STRENGTHENING POSTSECONDARY READINESS AND ENROLLMENT

Going to College:

The Intersection of Postsecondary Enrollment and California's College and Career Index

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Abstract

Limited empirical information is available on how well newly adopted college and career readiness measures classify college enrollment. This study examined the relationship between California's College and Career Index (CCI) and college matriculation for students attending two- and four-year institutions. We analyzed a sample of 6,977 students from two large urban school districts in California. The study found the CCI was sensitive and specific for students matriculating at four year institution with fewer than 17% Type I errors and less than .7% Type II errors, but fit students attending two-year institutions less precisely, where the Type II error rate increased to 10.8%. This study could help school leaders make more informed decisions about postsecondary access and increase the college-going rate of all students.

Keywords: accountability, National Student Clearinghouse, confusion matrix, college and career readiness, college access

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School accountability has evolved since its formal inception in 1965. Initially, the Elementary and Secondary Education Act (ESSA) established the means by which academic progress is tracked in schools, using primarily reading and math scores. Today, school accountability involves additional forms of measuring school quality including graduation rates, attendance, and psychosocial factors such as engagement and motivation. This expansion of school accountability has led some to question the relationship between these additional criteria and the stated purpose of accountability — to improve student learning. In response to the criticism, Hanushek and colleagues (2005) concluded state accountability has had a positive impact on student performance, especially consequential incentives which have shown to positively impact both student learning and teacher behavior. Hanushek's research is not without its detractors. Others have found using accountability results to change behavior problematic and fraught with issues such as narrowing the curriculum, cheating on standardized tests, and other problems (Crocco, M.S., Costigan, A.T., 2007; Kane & Staiger 2002). The debate around this issue raises an important policy question: How do those of us serving in regional or state-level positions influence school-level decision-making using accountability information?

Using Results for Local Decision Making

The notion that school leaders use accountability results for the basis of decision-making is not common. Consequential incentives is one way research has determined affects the use of accountability information (Hanushek, E.A., Raymond, M.E., 2005). In California, when districts fail to meet accountability targets they are designated for differentiated assistance (DA), a type of consequential incentive requiring districts to engage with a support provider and adjust what they do to obtain better results, but the California Department of Education (CDE) designed DA to address systems issues at the district level, so by design, it does not focus on school-level accountability. Our aim in this study is to increase the capacity of building-level leaders to use accountability results to make informed decisions about student learning.

Evaluation has a well-documented history of encouraging stakeholders to use results, albeit with limited success. Evaluation research suggests when leaders are more knowledgeable of the evaluation process, when policies are in place to evaluate programs, when stakeholders are involved, increased use of findings are more likely (Callahan, C.M., Tomlinson, C.A., Hunsaker, S.L., Bland, L.C., & Moon, T., 1995). The California School Dashboard covers a broad range of outcomes aligned to the state's eight priority areas. The College and Career Index (CCI), in this case, is one of the Dashboard indicators by which CDE monitors and evaluates student performance. Schools receive colored "pies" based on student performance, where a red pie represents the lowest performance and a blue pie the highest performance with three other colored pies between these two. Evaluation research on use of results, therefore, suggests the more knowledgeable school leaders are of the factors associated with the CCI, the more likely they will utilize the results to improve outcomes.

Another form of use more central to this study is the conceptual use of findings. Conceptual use occurs when decision-makers use results to substantiate a position they already hold. According to Radaelli (1995), conceptual use is one of the most important types of use in evaluation. A field example of conceptual use occurred during an evaluation

of the Drug Abuse Resistance Education Program (DARE). Study conclusions determined evaluation results were used to persuade others of the efficacy of DARE, or in most cases its ineffectiveness (Weiss, C.H., Murphy-Graham, E., & Birkeland, S., 2005). The study documented several case studies where decision-makers opted to eliminate DARE programs in their schools, not as a result of evaluations they conducted, but from the published results of ineffective DARE programs. This finding is important to this study. Practitioners recognize that accountability results around academic preparedness for college are important; however, they often fail to act on the information to make improvements that affect the rate of academic preparedness. If we can boost the credibility of "academic preparedness" by bridging information from the CCI with information not currently contained in the CCI, namely actual college enrollment, then we might compel school leaders to use the evidence in the CCI more proactively — potentially yielding greater postsecondary options for more students.

