Assessing Measures of College-and-Career Readiness in High School: How do they relate to College Success, and are they Equitable?

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INTRODUCTION

The purpose of this paper is to examine two key metrics used to evaluate College and Career Readiness[a] among high school students in Connecticut, and these metrics' relationship to college enrollment and performance. We further assess how college and career readiness metrics include or exclude students differentially according to demographic factors. According to the Connecticut State Department of Education (CSDE), *College and Career Readiness* "involves three major skill areas: core academic skills and the ability to apply those skills to concrete situations to function in the workplace and in routine daily activities; employability skills (such as critical thinking and responsibility) that are essential in any career area; and technical, job-specific skills related to a specific career pathway. These skills … allow students to enter true career pathways that offer family-sustaining wages and opportunities for advancement."[1]

Helping students achieve college and career readiness remains a paramount goal. Indeed, students who attend college and successfully complete a bachelor's degree can expect to earn, on average, $1,174,752 more over the span of a 40-year career than those who hold only a high school diploma. Furthermore, individuals holding a bachelor's degree have an unemployment rate that is 22.5% lower than the average unemployment rate.[2] As of 2019, for associate-degree earners, median yearly earnings were some $9,600 higher than those with no college degree.[3] In addition to higher earnings and lower unemployment, attaining a college degree has been linked to a healthier lifestyle, improved self-esteem, networking opportunities, and higher job satisfaction.[4] Public benefits of a college education include individuals paying more toward state and federal taxes and decreased reliance on social support programs such as SNAP, Medicaid, and unemployment insurance.[3] Furthermore, with lingering gaps in earnings for women and historically underserved groups,[5] the attainment of a college degree may represent a unique path to earnings equity for marginalized students. Given that Connecticut State Colleges and Universities (CSCU) serves a population that is at least 43% BILPOC (Black, Indigenous, Latinx, People of Color),[6] addressing institutionalized performance gaps is of central importance.

With the profound and wide-ranging benefits of a college education, it is necessary that the CSDE has the ability to assess students' level of College and Career Readiness during their high school career. Any measures of College and Career Readiness in students should be grounded in research to ensure the appropriateness of such measures. High-quality College and Career Readiness metrics will allow the CSDE to both track longitudinal trends in College and Career Readiness, as well as to implement any necessary interventions for students prior to their leaving secondary school. While the CSDE has several such metrics in place, an investigation into the strength of the relationship between these metrics and actual college performance was needed.

[a]Throughout this paper, the term "college and career readiness" is used to reflect the established metrics and language used by the Connecticut State Department of Education. However, we note that Connecticut State Colleges and Universities uses the term "opportunity," as it shifts the onus to the systems and institutions to address structural barriers that yield inequity.

To this end, we leveraged the P20-WIN data exchange to join CSDE's high school student data with the Connecticut State Colleges and Universities (CSCU)'s data on students' college performance. P20-WIN is a statewide data collaborative that allows for the secure exchange of information among several statewide agencies to track longitudinal trends of Connecticut residents.[7] The memorandum of agreement for the particular data request that encompasses the current research can be found here.

THE CURRENT RESEARCH

The current research aims, broadly, to investigate how well the CSDE's metrics of College and Career Readiness (CCR) actually correspond to college enrollment and success after high school. We also consider how well the metrics represent the demographic makeup of the population. To do this, we focused on two primary metrics used by CSDE:

CCR-Exam: The CCR-Exam metric is a binary metric that uses SAT, ACT, Advanced Placement (AP), International Baccalaureate (IB) exam scores to categorize each student as *CCR* or *Not CCR*. If a student meets a certain benchmark on an SAT or ACT test, or on any AP or IB Exam, they are identified as *CCR-Exam*.[b] If they have not met the benchmark score on any of those metrics, they are identified as *Not CCR-Exam*. Students may change from *Not CCR-Exam* to *CCR-Exam* at any point in high school by scoring above the required threshold on one of the aforementioned exams.

