



California Partnership for Achieving Student Success

# **An Early Alert System for Remediation Needs of Entering Community College Students: Leveraging the California Standards Test**

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**A report by the**

**California Partnership for Achieving Student Success**

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## Executive Summary

A majority of students entering California community colleges require remediation in either math or English. In addition to being costly, remediation at college level doesn't always translate into academic success for students. Several studies have shown that there may be ways to identify students who will need remediation at college and correct that path before they have completed high school, thereby giving them stronger skills at college entry and better positioning them for college success. This study examines the relationships between California students' high school achievement in math and English, measured by statewide standardized tests and grades, and the levels of and grades in their first attempted math and English courses at community college. If high school standardized test results or course grades predict college preparedness, the need for remediation in college may be reduced by putting students on a corrective trajectory before they leave high school.

California's 110 community colleges do not use a statewide placement assessment system. They are governed by 72 independent, local governing boards, and each district has the right to establish appropriate methods to determine student placement. Colleges are required to consider multiple measures in placing students, using test scores as well as other sources of information about students' skills, abilities, motivations, and social support. Despite the variation in approaches to assessment, they all point to the same conclusion: Many students entering community colleges are not prepared to perform at college level in English and math. Remediation rates could be as high as 75 percent to 90 percent at some colleges (Johnstone, 2004).

In addition to raising doubts about the likelihood of academic success among these students, remedial education comes with a significant price tag. One conservative estimate for California community college remediation is \$135 million (Alliance for Excellent Education, 2006). Approximately 10 percent of the 2006-2007 community college teaching load was dedicated to remedial English and math courses (California Community College Data Mart). This represents about \$600 million of the \$6 billion California community college budget from Proposition 98 funds (Legislative Analyst's Office, 2008; P. Steenhausen, personal communication, April 24, 2008).

## The Data

California Partnership for Achieving Student Success was the source for this report's data. Cal-PASS is a publicly-funded initiative that collects information from regionally-based partnerships of high schools and post-secondary institutions. The database includes over 200 million student records from participating K–12 districts, community colleges, and universities. Data include demographics, coursework, awards, and California Standards Test (CST) scores. The database has some limitations. It does not have data for all California schools, and the period covered for most schools is five years (2001–2006). Because each community college uses a separate assessment system, Cal-PASS data do not include placement test scores. In fact, no statewide set of assessment data exists.

This study began by matching high school and community college student records. Of 41,560 students with a math CST score, 3,743 had received a grade in a math course at a community college by the end of the 2006 fall semester. For the English data set, 44,939 students with an English CST score were identified. Of these, 4,700 had received a grade in a community college English course by the end of the 2006 fall semester. The final analyses included students from 31 community colleges in math and 47 in English.

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## Research Questions

### *Can the CST Be Used for Placement and Assessing Readiness for College?*

The California Standards Tests measure how well students are mastering specific skills defined for each grade by the state. The test is given to all public school students in grades 2 – 11. The universality and uniformity of the CST is the key to its potential value a predictor of college preparedness. Test scores range from 150 to 600, and student scores are compared to preset criteria to determine if the student performance on the test is advanced, proficient, basic, below basic, or far below basic. Eleventh graders take one English CST and one of seven math CSTs, corresponding to the math course in which they are currently enrolled.

Overall, 11th grade math CST scores were better predictors than class grades of both the level of and grade in the first attempted community college math course. The study found a moderately strong correlation between scores for most forms of the math CST and college course levels and grades. In English, CST scores were moderately strong predictors of the level of the first attempted college English course.

The researchers were particularly interested to see if there was a specific CST score above which students were highly likely to succeed in transfer-level coursework. An example cut score model is presented but exploratory analyses suggest that useful cut scores must be validated to incorporate local factors such as differences in course content between high schools and community colleges.

### *Can 11th Grade Achievement Be Used to Assess College Readiness?*

Researchers found a moderately strong correlation between grades in 11th grade math and English and the level of students' first attempted community college math and English courses. The correspondence was stronger for students in Geometry, Algebra 2, Integrated Math 3 and Summative Math. High school grades in math and English were moderately strong predictors of college grades in those subjects.