Postsecondary Preparedness

Accountability at the secondary level has evolved similarly over the past 20 years, partly due to the No Child Left Behind Act (NCLB), but also due to public pressure to increase rates of college and career readiness. In 2016, the high school graduation rate improved to 82%, an all-time high according to the National Center on Educational Statistics (2016). In addition to rising graduation rates, students' aspirations for postsecondary options also steadily increased. Nearly 90% of high school freshman intend to enroll in some form of postsecondary education (Gao, N., & Johnson, H., 2017). Concurrent with these facts, postsecondary institutions have increased calls for greater preparation of K-12 students for college success (Darling-Hammond, Wilhoit, & Pittenger, 2014). While more students are graduating from high school and entering college, postsecondary institutions are remediating students at their highest rates ever. Furthermore, due to this mismatch, states are requiring greater accountability from secondary institutions to know if students are truly ready for college work.
The notion of college readiness, therefore, is more urgent than the academic debate implies. By 2030, demand for jobs requiring postsecondary experience will outstrip supply (PPIC 2017). But what does it mean to be ready for college, and how will state and local K-12 educational agencies operationalize readiness?

College and career readiness is defined broadly by David Conley as "a student who is ready for college and career and can qualify for and succeed in entry level, credit-bearing college courses leading to a baccalaureate or certification, or career pathway oriented training program without the need for remedial or developmental coursework" (2012). From Conley's perspective, college and career readiness includes cognitive strategies, content knowledge, transition knowledge and skills, and learning skills and techniques (2012). While states including California grappled with readiness indicators, most state-level accountability systems fail to capture the full picture of what Conley describes as "college readiness." Instead, these accountability systems focus on content knowledge or on "academic preparedness" pieces of the readiness definition.

In 2001, the National Commission on the High School Senior Year's landmark study called for increased accountability in high schools to address the large percentage of students poorly prepared for college. On the heels of this study, Texas legislators began mandating school districts examine college and career readiness along six factors including (a) AP exam scores, (b) dual credit courses, (c) standardized test scores in English Language Arts (ELA)/mathematics, (d) advanced coursework in science, math, and foreign language, and (e) scores on state college-readiness assessments (Barnes, W., Slate, J., & Rojas-LeBouef, A., 2010). School administrators and counselors were to use these new measures to ensure students were ready for college. While these initial efforts in Texas fell short of Conley's full definition of readiness, by focusing more on academic preparedness and disregarding the psychosocial factors such as self-efficacy involved in college and career readiness, this work served as an important launching point for states to engage in similar work to monitor and strengthen students' academic preparation for college.

Similar to Texas, California began expanding its secondary accountability model to include additional factors around college and career readiness. In 2015, the CCI gauged academic preparedness along five factors: (a) completion of a Career and Technical Education (CTE) pathway, (b) meeting or exceeding standards on statewide assessments, (c) passing Advanced Placement or International Baccalaureate tests, (d) completing college credit courses, and (e) meeting University of California and California State University "a-g" requirements.

Figure 1. The California Department of Education's College/Career Indicator

College/Career Indicator Performance Levels

There are three levels that measure postsecondary preparedness in the College/Career Indicator (CCI):

- Prepared
- Approaching Prepared
- Not Prepared

Prepared Level - Does the graduate meet at least 1 measure below?

High school diploma and any one of the following:

- Career Technical Education (CTE) Pathway Completion **plus one** of the following criteria:
  - Smarter Balanced Summative Assessments: At least a Level 3 "Standard Met" on ELA or Mathematics and at least a Level 2 "Standard Nearly Met" in the other subject area
  - One semester/two quarters of Dual Enrollment with passing grade (Academic/CTE subjects)
- At least a Level 3 "Standard Met" on both ELA and Mathematics on Smarter Balanced Summative Assessments
- Completion of two semesters/three quarters of Dual Enrollment with a passing grade (Academic and/or CTE subjects)
- Passing Score on two Advanced Placement (AP) Exams or two International Baccalaureate (IB) Exams
- Completion of courses that meet the University of California (UC) or the California State University (CSU) a-g criteria **plus one** of the following criteria:
  - CTE Pathway completion
  - Smarter Balanced Summative Assessments: At least a Level 3 "Standard Met" on ELA or Mathematics and at least a Level 2 "Standard Nearly Met" in the other subject area
  - One semester/two quarters of Dual Enrollment with passing grade (Academic/CTE subjects)
  - Passing score on one AP Exam OR on one IB Exam