CCR-Participation: The CCR-Participation metric is a binary metric that uses course participation to determine CCR status. If a student has taken two or more AP, IB, or Dual Enrollment (DE) courses, they are identified as *CCR-Participation*. If a student has taken fewer than two such courses, they are considered *Not CCR-Participation*. Students may change from *Not CCR-Participation* to *CCR-Participation* at any point in high school by enrolling in their second AP, IB, or DE course.

For a CCR metric to be a useful tool to guide analyses and student intervention, it should be readily available for all students, and it should also be correlated with success in college and/or the workforce. To the second point, we leveraged the P20-WIN data exchange to join CSDE's data on students' CCR status during high school with data on students' college performance. This allowed us to examine the relationship between CCR status in high school and college success. The data for the current project were compiled in the Spring of 2019.

Population. The population comprised 35,417 students who graduated high school from a public CT high school in 2017. The 2017 graduating class was chosen because it was the only graduating class for whom there were both (a) complete CCR data from CSDE and (b) enough time post-high school to determine college outcomes, such as first-year retention and first-year college GPA. Given that the data for this project were collected in the Spring of 2019, the high school graduating class of 2017 could have attended a total of six possible college semesters (Summer 2017, Fall 2017, Spring 2018, Summer 2018, Fall 2018, and Spring 2019).

Outcome variables. We established several outcome variables with the aim of exploring their respective associations with the CCR-Exam and CCR-Participation designations. The outcome variables were:

- **Attending any college:** To determine whether a student attended college, we used data matched with the National Student Clearinghouse records. The National Student Clearinghouse provides

[b]To be considered *CCR* according to the CCR-Exam metric, a student must meet any one of the following: (a) SAT: an Evidence-Based Reading and Writing score of at least 480 and a Math score of at least 530; (b) ACT: on at least 3 of 4 exams, an English score of 18, a Reading score of 22, a Math score of 22, and/or a Science score of 23; (c) AP Exam: a score of 3 or higher; or (d) IB exam: a score of 4 or higher.

enrollment information for nearly 3,600 institutions of higher education, with about 97% of US colleges represented.[8] This allowed us to determine not only whether a student attended college in CT, but throughout the country. Only college semesters attended after high school were counted.

- **Average number of semesters attended.** Using the National Student Clearinghouse data match, we counted the number of semesters a student attended. We used the following process to ensure that semester counts for students enrolled in colleges with 3 semester terms per year were comparable to students enrolled in colleges that used 4 or more "mini-semesters" per year:
    - A semester had to be longer than 10 days to count.
    - Students were limited to 3 semesters per calendar year. Therefore, if a student enrolled, for example, in Spring, two shortened Summer Semesters, and Fall in a given calendar year, they were counted as having 3 semesters for that calendar year.
    - Semesters needed start dates of at least 30 days apart to count as separate semesters. For example, if a student started a semester at a community college on August 15th, and began at an online University on August 31st, it was counted as the same semester.
    - Because the study period was approximately two years, from Summer 2017 to Spring 2019, the number of semesters it was possible to attend was limited to six.
- **Attending at least three semesters of college ("First Year Retention").** This metric was meant to approximate the commonly used metric of First Year Retention, which is often defined as a student's enrollment into their Sophomore Fall semester. Typically, it is their third semester, after First-Year Fall and First-Year Spring. Therefore, we defined Retention as attending at least 3 college semesters after finishing high school.
- **Of those attending college, percent attending a 2-year institution as the highest level.** The data returned by the National Student Clearinghouse included an indicator for whether each institution attended was a 4-year or 2-year institution. We marked whether the student had only 2-year institution attendance, or whether they had at least some attendance at a 4-year institution.
- **Average first-year English GPA at a CT State University (CSU).** Using course data provided by the CSUs, we calculated the English GPA for courses taken during a student's first year of attendance. The four CSUs are Central Connecticut State University, Eastern Connecticut State University, Southern Connecticut State University, and Western Connecticut State University.
- **Average first-year Math GPA at a CSU.** Similarly, using course data provided by the CSUs, we calculated the Math GPA for courses taken during a student's first year of attendance.