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## **What Does This Tell Us?**

Understanding the predictive value of CST scores and high school grades can provide early feedback to 11th grade students on their preparedness for various levels of community college English and math coursework. In a similar fashion, the California State University's (CSU) Early Assessment Program (EAP) uses an augmented version of the CST to inform students of their readiness for CSU English and math coursework (<http://www.calstate.edu/EAP/>). This report also suggests that 11th grade English and math CST scores and grades, in conjunction with other quantitative and qualitative information about student preparation, may also assist community colleges in making placement recommendations. Further, the value of using high school test scores and grades in placement would improve greatly with increased alignment of math and English course content between high schools and community colleges. Improving entering student's placement levels in math and English by even one course will shorten their pathway to transfer and degree completion; as a result more community college students should be able to earn credentials or enroll in four-year colleges and graduate.

## Introduction

Two issues are paramount in the transition from high school to California's community colleges: the high number of first time college students who arrive unprepared for college level work in math and English; and the lack of common assessment and placement methods among community colleges.

Remedial classes in community colleges-sometimes called basic skills, precollegiate, or developmental-cover secondary school material. They are not transferable to a university, and many cannot be applied to certificates or associate degrees. The coursework spans a broad range of content and skills considered foundational for college-level work.

Students who require remediation have significant hurdles to overcome to successfully meet their goals such as enhancing job skills, completing a program, or transferring to a four-year college. At one college only 11 percent of those who started at the lowest-level math course progressed successfully through a transfer-level sequence (Johnstone, 2004). In English the rate was lower still: Only nine percent of students starting in the lowest-level course completed the sequence through transfer-level coursework. These numbers are likely typical among California's community colleges.

Most students entering college require basic skills course work. As noted in the California Community Colleges Strategic Plan (2006):

... across California's higher education system, a significant proportion of students start their college education in need of additional basic skills education in English, math, or both... Over half of the incoming community college students need basic skills programs. (p.8)

Identifying high school students unprepared for college work makes it more likely that they will get academic intervention before arriving at community college. Early identification also could lead to more effective and efficient allocation of resources to academic and nonacademic student support services. There are significant education costs associated with longer times to program completion, and sobering impacts to the workforce. Students without basic English and math skills leave college early and unprepared for the world of work. This contributes to increased training costs for employers or deficits in qualified personnel if students do not successfully complete certificate and other training programs.

Researchers and study groups have recommended alternatives to the myriad of local placement tests. A review conducted by the Research and Planning Group for the California Community Colleges (RP Group) called for greater research into the alignment of K–12 curricula with California community college placement standards: “Site-specific placement exams at community colleges hinder systemic action. The intersegmental data sharing consortium, Cal-PASS, may help with the information sharing and assessment of college preparation of entering students” (2005, p.6).

Another study compared California community colleges’ math and English placement standards to learning outcomes for 11th graders “...to determine if what we are expecting in high school matches what students need to know to take credit-bearing courses at the community college” (Brown & Niemi, 2007, p. iv). The researchers found “sufficient alignment” between 11th grade English California Standards Test results and college English placement test content, and “adequate alignment” between math CST results and college mathematics placement tests suggesting value in continuing this line of inquiry.

### *Related Research*

A number of studies have traced the connection between high school achievement and post-high school success. The findings are fairly consistent. Using a sample of 80,000 University of California freshmen, Geiser & Santelices (2007) found a strong association between high school and college grades. They found

**“ ...students who went through mandatory assessments were significantly more likely to pass remedial English or math courses... ”**

a moderate association between SAT 1 verbal scores and college grades; the association between SAT math scores and college grades was weaker. In a related article, Brown & Conley (2007) examined math and English assessments from 20 states and found moderate alignment with university standards. Although none of these state exams were developed with

the specific intent of aligning high school content standards with postsecondary education placement standards, the potential for linking the two was strong. Greater alignment of curricula between secondary and post-secondary institutions might improve the reliability of K–12 standardized tests as indicators of higher education placement and performance.