The number of prepared students serves as an important accountability measure for how well school districts prepare students for success after high school graduation. As previously mentioned, the stated purpose of accountability is to improve student learning — to improve academic preparedness in this case. However, to accomplish this purpose, accountability results must be used in local decision-making and these efforts to improve readiness must be connected to tangible outcomes after graduation, including postsecondary outcomes such as enrollment, persistence, and completion.

While linking efforts to postsecondary persistence and completion are beyond the scope of this study, the ultimate aim of this project is to help school leaders use accountability evidence about college readiness to make more informed decisions about student learning and postsecondary access. To achieve this aim, we must examine the quality and credibility of the information school leaders use to make these decisions by investigating how well the CCI classifies students as college-enrolled. The better school leaders understand postsecondary enrollment and the factors contributing to it, *the more likely they are to use this information to bolster postsecondary access.*

Research Questions

In this study, we examined the following questions:

1. **How well does the CCI perform in classifying actual college enrollment?**
2. **What are the K-12 characteristics associated with students classified as false positives and false negatives, and how do they differ from true positives and true negatives?**

Methods

School systems use information about academic performance to counsel students about college and career options. Therefore, academic preparedness factors, including those in Figure 1, establish many students' postsecondary trajectories. Given this situation, we sought to determine the following: (1) How well does the CCI classify students enrolled in college? (2) What share of enrolled students are not academically prepared? (3) What share of academically prepared students are not enrolled in college? and (4) What are the similarities and differences among enrolled and unenrolled and prepared and unprepared students? These questions will help us identify how well the CCI explains the reality of college enrollment along with the characteristics of students whom the CCI misclassifies.

In this study, we hypothesized that academic preparedness decisions using the CCI yielded high rates of misidentification. Identifying student misclassifications will help us understand the reasons why they are misclassified, how to improve the classification, and how to intervene when students are misclassified.

Participants

The study focused on 6,977 high school graduates from two large urban, public school districts in San Diego County in 2014-15. About 54% of participants were female and 46% male. Ethnicity and race are a two-part question in California, where parents/guardians are first asked to self-identify as Hispanic, then choose a race. Approximately 38% of the parents/guardians identified their student as Hispanic. Additionally, 52% identified their student's race as White, 5.9% as Black or African American, and less than 4% identified Asian, Pacific Islander, and other races. Almost 6% declined to state an ethnicity. Furthermore, about one-sixth of parents or guardians identified their student (16.5%) as receiving free and reduced-price lunch and 7.3% were classified as English learners. We are reporting only on current English learners and not on students reclassified as English proficient. About 16.1% of parents or guardians indicated they obtained no high school diploma, 21.7% indicated they received a high school diploma, 28.5% some college or AA degree, 17.6% a college degree, and 11.2% a post-graduate degree.

Variables

Academic Variables

We operationalized each of the measures from the CCI using the school district's student information system, which created five nominal-level independent variables for each measure of the CCI. For example, for Measure 1, we identified the students completing a CTE pathway (and met the other underlying criteria outlined in Figure 1) and labeled the student as *successfully completing the CTE pathway measure, or enrolled in the pathway, or not enrolled in a pathway*. We operationalized three of the other four measures similarly and created a single binary variable from all four measures, where a 1 indicated the student met at least 1 of the measures and a 0 meant the student failed to meet a measure. We opted not to use Measure 3 (dual enrollment) in this study because schools had difficulty reporting dual enrollment accurately.

Postsecondary Variables

To track students beyond the K-12 system, we gathered data from the National Student Clearinghouse (NSC) and matched this information to the demographic student data (including free and reduced-price lunch, gender, race, ethnicity, and parent education level) along with the operationalized measures from the CCI. Using the high school graduation class of 2014-15 allowed us to have 18 months of enrollment data.

