and median income as they capture different sources of information about the community. Median income provides insight into tax base and serves as a proxy for economic vitality, while FRL captures school level experiences of students. We include IB as a dichotomous indicator as schools offering IB may choose to offer fewer AP or CE opportunities to students. Table 1 presents the racial/ethnic composition of the full sample in the descriptive statistics, but the analysis dichotomized race/ethnicity into non-White and White.

Notable in the descriptive characteristics are the number of rural schools and those meeting the NCES definition of town. The majority of high schools, although not students, are rural. Typically, researchers collapse NCES urbanicity into rural, suburban, and urban. The current study preserves the town variables for "town, distant" and "town, remote" as they describe the setting of 12% of the sample in the state and the experience does not easily fit into the other categories. Specifically, "town, distant" and "town, remote" are defined as being between 10 miles and 35 from an urbanized area or more than 35 miles respectively. The variable "town fringe" describes schools less than 10 miles from an urban area and was included in suburban (Phan & Glander, 2008). We use suburban as the reference group in all regressions.

Table 2 presents percentages of schools by program offering. Courses are grouped by subject type: English, math, science, and social studies. Concurrent Enrollment is offered in most school districts but not all high schools and 81% of schools in the sample offer at least one CE course. Approximately 22% of schools in the sample offer only CE. There is wide variation in the CE subjects available with 81% of schools offering some form of social studies, 80% have English, and 63% of schools offer science. Math is the least commonly offered CE subject area and is available in only 48% of schools.

Table 1
Descriptive Characteristics

School Characteristics		
	Mean	SD
Student Teacher Ratio	15.76	5.24
IB	0.09	0.29
Rural	0.46	0.50
Suburban	0.22	0.41
Town	0.12	0.33
Urban	0.23	0.42
Median Income	57,985.65	19,850.39
FRL Percentage	23.26	25.39
Student Teacher Ratio	15.76	5.24
Charter	0.06	0.24
11th and 12th Grade Enrollment	500.26	516.56
Student Characteristics		
Native American	0.92	2.42
Asian	1.99	2.48
Hispanic	27.59	22.49
Black	2.86	5.85
Pacific Islander	0.22	0.53
Multiracial	2.41	1.94
White	64.02	24.37
Percentage Non-White	35.98	24.37
ACT Composite	19.95	2.40
Observations	942	

Advanced Placement is less widespread with 73% of schools offering at least one AP course with 15% offering only AP. The variation in availability does not follow the CE trend, however. AP math, English, and social studies are both offered at 56% of the schools in the sample. AP science is offered in a little over half the schools.

Table 2

Course Offerings

	Mean	SD
Any Concurrent Enrollment	0.810	0.400
Only Concurrent Enrollment Offered	0.221	0.425
Concurrent Enrollment Social Studies	0.812	0.391
Concurrent Enrollment English	0.798	0.402
Concurrent Enrollment Science	0.629	0.483
Concurrent Enrollment Math	0.475	0.500
Any Advanced Placement	0.734	0.442
Only Advanced Placement Offered	0.150	0.357
Advanced Placement English	0.564	0.496
Advanced Placement Social Studies	0.556	0.497
Advanced Placement Science	0.513	0.500
Advanced Placement Math	0.556	0.497
Observations	942	

RESULTS

ADVANCED PLACEMENT

Prior researchers noted the influence of highly prepared students and enrollment as drivers in AP enrollment (Gagnon & Mattingly, 2016; Iatarola et al., 2011), but there has been comparatively little research examining if CE enrollment functions similarly. We begin with a statewide examination of AP course offerings with results presented in Table 3 and continue with CE in Table 4. Each column represents a separate regression with the outcome variable in the column header.

Our results largely mirror prior analyses on AP. We find increases in student achievement—as measured by ACT composite score—were frequently significant predictors of course offerings. Specifically, a one-point increase in the average ACT score of the school was associated with 3% increase in the probability of offering any AP courses ($p < 0.05$). Subject level analyses were only significant for math ($p < 0.10$) and science ($p < 0.10$) with a one-point increase in average ACT score corresponding to an approximately 3% in the probability of the subject offering. ACT score was significant for offering only AP subjects at the more liberal $p < 0.10$ level. The number of 11th and 12th graders—the typical AP population—was significant across all regressions with a 100-student increase in enrollment equating to approximately 2.5% increase in the probability of offering an AP course ($p < 0.001$). For all AP subjects, an increase of 100 students corresponded to approximately a 3% increase in the probability of offering any AP courses.