Finally, a study of nearly 6,000 students from 160 two-year and four-year schools found that students who went through mandatory assessments were significantly more likely to pass remedial English or math courses than those students who were in programs with a voluntary assessment system (Boylan, Bliss and Bonham, 1997). This suggests that the more informed students are about the assessment and placement process, the better the expected outcomes. Using the CST as a form of early assessment may bring students’ expectations of what constitutes college-level work into closer alignment with the actual demands they will soon face.



## This Study

Although California Standards Tests were not developed for the college placement process, prior studies suggest potential value. All students in California's public schools take the CST in grades 2 - 11. This universality of the CST could make it a valuable tool for a vast community college system with no uniform placement assessments. This study explores the relationship between high school achievement (scores and grades) and the levels of and grades in the first math and English courses attempted at community college.

This research began with two fundamental questions:

- 1) Can the CST be used to assess college preparedness and placement?
  - 2) Can grades in 11th grade classes be used to assess preparedness for college-level work?
- 

## Data Considerations

The data used in these analyses are from high schools and community colleges that volunteer to participate in the Cal-PASS initiative. Since this group of institutions is not a random sample, the students included may not be representative of all California students, and the findings from this study might not be valid for all students.

Another consideration is that for students, at least, CSTs are low-stakes tests. Scores do not directly affect student grades or graduation. This weakens the reliability of the CST as a measure of skills for students who do not make a focused effort to answer the questions correctly. Despite these data limitations, the findings here may encourage more research in an area vital to the success of community colleges and to the health of California's economy.

## Method

Using correlation methods, researchers determined how well each CST test form corresponded with the levels of the first attempted community college math and English courses, and with the grades students received in these courses. CST forms are linked to specific high school courses. Eleventh-grade math has seven forms; English has one. Each form is divided into clusters of questions that address similar content and test specific skills. Details on the clusters are given in Appendix A. In math, correlations were run on each CST form and all seven levels of college math.

- Arithmetic
- Pre-Algebra
- Beginning Algebra/Geometry
- Intermediate Algebra
- Statistics
- Advanced Algebra/Precalculus
- Calculus or above

All 11th graders take the same English CST test. Scores were correlated with four levels of community college English classes defined by their relation to transfer English.

- Three or more levels below Transfer Level
- Two levels below Transfer Level
- One level below Transfer Level
- Transfer Level or above

In addition to simple correlations, two multivariate analyses were also conducted. The first used regression techniques to create a set of example cut scores to predict the level of and success in the first attempted community college English or math course, based upon both 11th grade CST scores and grades. The second analysis used Classification and Regression Trees (CART) as described in Breiman, et al. 1994 to include a more expansive set of predicting factors such as student demographics and schools attended to explore how these may influence student placement and success in college. The variables used in these CART analyses are identified in Appendix B. The actual rule sets are shown in Appendix D.