Results

The CCI consists of four measures of academic preparedness aggregated into a single measure and the NSC indicated whether a student was enrolled in college. By creating a single "prepared" variable as our "test" variable, and using the NSC as an outcome variable, we created a confusion table to determine how well preparedness classifies students as post-secondary enrolled.

Table 1. A 2 x 2 Matrix using College Career Index (CCI) and National Student Clearinghouse (NSC)

		NSC		
		College Enrolled	Not College Enrolled	Total
CCI	Prepared	3176 (45.5%) *True Positive*	1186 (17.0%) *False Positive*	4362 (62.5%) *Prepared*
	Not Prepared	804 (11.5%) *False Negative*	1811 (26.0%) *True Negative*	2615 (37.5%) *Not Prepared*
		3980 (57.0%) *Enrolled*	2997 (43.0%) *Not Enrolled*	6977 *Students*

Of the 6,977 students, 4,362 were "prepared" by meeting at least one CCI measure of academic preparedness. Approximately 3,176 (45.5%) of the prepared students in this study were enrolled in college, while the other 17% or 1,186 prepared students had no college record. Conversely, 2,615 or 37.5% of the total students were not prepared according to the CCI and not enrolled and 804 (11.5%) unprepared students were enrolled in college. Based on the confusion matrix, using academic preparedness as the test variable and NSC as the outcome variable, 3 in 10 students are misclassified.

To answer the first research question, we examined the confusion matrix above through the concepts of prevalence, sensitivity, specificity, and predictive values. In statistics and other fields, practitioners use the term *gold standard* to represent the best available test under reasonable conditions. Any test, such as "academically prepared according to the CCI," has tradeoffs in terms of sensitivity and specificity (described below), but with the ideal diagnostic presenting sensitivity 100% of the time (all enrolled students being prepared) and specificity 100% of the time (all unenrolled students unprepared). The use of a gold standard is appropriate in this context given the outcome is known (students enrolled in college) and our test (preparedness) should present the best accuracy in terms of sensitivity and specificity.

Prevalence

Prevalence refers to the extent to which the outcome occurs in the population. In this study, determining prevalence requires examining the total number of students enrolled in college compared to those not enrolled. In these districts, 3,980 of the 6,977 students were enrolled in college or 57.0%, our prevalence rate. Prevalence is an important concept because in a high prevalence setting, or in a setting where more students are enrolled in college, then a student in college is more likely to be prepared compared to a population where the prevalence of college enrollment is low. In these districts, prevalence is slightly below average considering the national college-going rate is 69.7% (U.S. Department of Education, 2019).

Sensitivity

Sensitivity is the probability the CCI will indicate enrolled among those enrolled. It answers the question: *What are the chances an enrolled student is academically prepared*, also known as the true positive rate. For these districts, we calculated the sensitivity by dividing the true positives by the total enrolled, so 3,176/3,980 is 79.8%. In other words, 4 out of every 5 enrolled students are academically prepared according to the CCI.

Specificity

Specificity, on the other hand, is the fraction of unenrolled and unprepared students according to the CCI. It answers the question: What is the chance an unenrolled student is also not prepared, also known as a true negative rate. Specificity therefore is calculated by dividing the true negatives (1,811) by the total number not enrolled (2,977), or 60.4%. Basically, the likelihood of being unenrolled in college and academically unprepared according to the CCI is 60%. Or put another way, a coin flip is a slightly less accurate test of whether an unenrolled student is unprepared.

Positive Predictive Values

A positive predictive value (PPV) allows us to answer the question: *What is the chance a prepared student is enrolled in college?* The PPV examines the values across the top row of the confusion table. We should pay attention to the PPV since it tells us how well our "test" is predicting the outcome. We calculated the PPV by dividing the true positives (3,176) by the total prepared (4,362), or 72.8%. PPV tells us about 3 out of 4 students who are academically prepared based on the CCI will be enrolled in college.

Negative Predictive Values

A negative predictive value (NPV) allows us to answer the question: *What is the chance an unprepared student is not enrolled in college?* Similar to the PPV, we calculated the NPV as true negatives (1,811) divided by total not prepared (2,615), or 69.3%. Basically, 7 in 10 students were not prepared for college or enrolled. This means that when students are not prepared for college according to the CCI most (or about 70%) do not enroll in college. Conversely, this result means that 3 in 10 were not prepared and were enrolled.