Descriptive Statistics: The demographic makeup of the class of 2017. The table below shows the percent of students by gender, free-or-reduced price lunch status, and ethnicity in the population.

Table 1

Total Population	35,497
Female	49.8%
Male	50.2%
Receiving Free/Reduced Price Lunch	38.0%
American Indian or Alaska Native	0.3%
Asian	4.3%
Black or African American	12.4%
Hispanic/Latino of any race	18.1%
Native Hawaiian or Other Pacific Islander	0.1%
Two or More Races	1.9%
White	63.0%

FINDINGS

Most students in the class of 2017 attended at least some college. Over three-quarters of the class of 2017 attended any post-secondary school. For those who attended college, about four-fifths attended at least three semesters, and three-quarters of them attended at least one semester at a 4-year institution. A CSU was attended by 4,027, or about 15% of those who attended college anywhere.

Table 2

Number who attended any college	27,362
Percent of population who attended any college	77.1%
Of those who attended any college:	
Average number of semesters attended	3.6
Percent attending at least 3 semesters	81.8%
Percent attending a 4-Year Institution as highest	76.3%
Of those who attended a CSU	
Number who attended a CSU	4,027
Average First-Year Math GPA	2.0
Average First-Year English GPA	2.5

The CCR-Exam Metric is strongly related to attending college and success in early college. Scoring above benchmark on an AP, IB, SAT, or ACT exam and achieving a status of CC*R-Exam* was associated with strongly positive trends in terms of college attendance and college performance in the first year. For example, 91.1% of students determined to be CC*R-Exam* attended any college, compared to only 65.4% of those marked *Not* CC*R-Exam*. A chi-square test, which assesses the likelihood of two groups differing on a binary outcome by chance, showed that the difference between the groups was significant at the $p < .0001$ level. In other words, the probability of this trend occurring by chance is less than 1 in 10,000 and is statistically significant.

Among students who attended college, students who were assessed as CC*R-Exam* in high school were significantly more likely to attend a 4-year institution and to attend at least three semesters, and they attended significantly more semesters during the observation period, compared to students assessed as *Not* CC*R-Exam*. For those attending a CSU, first-year Math and English GPAs were significantly higher for students marked CC*R-Exam* compared to those determined to be *Not* CC*R-Exam*.

Table 3

	Students Marked *CCR* using the Exam Metric	Students Marked *Not CCR* using the Exam Metric	Sig. of difference between students marked *CCR* and those marked *Not CCR*
Number of Students	16,123	19,374	
Percent of Students	45.4%	54.6%	
Number who attended any college	14,683	12,676	
Percent who attended any college	91.1%	65.4%	$p < .0001$
Of those who attended any college:			
Average number of semesters attended	3.9	3.2	$p < .0001$
Percent attending at least 3 semesters	91.7%	70.4%	$p < .0001$
Percent attending a 4-Year Institution	93.2%	56.6%	$p < .0001$
Of those who attended a CSU			
Number who attended a CSU	1,241	1,684	
Average First-Year Math GPA	2.4	1.6	$p < .0001$
Average First-Year English GPA	2.7	2.4	$p < .0001$

Note: In the case of binary outcome metrics (attending any college, attending a 4-year institution as the highest level, attending at least 3 semesters), chi-square tests were conducted. In the case of continuous outcome metrics (average semesters attended, average GPAs), independent samples t-tests were conducted.

The CCR-Participation Metric is also strongly related to attending college and success in early college. Similar to the CCR-Exam Metric, taking two or more AP, IB, or DE courses and achieving a status of *CCR-Participation* in high school was linked to stronger college attendance and performance. For example, 89.5% of students determined to be *CCR-Participation* attended any college, compared to only 67.5% of those marked *Not CCR-Participation*. A chi-square test showed that this difference was significant at the $p < .0001$ level.