The median income of the ZIP code of the high school was consistently predictive of AP offerings. A one standard deviation increase in median income—approximately $20,000—equated to a 7.5% increase in the probability of offering any AP subject ($p < 0.001$), nearly 11% for math

and social studies ($p < 0.001$), approximately 7% for science ($p < 0.05$) and 8.7% for English ($p < 0.001$). Finally, a one standard deviation increase in median income increased the probability of offering only AP subjects by approximately 5% ($p < 0.001$).

No other variables were consistent predictors of AP offerings. The percentage of students qualifying for free/reduced price lunch (FRL) participation was significant only for AP math, with a 1% increase in FRL corresponded to a 0.2 ($p < 0.05$) decrease in the probability of course offering. A school located in a community meeting the town designation was significant relative to suburban—the reference group—for any AP course and math at 19% and 22.8% respectively ($p < 0.05$). The town designation was negatively associated with a school offering only AP and lowered the probability by 17% ($p < 0.05$). Similar to town, rural schools were significantly less likely to offer only AP by 18% ($p < 0.05$).

CONCURRENT ENROLLMENT Next, we turn to the probability of offering CE courses, an area with considerably less prior research than AP. Significant predictors for CE were locations distant from urban centers and charter status. Charter was a consistently a positive predictor of CE course offerings. Specifically, charter status increases the probability of offering any CE course by approximately 22% ($p < 0.05$). In the case of individual subjects, charter status increased the probability of offering CE math by 36% ($p < 0.05$), CE science by 28% ($p < 0.05$), and CE English by 18% ($p < 0.05$). Charter status was weaker for CE social studies at 16% ($p < 0.10$) and was not a significant predictor for only offering CE courses.

Geographic location was an important predictor for rural and town, relative to suburban, the comparison group. With the exception of CE science and only offering CE subjects, rural designation was consistently a significant predictor. Rural equated to an approximate 18% ($p < 0.05$) increase in the probability of offering CE math, social studies, and English relative to suburban schools. Rurality increased the probability of offering any CE subject 20% ($p < 0.05$). Town was a significant predictor across all outcomes with the exception of offering only CE. Results show a 24% increase for offering any CE subject ($p < 0.001$) and CE social studies ($p < 0.05$). The increase in probability for CE math was approximately 29% ($p < 0.05$). CE science and English were 27% ($p < 0.05$) and 21% ($p < 0.05$) respectively.

Most noteworthy was the relationship between income and CE offerings. As median income increased in the community, the probability of offering CE subjects dropped for most subjects, unlike AP. A one standard deviation increase in income resulted in approximately 6% decrease in the probability of course offering for CE science and 7% CE social studies ($p < 0.05$). For any CE subject, the resulting decrease was nearly 5%. Finally, a one standard deviation increase in median income corresponded with an 8% decrease in the probability of a school offering only CE subjects.

Table 3

Probability of Offering AP Courses by Subject

Variable	Any AP	Only AP	AP Math	AP Science	AP Social Studies	AP English
ACT Composite Score	0.030**	0.010*	0.030*	0.028*	0.018	0.022
	(0.014)	(0.012)	(0.017)	(0.016)	(0.016)	(0.014)
11th and 12th Enrollment	0.000***	0.000	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Charter	-0.150	-0.211**	-0.060	-0.033	-0.149	-0.245
	(0.126)	(0.080)	(0.132)	(0.131)	(0.134)	(0.135)
Ratio	-0.003	0.004	-0.002	0.006	0.004	0.003
	(0.008)	(0.005)	(0.008)	(0.009)	(0.009)	(0.008)
Title I	0.033	-0.057	-0.108	-0.077	-0.073	-0.015
	(0.103)	(0.060)	(0.090)	(0.104)	(0.090)	(0.102)
FRL	-0.001	0.000**	-0.002**	-0.002	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Rural	0.034	-0.184**	0.030	-0.018	-0.044	-0.009
	(0.072)	(0.064)	(0.074)	(0.072)	(0.074)	(0.074)
Town	0.190**	-0.171**	0.228**	0.059	0.120	0.099
	(0.078)	(0.064)	(0.079)	(0.083)	(0.084)	(0.083)
Urban	0.078	-0.063	0.086	0.029	0.078	0.018
	(0.064)	(0.060)	(0.065)	(0.060)	(0.063)	(0.066)
International Baccalaureate	0.021	-0.035	0.007	0.028	-0.010	-0.074
	(0.049)	(0.070)	(0.063)	(0.055)	(0.055)	(0.057)
Percentage Non-White	0.001	0.000	0.003	0.002	0.001	0.001
	(0.002)	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Standardized Median Income	0.075***	0.049***	0.106**	0.069**	0.109**	0.087***
	(0.023)	(0.023)	(0.025)	(0.026)	(0.025)	(0.026)
Observations	942	942	942	942	942	942
R square	0.237	0.098	0.344	0.368	0.347	0.289