Two- and Four-Year College Enrollment

To understand why a large percentage of students report as false negatives (unprepared and enrolled in college), we split the data set into two groups: students attending two-year and four-year institutions. In examining the 2 x 2 matrix for both groups, the CCI does a much better job matching the reality of students enrolled in four-year institutions.

Table 2. A 2 x 2 Matrix using College Career Index (CCI) and National Student Clearinghouse (NSC) for Students Attending Two- or Four-Year Year Institutions

CCI		NSC			
		Two-Year College Record	Four-Year College Record	No College Record	Total
	Prepared	1955 (28.0%) *True Positive*	1219 (17.5%) *True Positive*	1186 (17.0%) *False Positive*	4362 *Prepared*
	Not Prepared	753 (10.8%) *False Negative*	51 (.7%) *False Negative*	1811 (26.0%) *True Negative*	2615 *Not Prepared*
		2708 *Enrolled*	1270 *Enrolled*	2997 *Not Enrolled*	6977 *Students*

While the distributions of unenrolled college students remain unchanged, 1,270 students are enrolled in a four-year institution. Of the 1,270, 1,219 are true positives meaning the students were enrolled in college and identified as prepared by the CCI. For students enrolled in a four-year institution, 95.9% were prepared according to the CCI compared to 72.2% for the combined model. The false negative rate for four-year students accounts for only 0.7% of the cumulative rate from Table 1. Academic preparedness as a test variable in the four-year model is more sensitive to Type II errors, meaning school leaders can be fairly certain a student enrolled in a four-year institution is academically prepared according to the CCI.

The two-year model, on the other hand, presents a different picture. The false negative rate in the two-year model is significantly higher at 10.8% and contributes heavily to the combined rate of 11.5%. If we eliminated students enrolled in a four-year institution from this model, nearly 28% of students are misidentified by the CCI. This means that nearly 3 in 10 students enrolled in two-year colleges are not prepared according to the CCI. Additionally, the two-year model's sensitivity, or the likelihood an enrolled student is prepared, is 72.2%, a stark contrast from the four-year model's sensitivity rate at 96%. While school leaders can be fairly confident that a student enrolled in a four-year college is prepared according to the CCI, the confidence levels for two-year enrollees is much lower.

We set out to answer two additional questions in this study. The first question examined how well the CCI classifies students as enrolled. We were also curious about the characteristics of students presenting as Type I and Type II errors — students not classified clearly into our gold standard groups, either enrolled and prepared or unenrolled and unprepared. In addition to their characteristics, we were interested in the extent to which they differed in terms of academic outcomes such as high school grade point average (HSGPA) compared to their counterparts.

The Unprepared and Enrolled Student

A Type II error in this situation is not a practical problem for the high school decision-maker since a Type II error is a college enrolled student. However, if we were attempting to improve the sensitivity and specificity of the CCI, we would need to determine what additional factors might be added to our test variable to better classify students as college enrolled (since the CCI is not identifying these students as prepared). While a college enrolled student might not present as an issue for the high school decision-maker, an unprepared student does pose a greater risk in terms of persisting and completing college.

Table 4. Frequency table of unprepared and enrolled (Type II errors) versus unprepared and unenrolled students

	UU		UE	
Variables	**N**	**%**	**N**	**%**
Female	1058	58.4%	434	54.0%
Male	753	41.6%	370	46.0%
Black or African American	157	8.7%	45	5.6%
Hispanic	880	48.6%	335	41.7%
White	711	39.3%	394	49.0%
Parent with college or beyond	917	45.4%	370	52.0%
Receive free/reduced-price lunch	472	26.1%	233	29.0%
English learner	297	16.4%	141	17.6%
Students with disabilities	108	5.9%	65	8.1%
Cumulative High School GPA	2.08	(.73)	2.61	(.53)
% Persisting	--	--	547	68%

Compared to the unprepared and unenrolled (UU) student, the unprepared and enrolled (UE) student is slightly more likely to be male, white, and have parents who attended college. This student is also likely to have a substantially higher HSGPA (M=2.61, SD .53) compared to a UU student (M=2.08, SD .73). The difference between these groups' HSGPAs were significant at the p<.000 level [F (1, 2613) = 338.49, p=.000, Effect Size .84]. An additional noteworthy statistic is college persistence, nearly 550 of the 803 UE students (68%) persisted in college compared to the San Diego countywide college persistence rate of 89%.