Furthermore, among those students who attended college, those assessed as *CCR-Participation* outperformed their *Not CCR-Participation* counterparts in terms of attending a 4-year institution, attending at least three semesters, number of semesters attended, and first-year Math and English GPAs (for those attending a CSU).

Table 4

	Students Marked *CCR* using the Participation Metric	Students Marked *Not CCR* using the Participation Metric	Sig. of difference between students marked *CCR* and those marked *Not CCR*
Number of Students	15,438	20,059	
Percent of Students	43.5%	56.5%	
Number who attended any college	13,819	13,540	
Percent who attended any college	89.5%	67.5%	$p < .0001$
Of those who attended any college:			
Average number of semesters attended	3.9	3.3	$p < .0001$
Percent attending at least 3 semesters	90.5%	72.9%	$p < .0001$
Percent attending a 4-Year Institution as highest	90.9%	61.3%	$p < .0001$
Of those who attended a CSU			
Number who attended a CSU	1,454	2,002	
Average First-Year Math GPA	2.2	1.8	$p < .0001$
Average First-Year English GPA	2.7	2.5	$p < .0001$

The Participation CCR and Exam CCR metrics show similar relationships with College Outcomes. The table below shows selected outcomes side-by-side for both the Exam and Participation metrics. There are similar drop-offs between the CCR and *Not CCR* students, regardless of which metric is used. For example, students assessed to be *CCR* according both metrics attended an average of 3.9 semesters of college after high school. Those assessed to be *Not CCR-Exam* attended only 3.2 semesters. Those determined to be *Not CCR-Participation* attended 3.3 semesters on average. In short, CCR Exam and CCR Participation are both strongly related to college success and attendance, and are related in a very similar manner.

Table 5

	EXAM METRIC		PARTICIPATION METRIC	
	Students Marked *CCR* using the Exam Metric	Students Marked *Not CCR* using the Exam Metric	Students Marked *CCR* using the Participation Metric	Students Marked *Not CCR* using the Participation Metric
Attended any College	91%	65%	90%	68%
Avg number of semesters attended (out of 6 possible semesters)	3.9	3.2	3.9	3.3
Percent attending a 4-Year Institution	93%	57%	91%	61%
Average First-Year English GPA	2.7	2.4	2.7	2.5

There were large performance gaps for meeting the requirements of CCR, and the gaps were wider for the CCR-Exam metric than the CCR-Participation metric. For all ethnic groups combined, 45% of students met benchmark exam scores to be considered CC*R-Exam*, while 43% of students took two or more AP, IB, or DE courses and were considered CC*R-Participation*. However, broken down by ethnicity, the percentages marked CC*R* varied considerably.

The table below shows the percent of each ethnicity identified as CC*R* by both metrics. We focus on the three largest ethnicities by count of students in the population, which are Black, Hispanic, and White. Performance gaps can be seen in which according to the Exam metric, 16% of Black students, 19% of Hispanic students, and 57% of White students were identified as CC*R*. This translates to White students achieving CC*R-Exam* status at a rate of about three times that of Black and Hispanic students.

Turning to the participation metric, the performance gaps are still present, but are mitigated. Here, 32% of Black students, 29% of Hispanic students, and 48% of White students are considered CC*R-Participation*. This translates to White students achieving CC*R-Participation* status at a rate of about 1.6 times the rate of Black and Hispanic students – a considerably narrower gap than found with the exam metric.