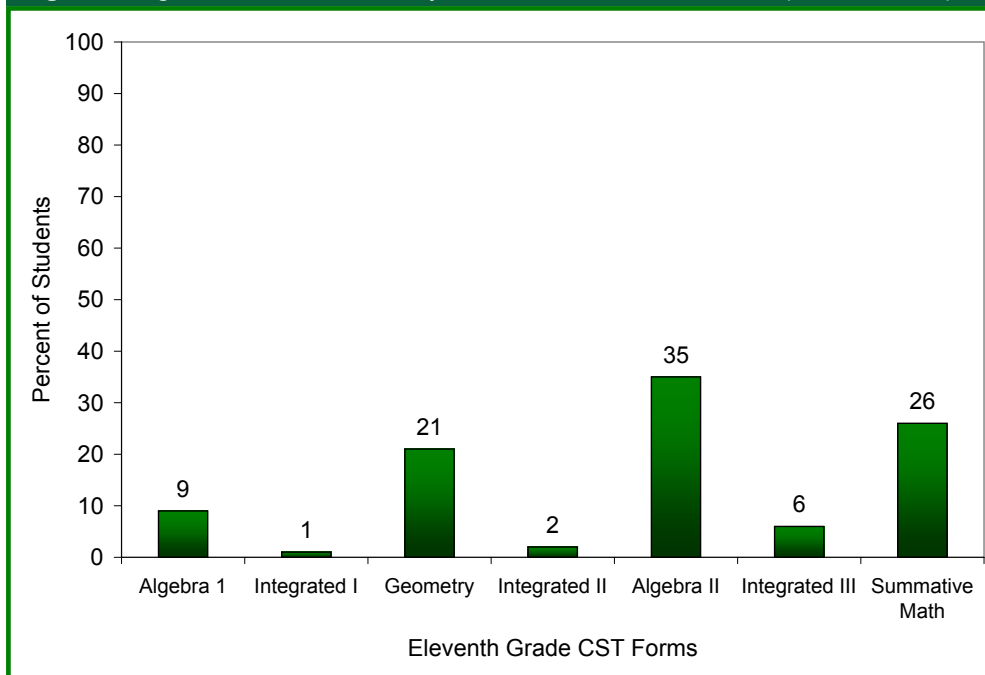
## Study Sample Demographics

### Students in the Math Data Set

As noted above, the study began with 41,560 student records. Of these, 3,743 students received a math grade at a community college by the end of the 2006 fall semester. Almost half of the students were white, one-fourth Latino, 14 percent were Asian. Females outnumbered males by a slight margin. Three-fourths of the students were native English speakers.

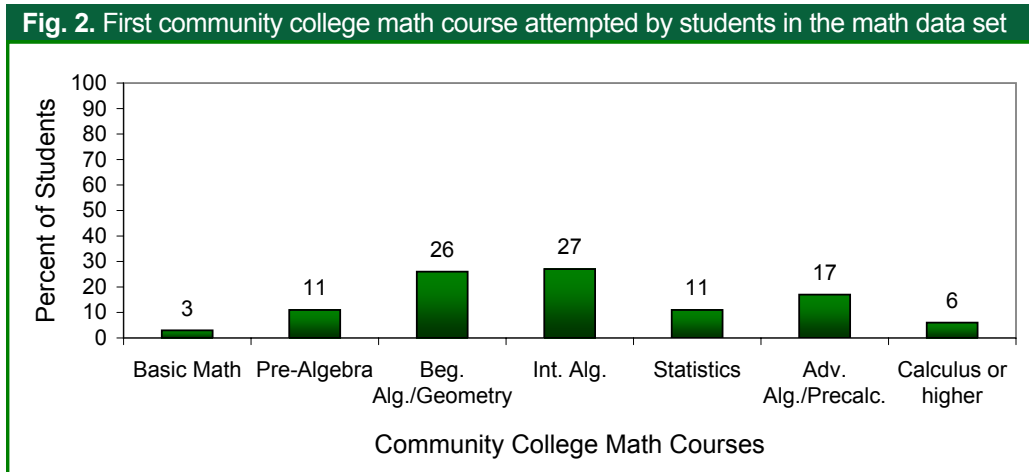
More than one-third of the students in this group took the Algebra II CST in 11th grade. Slightly more than one-fourth took the Summative Math CST.

**Fig. 1.** 11th grade CST form taken by students in the math data set (% of students)



Note: Percents may not sum to 100% due to rounding

Over half of the students took Beginning Algebra/Geometry or Intermediate Algebra as their first course in college. One-third of students attempted transfer-level courses (Statistics, Advanced Algebra/Precalculus, Calculus or higher). Just over two-thirds of all students in this study passed their first attempted math class.