The Prepared and Unenrolled Student. For the next two groups, we compared the demographics of the false positives to the true positives, or of prepared students but not enrolled (PU) in college to the prepared and enrolled (PE) students. Since these students were prepared according to the CCI, we also expanded our comparison to include the four CCI measures.

Table 5. Frequency table of prepared and enrolled versus prepared and unenrolled students (Type I errors)

	PE		PU	
Variables	N	%	N	%
Female	1559	49.1%	674	56.8%
Male	1617	50.9%	512	43.2%
Black or African American	139	4.4%	71	5.9%
Hispanic	967	30.5%	474	39.9%
White	1918	60.4%	593	50.0%
Parent attended college or beyond	2223	70.0%	683	57.6%
Free/Reduced-price lunch	315	9.9%	134	11.3%
English learner	26	.8%	48	4.0%
Students with disabilities	18	.6%	3	.2%
CCI#1				
Did not complete a CTE pathway	13	.4%	18	1.5%
Completed a CTE pathway	500	15.7%	334	28.2%
Not enrolled in CTE pathway	2663	83.9%	834	70.3%
CCI#2				
Did not pass both ELA/Math assessments	510	16.1%	222	18.7%
Passed both ELA/Math assessments	2595	81.7%	895	75.5%
CCI#4				
Did not pass 2 or more AP/IB tests	494	15.5%	93	7.8%
Passed 2 or more AP/IB tests	1074	33.8%	106	8.9%
Not enrolled in AP	1608	50.6%	987	83.3%
CCI#5				
Did not complete A-G requirements	1322	41.62%	957	80.7%
Completed A-G requirements	1854	58.38%	229	19.3%
Cumulative High School GPA	2.69	(.74)	2.41	(.66)
% Persisting	2705	85.2%	--	--

The PU student is more likely to be female, Hispanic, not have a parent who attended college, and slightly more likely to be an English learner compared to a prepared and enrolled student. Twice as many PU students completed a CTE pathway compared to the PE student. Interestingly, about the same percentage of students from both groups met or exceeded standards on the summative state assessments in grade 11 (82% for PE and 76% for PU). The PU student is much less likely

to have enrolled in Advanced Placement/International Baccalaureate (AP/IB) classes, and if s/he were, then much less likely to have passed the AP/IB tests associated with those classes. About 19% of PU students completed UC/CSU "a-g" requirements compared to their college-enrolled counterparts at 58 percent. Finally, the differences in HSGPA between the two groups was significant at the p<.000 level [F 1, 4360) = 1138.81, p=.000, Effect Size 1.11]. Also, of the 3,176 college enrolled students, 85% persisted compared to 68% of the unprepared and enrolled students from Table 4.

Discussion

We examined how well the CCI classified students enrolled in college by first developing a confusion matrix with CCI by college enrolled and investigated the model's sensitivity, specificity, and predicted values. We examined these characteristics for the purpose of supporting school leaders to use evidence to make more informed decisions about student learning and postsecondary access.

In this study, we hypothesized that academic preparedness decisions using California's CCI yielded high rates of misidentification. Holding the results up to the gold standard where sensitivity and specificity present 100% of the time, we were unable to reject this hypothesis since sensitivity presented 79% of the time and specificity 60%. To that end, the CCI misclassified about 3 in 10 students in the combined model. Since the outcome in a confusion matrix is known (college enrolled or unenrolled student), policymakers must continue to refine the CCI and reduce classification errors. While no test may present 100% sensitivity and specificity, the CCI should match closely the reality of college enrollment since schools and districts use this information to make decisions about postsecondary access.