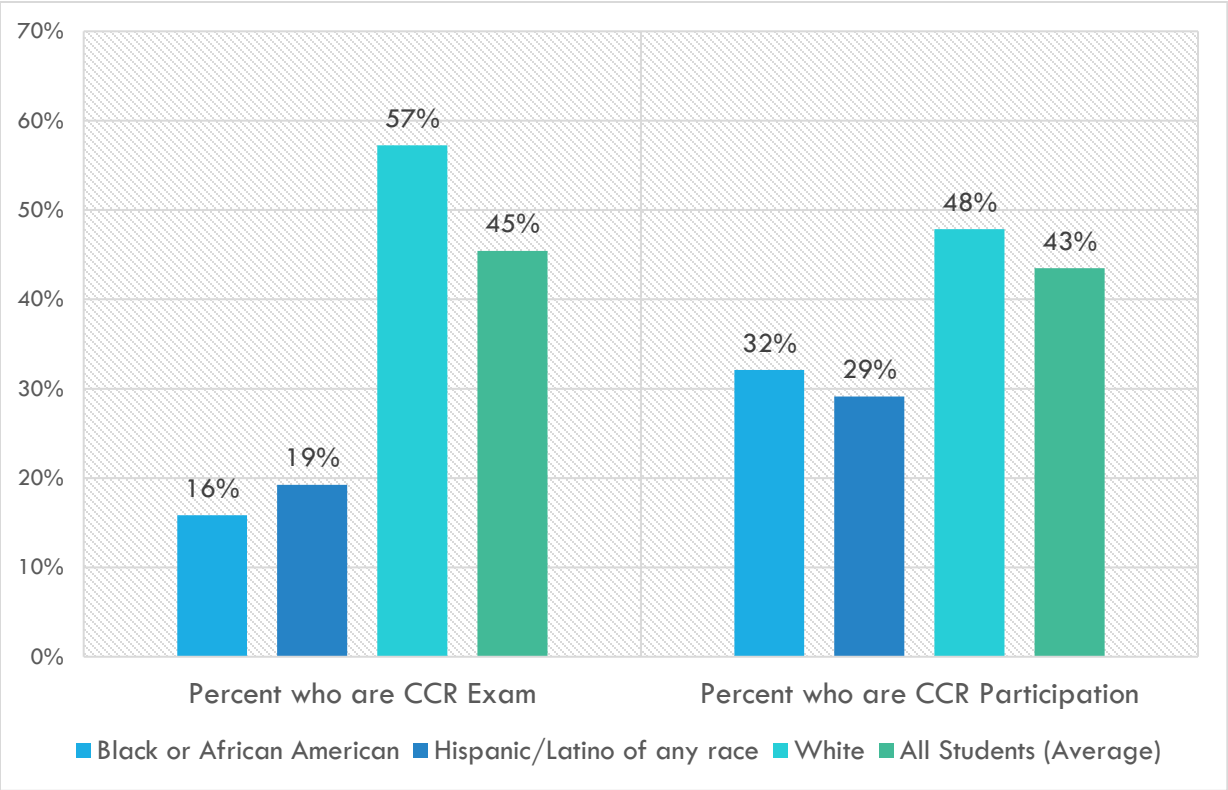
Table 6

Ethnicity	Percent Marked CC*R-Exam*	Percent Marked CC*R-Participation*
American Indian or Alaska Native	*	39%
Asian	71%	73%
Black or African American	16%	32%
Hispanic/Latino of any race	19%	29%
Native Hawaiian or Other Pacific Islander	*	48%
Two or More Races	41%	44%
White	57%	48%
All Students	45%	43%

Note: Cells with asterisks indicate data suppression due to small cell size.