* $p<0.10$, ** $p<0.05$, ***$p<0.001$ robust standard errors in parenthesis

SMALL SCHOOLS

The population of 11th and 12th graders varies widely with largest schools having over 2,600 students and the smallest having 10 or less students. We re-analyzed the smallest five deciles of enrollment—or schools with approximately 100 juniors and seniors combined. Not surprisingly, this group has a higher percentage of rural schools, higher percentages of White students, and lower wealth as measured by both FRL participation and median income. In fact, the median income in the small school sample is over $15,600 lower on average. The significant predictors of AP remain the number of 11th and 12th graders enrolled and median income. The only substantive difference was in the role of ACT score, which was a significant predictor in only one instance with each point increase corresponding to a nearly 4% increase in the probability of offering any AP course ($p < 0.05$). For brevity, we do not present individual regression results. Of particular concern are the 12 low-enrollment, predominantly rural schools that did not report any AP exam

takers or CE enrollment completers. Additional data cleaning and cross checking with data providers did not indicate this to be an error.

DISCUSSION

There is a large body of research regarding advanced academic coursework in high school coursework and postsecondary success (Adelman, 1999; Evans, 2019; Gollub et al., 2002; Horn et al., 2001) much of it focused on AP (Long et al., 2012; Scott et al., 2010; Smith et al., 2015; Speroni, 2011). A longstanding policy concern is uneven access to these courses especially for traditionally underserved populations including those living in poverty or rural contexts (Dougherty et al., 2006; Gagnon & Mattingly, 2016; Klopfenstein, 2004a). Indeed, one of the central criticisms of AP has been the relative unequal access to courses (Kalogrides & Loeb, 2013; Kolluri, 2018) despite efforts to increase access (Holstead et al., 2010; Jeong, 2009). Our results confirm prior work on the factors predicting AP course offerings (Iatarola et al., 2011; Klopfenstein, 2004a, 2004b). Nearly two decades after the early analyses of AP access, larger, wealthier, higher achieving schools are still more likely to offer AP. In many ways, AP continues to reflect the traditional college bound population and the schools that serve them. Previous authors theorized CE and AP could serve different populations of college bound students (Hugo, 2001; Klopfenstein & Lively, 2012) and multiple studies showed CE leading to success for students not typically considered college bound (An, 2013; Bailey & Karp, 2003; Taylor, 2015). As a result, many have identified CE as a mechanism to increase access to college pathways for underserved populations as a statewide policy mechanism (Gagnon & Mattingly, 2016; Karp et al., 2004). Concurrent enrollment appears to be fulfilling the access policy goal with less affluent schools more likely to offer CE and achievement no longer a significant predictor of course offerings. Further, schools offering CE are often more likely to be distant from urban and suburban population centers where AP is more common. Because CE can be offered at a local community college or utilizing community college staff at a high school, schools do not need a large population to offer courses. As a result, enrollment is not a significant predictor of CE course offerings, unlike AP. This flexibility further supports charter and low enrollment high schools. All these factors point to an increase in access to advanced academics for traditionally underserved schools. Prior research shows few substitution effects within high schools that offer both CE and AP supporting the idea that CE can continue to serve to increase access even when AP is present (Clayton, 2021) To our knowledge, this is the first statewide study to examine the factors predicting CE on the subject level. While most schools have access to some form of CE, access by subject varies. Less than half of schools offer CE math and less than two-thirds offer CE science. Enrollment in both of these subject areas often requires prerequisite coursework sometimes extending back to middle school (National Research Council, 2002). In order for more students to be prepared to take these courses in the junior and senior years of high school, greater de-tracking efforts in grades 6-10 may be required (Attenberry et al., 2019). The implications for STEM pathways for these schools remains an important next step for both research and policy. These apparent differences in the types of schools offering CE or AP bring concerns about the signaling effects for postsecondary admission and segregation effects within schools. CE credit on a high school transcript could serve as a signal about the student characteristics or school they attended, with CE being associated with open access programs, less wealthy, and potentially remote communities. Few schools offer only one program bringing up questions of tracking within schools as the programs often grow independently (Clayton, 2021). Schools may be developing profiles of students they advise into

AP or CE (Davis et al., 2013). Future research should focus on within school differences in participation and the advising and barriers to entry associated with each program.

Finally, policymakers must remain vigilant for the subset of traditional high schools where students do not have access to either AP or CE. If both programs are designed to serve a college bound population and potentially provide postsecondary credit, does their absence place students at a disadvantage upon graduation? The state's new graduation requirements make AP and CE part of a menu of options to demonstrate college and career readiness but do not require either program (CDE, 2021).

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