Policymakers might explore ways to improve misclassification rates by adjusting thresholds for CCI measures. We explored one explanation for misclassification in this study by comparing differences between a combined 2 and 4 year college model and a separate model. In the separate model, only 4% of unprepared students were matriculating at four-year institutions. Therefore, the CCI is much more sensitive to four-year college readiness than two-year readiness. This finding raises the question, how do unprepared students navigate to college? *What evidence are counselors using to advise unprepared two-year students about college? What experiences have these students had that might explain their college aspirations? To what extent might such factors be integrated into the CCI?* Policymakers might consider using college aspirations as a CCI measure. Aspirations are important to college matriculation. Poynton and Lapan determined a student with high college aspirations in 10th grade has higher aspirations in 12th grade and is 2.5 times more likely to enroll in college (2017). In our study, nearly 68% of academically unprepared students persisted or graduated with an AA degree. Poynton and Lapan's research and our results suggest the validity of the CCI might improve by including information about college aspirations, especially if aspirations help classify two-year students as college enrolled when they are.

Another reason why the model lacks sensitivity and specificity might result from the binary composition of the CCI measures. For example, the CTE measure (see Figure 1 for full details) captures information about whether a student completed a pathway or not. CTE has many pathway derivations. Some include two-course sequences, while others include three and four-course sequences. Some pathways, like robotics, include heavy mathematics components, while other pathways do not. Therefore, schools and districts do not design all CTE pathways equally. More than 40% of students pre-

senting as false positives in this study completed some iteration of a pathway. Perhaps the CTE pathway measure is contributing to the high error rates and needs further refinement. A two-course sequence, for example, might not truly reflect academic preparedness for college. By making these adjustments, a large percentage of false positives (unenrolled CTE completers of two-course sequences) might become true negatives. That is to say, students completing a two-course CTE sequence might be categorized as unprepared and unenrolled versus prepared and unenrolled as they are now. Because we already know these students are not enrolled in college, making this adjustment simply mirrors the reality of the context. Another example, but from a different side of the matrix, involves meeting UC/CSU "a-g" requirements. California's University of California/California State University (UC/CSU) "a-g" requirements represent a student obtaining a C or better in 18 high school courses. If a student obtained A's in 17 of these courses and a D in the 18th, then the student would be classified as academically unprepared based on the "a-g" measure in the CCI (but may also be enrolled in college). If this hypothetical student had not met any other CCI measure, then she or he would present as a false negative in the confusion matrix. If policymakers were to adopt a different threshold for completing "a-g" criteria, completing 75% of the "a-g" criteria for example, then this new threshold might increase the sensitivity of the CCI compared to the all or nothing approach currently implemented. This alternative approach might reflect the reality of college enrollment better since 11% of students in this study presented as unprepared for college but are college enrolled. In this study, we could not determine how much of the UC/CSU "a-g" criteria these students met, but other efforts in our organization to examine these completion rates have determined students often fail to meet the UC/CSU "a-g" requirements due to the foreign language requirement or failing to get a C or better in a third-year math class. Performing poorly in one class should not determine whether a student is academically prepared for college, and the reality is many of these students do go on to enroll in college. Policymakers might examine this potential solution and determine if changing the threshold for meeting UC/CSU "a-g" criteria would better match the reality of college enrollment. Moreover, both recommendations are possible means to improve the sensitivity and specificity of the CCI and better classify students as enrolled when they are and unenrolled when they are not. The misclassification rates currently in the CCI may lead some to question its validity and not use it to make decisions about student learning and postsecondary enrollment.

Policymakers should encourage schools and districts to use the CCI proactively to improve postsecondary access. About 17% of students presented as false positives in this study, or students not enrolled in college but academically prepared for it. However, not all academically prepared students will enroll in college. Some will enter the workforce, while others will enlist in the military. In this sense, a real difference exists between false positives who will graduate high school academically prepared for college and enlist in the military and those who are academically prepared, have college intentions, but will simply fail to go to college. A college-intending student who fails to enroll in college after high school graduation may experience what researchers have labeled "summer melt" (Castleman, B.L., Arnold, K., Lynk-Wartman, K., 2012). Some share of prepared and unenrolled students in this study (false positives) most likely experienced summer melt, and high school decision-makers should examine which college-intending students failed to enroll in college and why. Summer melt results when students experience social anxiety, lack of financial counseling, and information barriers to college enrollment, typically during the summer following high school graduation. These are college-intending students choosing not to attend college because of resolvable reasons. Combating summer melt will not improve the predictive validity of the CCI. However, if policymakers were to direct school and district attention to these college-intending students presenting as false positives, then many schools and districts might rectify this problem so these students become true positives. Our point is we can improve the predictive validity of the CCI by focusing on misclassification errors, but we can also improve its concurrent validity by using the CCI proactively to increase postsecondary access for college-intending students, who may choose otherwise if left to their own devices.