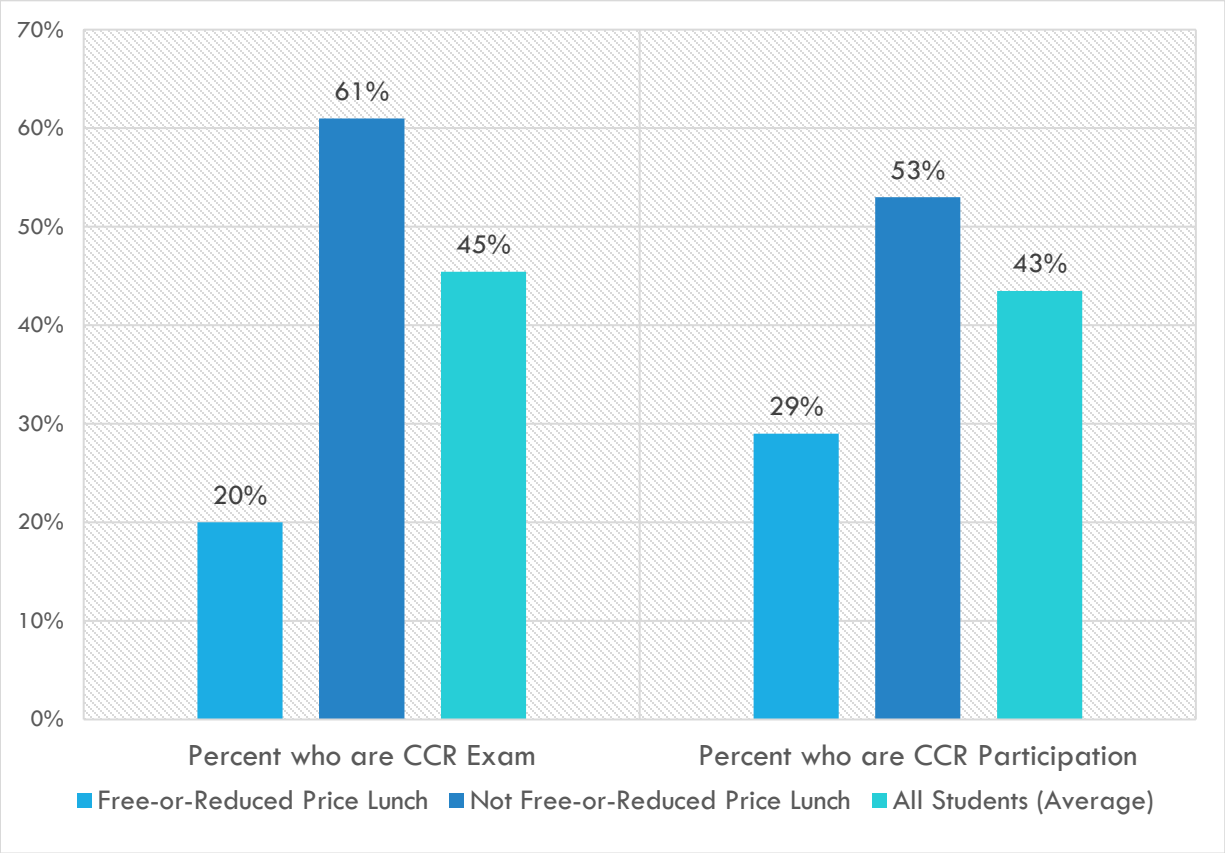
The figure below presents graphically the percent of the three largest ethnic groups who met the benchmarks of CC*R* according to each metric.

Figure 1. Percent CC*R* by Ethnicity and CCR Metric



The gap between students who received Free/Reduced Price Lunch (FRPL) and those who did not is wider for the CCR-Exam metric. Figure 2 shows a similar trend. Here, students receiving free- or reduced-price lunch are more likely to be identified as CC*R* according to the Participation metric (29% of such students are identified as CC*R-Participation*) compared to the Exam metric: only 20% of FRPL students are identified as CC*R-Exam*.

Figure 2. Percent CCR by Free/Reduced Lunch Status and CCR Type



Many students marked *Not CCR* still attended and persisted in college. Despite being assessed as "Not College and Career Ready" by the exam metric, nearly two-thirds of students with that designation still attended some college, and of those, some 70% attended at least three semesters. This amounts to some 8,924 Connecticut students with a *Not CCR* designation who persisted to enroll in at least three college semesters. Results are similar for the participation metric: over two-thirds of those with a *Not CCR-Participation* metric went on to attend at least of a semester of college, and of those, nearly 73%, or 9,871 students, persisted for at least three semesters.