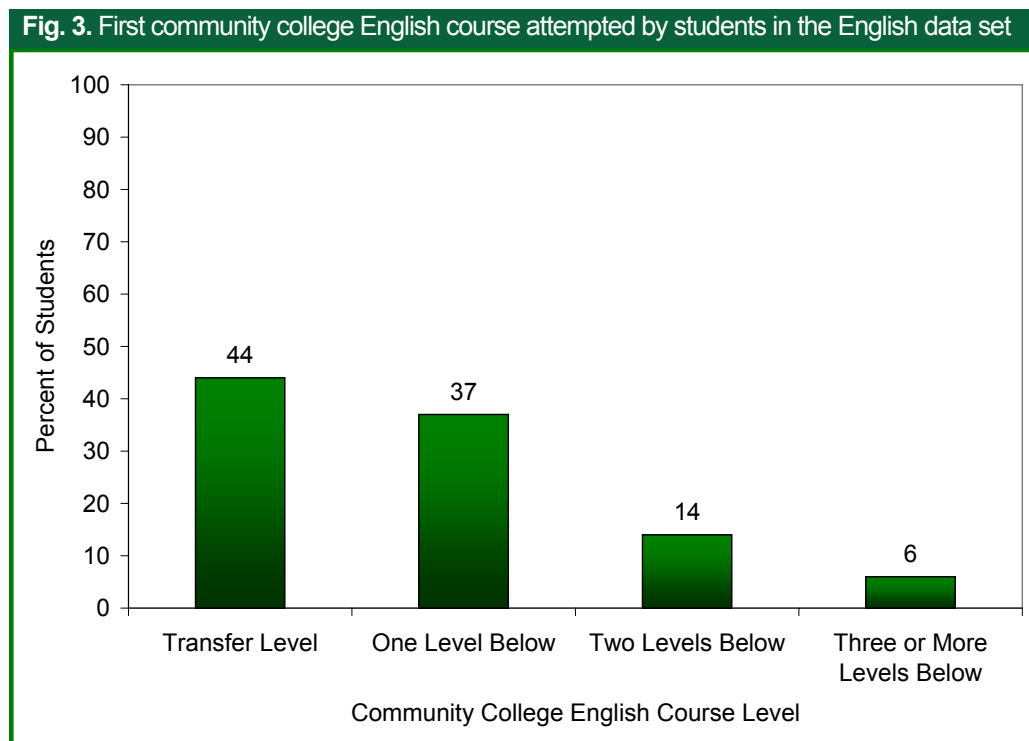


Note: Percents may not sum to 100% due to rounding

## Students in the English Data Set

The English data set was comprised of 4,700 students. More than half were white, nearly one-fourth were Latino, and 12 percent were Asian. Females outnumbered males by a slight margin. About three-fourths of the students were native English speakers.

Fewer than half the students in the English data set attempted a Transfer level English course. More than one-third of the students attempted an English course one level below college level. The remaining one-fifth attempted courses below that. Eighty percent passed their English course.



Note: Percents may not sum to 100% due to rounding

## Findings

The associations between variables in this study were measured first by correlation coefficients, which can range from  $-1.00$  to  $+1.00$ . In education and the social sciences, strong associations are generally defined as those reaching an absolute value of  $.40$  and higher; moderate correlations are between  $.20$  and  $.39$ ; and anything less than  $.20$  is considered a weak correlation. Although the math set included 3,743 students, the many components analyzed (seven CST forms and seven college levels) limited the sample size for each correlation.

### Math

#### *Relationships between 11th grade math CST scores and college math level and class grade:*

Researchers found statistically significant correlations between math CST scores and college class levels and grades for many forms of the test. CST scores were more strongly associated with the level of first community college math than with the grade in that class. While the associations between scores and college grades were weak, those associations with the higher numbers of students achieved statistical significance.

**Table 1.** Spearman Rho correlation coefficients between 11th grade math CST and level of and grade in first attempted community college math course

CST Form	College Course Level		College Course Grade	
	Coefficient	Number of Students	Coefficient	Number of Students
Algebra 1	0.27**	353	0.13*	341
Integrated Math 1	0.31	31	0.04	31
Geometry	0.37**	788	0.08*	772
Integrated Math 2	0.25*	79	0.14	79
Algebra 2	0.41**	1317	0.17**	1291
Integrated Math 3	0.11	217	0.13	217
Summative High School Math	0.36**	958	0.20**	951

\*\* $p \leq .01$  \* $p \leq .05$  Note: Darker cell shadings indicate stronger correlations.

### *Relationships between grades in 11th grade math and college math level and class grade:*

Associations between high school math grades and the level of and grade in the first attempted community college math course varied among the students taking different forms of the test. Grades of students taking the Algebra 2 CST correlated most strongly to class level.

**Table 2.** Spearman Rho correlation coefficients between 11th grade math achievement and level of and grade in first attempted community college math course

CST Form	College Course Level		College Course Grade	
	Coefficient	Number of Students	Coefficient	Number of Students
Algebra 1	0.06	353	0.14**	341
Integrated Math 1	-0.05	31	0.14	31
Geometry	0.31**	788	0.27**	772
Integrated Math 2	0.31**	79	0.16	79
Algebra 2	0.36**	1317	0.24**	1291
Integrated Math 3	0.17*	217	0.25**	217
Summative High School Math	0.18**	958	0.30**	951

\*\* $p \leq .01$  \* $p \leq .05$  Note: Darker cell shadings indicate stronger correlations.