Other evidence in this study suggests that the high false positive rate may result from bias in the measures of the CCI that benefit some students more than others. For example, the fact that prepared first-generation Latina students do not enroll in college at the same rates as other students is one reason why more prepared students overall are not enrolled in college. In an age where more females are attending college, some research suggests that Latina students' college enrollment decisions are less influenced by measures of academic achievement and parental expectations and more influenced by their relationships with their teachers and their initiative in navigating the overly complex college application and enrollment process (Zarate, M. E. & Gallimore, R., 2005). Latina students who lack these relationships and necessary supports may be prepared for college but not enroll. School leaders must be cognizant of these additional factors that contribute to college enrollment (which are not captured in the CCI). School leaders might introduce college counselors earlier in the high school experience and identify teachers and other school personnel as the primary agents of change regarding Latina students' college aspirations versus parents and family members. These kinds of decisions might mitigate some of the challenges prepared Latinas face when enrolling in college and increase access to postsecondary options for all students.

Policymakers should determine how CCI measures interact with each other in practice and determine the consequences of the interaction on classification errors. As mentioned, many academically prepared students not enrolled in college complete CTE pathways, but these students also take AP/IB classes and complete UC/CSU "a-g" requirements at much lower rates than their college-going peers. One possible explanation for this finding is CTE classes prevent students from accessing AP/IB classes or other classes categorized as UC/CSU "a-g". Counselors may interpret students' failure to complete more rigorous courses as explicit intentions not to attend college, which may in turn affect college counseling discussions. Completing a CTE pathway may be an important marker of college and career success. Currently, however, it confounds the results in the confusion matrix and does not add value to our understanding of postsecondary enrollment. Policymakers should figure out how completing a CTE pathway interacts with other CCI measures in practice and address any contexts in which it counteracts another measure.

Conclusion

The goal of this study was to improve the usability of accountability information so school leaders can make more informed decisions regarding postsecondary options. We concluded the validity of the CCI needs to be improved by increasing its sensitivity to and specificity toward college enrollment. When a school has a high percentage of students enrolled in college, the CCI should present a high percentage of prepared students. Furthermore, we concluded that while the CCI provides valuable information to school leaders regarding the factors leading to postsecondary success, a more integrated CCI model with HSGPA, parent education levels, and psychosocial factors might be a more robust accountability tool and perhaps more reflective of college readiness versus academic readiness for college. These improvements to the CCI will potentially increase school leaders' understanding of postsecondary enrollment and the likelihood they will use this information to bolster postsecondary access.

Study Limitations

This study's findings are limited by several factors. First, we collected data from a purposive sample of students from two school districts in Southern California. The demographic information contained in these two groups may not match the California school population in general so these findings may not be generalizable beyond this group. Secondly, even though the California Department of Education reports CCI data, we found the data challenging to gather and to clean from our partnering districts. For example, the definition of what constitutes a CTE pathway has some loose criteria; there were some data inconsistencies across our two districts regarding CTE pathways. Additionally, school sites receive AP/IB test results from a third party vendor, so we had to gather this data separately and link it back to student records. While both districts had mechanisms in place to capture California's UC/CSU "a-g" requirements, some loopholes existed when students completed the requirements by taking community college courses. The student may not have reported completing the community college course to the school site or district so the percentage of students meeting UC/ CSU "a-g" criteria may not be one-hundred percent accurate. Finally, some readers may have questioned why we did not report data from Measure 3 (dual enrollment). Neither school district in this study captured dual enrollment or concurrent enrollment data in 2014-15. Therefore, issues regarding the "cleanliness" of the CCI measures may limit the generalizability of our findings even though we took numerous precautions to ensure data credibility.

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