DISCUSSION

Each of the College and Career Ready metrics studied displayed strong statistical relationships to college success and college attendance. High school participation in AP, IB, and/or DE courses, as well as scoring above benchmark on an AP, IB, or college admission test, provide statistically powerful correlates of college success, including first-year math and English GPA, attending college, and first-year retention.

While the two metrics, CCR-Exam and CCR-Participation, were correlated with college success similarly, they differed in terms of the demographic makeup captured as *CCR* by each. Using the CCR-Participation metric to determine CCR status more closely matched the sample make up in terms of ethnicity and free-or-reduced price lunch status. Specifically, the equity gaps in achieving CCR status was considerably reduced when using the CCR-Participation metric, compared to the CCR-Exam metric. Moreover, a growing body of

research shows that access to college-level coursework during high school is associated with greater likelihood of college enrollment and success.[9]

The authors wish to caution readers, especially practitioners, to be wary of taking the findings as meaning that when students score below benchmark on CCR metrics, they are not ready for college and should be guided toward other endeavors. On the contrary, about half of the students determined to be *Not CCR* according to the CCR-Participation metric went on not only to attend college, but to persist for at least three semesters. This amounted to 9,871 students in our sample. As such, we suggest that the focus is not on guiding students who score below the CCR thresholds away from higher education. Instead, a useful focus could be on raising students' performance on CCR metrics.

Regarding performance gaps, one area that should be examined is whether access to resources that raise students' performance is equitable. For example, do all students have equal access to AP, IB, and dual enrollment courses? Another useful focus could be increasing access to AP, IB, and dual enrollment opportunities.

Equality of access can also be investigated regarding test preparation resources, particularly in reference to the CCR-Exam metric, which relies partially on SAT and ACT scores. There are several well-known barriers to standardized test-score achievement for underserved groups,[10-11] including design and assessment biases, social and cultural capital and network limitations, and access to test-preparation. These barriers, which differentially impact underserved sectors of Connecticut's student population, call into question the continued use of standardized test scores for college admissions, and, we would argue, their usefulness for assessing college and career readiness.

Recently, CSCU has approved the Alignment and Completion of Math and English (ACME) Policy linked here, which shifts the metric used for initial math and English placement away from standardized test scores to high school GPA (HSGPA).[12] Given national trend toward HSGPA to determine admission and placement decisions, and the robust strength of association between HSGPA and college success,[13-18] perhaps another avenue for practitioners to explore would be the utility of a CCR metric based on high school GPA. Indeed, our own analyses of Connecticut students enrolled at a CT state college or university suggest that unweighted high school GPA provides a considerably stronger relationship to early college success outcomes than SAT scores do.[19]

Several areas are ripe for future research. Although it is clear that college coursework in high school is related to positive postsecondary outcomes, additional research could evaluate whether dual enrollment, Advanced Placement, and International Baccalaureate all convey equal benefits in terms of college outcomes for Connecticut students, or whether one type of college-level course is more highly related to success than the others. To follow, an assessment of whether ethnicity-based performance gaps in college-level course-taking are consistent across schools, types of schools, and districts, should consider whether there is equitable access to quality programming in all locations (e.g., school district and zip code) and for all groups of students within each location (e.g., gender, race/ethnicity, free or reduced lunch status and ability level). Last, a HSGPA-based CCR metric could be explored in terms of its relative usefulness compared to existing CCR metrics used in Connecticut. To these ends, the CSDE and CSCU should open a dialogue and undertake research to make a qualitative assessment of college-level coursework programs, such that we may continue to improve quality, accessibility, and student outcomes so that even more students can be identified as college-and-career ready.

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