### *English*

#### *Relationships between 11th grade English achievement (CST scores and grades) and college English class level and grade:*

Unlike taking the math CST, students take only one form of the English CST. Those scores correlated moderately strongly with the level of the students' first attempted community college English course. The association between CST scores and college grades was relatively weak, but statistically significant, due in part to the large sample size. Weak to moderate correlations were found between grades in 11th grade English and the level of and grades in college English courses.

**Table 3.** Spearman Rho correlation coefficients between 11th grade English CST and level of and grade in first attempted community college English course

11th Grade English Outcome Measure	College Course Level		College Course Grade	
	Coefficient	Number of Students	Coefficient	Number of Students
English CST Scores	0.49**	4700	0.23**	4700
English Grade	0.23**	4700	0.34**	4700

\*\* $p \leq .01$  \* $p \leq .05$  Note: Darker cell shadings indicate stronger correlations.

## *Predicting Transfer Level Community College Placement*

The findings from the correlation analyses raise the question of whether or not there are specific CST scores above which students are highly likely to succeed in transfer-level coursework. A set of regression equations was created to predict the course level of a student's first math or English attempt and the probability of a passing grade in that course based upon their 11th grade CST score and grades (Appendix D). All English data were used, but only the two most common math tests, Algebra 2 and Summative High School Math, were used. Note that CST scores range from 150 to 600 and only three sample CST score values were used in creating the example cut score tables. A complete cut score table would account for the full range of CST score possibilities.

Below are two examples of how to interpret the cut score tables:

- A student who took the Summative Math CST in 11th grade, scored 375 (Proficient), and earned a grade of D in a related course such as Pre-Calculus is predicted to take transfer-level math such as statistics at the community college with a 53% likelihood of earning a C or better in that class (Table 4).
- A student who took the 11th grade English CST, scored 275 (Below Basic), and earned a grade of C in 11th grade English is predicted to take a community college English course one level below transfer and has a 73% likelihood of earning a C or better in that class (Table 5).

The cut score tables are an example of how 11th grade performance information might inform student advising and placement. However, they should not be used without local validation. It is likely that the associations between 11th grade CST scores and course grades and community college course level and success are not consistent between institutions. Analyses presented in the next section shows the relatively strong influence of other variables, such as high school or community college attended. Variations in course content may contribute to differences. In particular, this could include variations in transfer-level course content between community colleges. If true, one would expect that greater standardization and alignment of expected course outcomes would result in stronger correlations and clearer, more useful cut score analyses.

Table 4. Example English “Cut Score” Guide for High School Advising and Community College Placement			
11th Grade CST Score (Proficiency Level)	11th Grade Course Grade	11th Grade High School Course Taken Regular English	
		Predicted Community College Level	Probability of Success
375 (Proficient)	A	Transfer	>90%
375	B	Transfer	>90%
375	C	Transfer	>90%
375	D	Transfer	77%
375	F	1 level below Transfer	65%
275 (Below Basic)	A	1 level below Transfer	>90%
275	B	1 level below Transfer	83%
275	C	1 level below Transfer	73%
275	D	1 level below Transfer	64%
275	F	1 level below Transfer	54%
200 (Far Below Basic)	A	2 levels below Transfer	73%
200	B	2 levels below Transfer	67%
200	C	2 levels below Transfer	60%
200	D	2 levels below Transfer	53%
200	F	2 levels below Transfer	<50%

Note: This table is provided for illustrative purposes only and should not be used for student placement or advising without local validation.

Table 5. Example Math “Cut Score” Guide for High School Advising and Community College Placement

11th Grade CST Score (Proficiency Level)	11th Grade Course Grade	11th Grade High School Course Taken			
		Algebra II		Summative Math	
		Predicted Community College Level	Probability of Success	Predicted Community College Level	Probability of Success
375 (Proficient)	A	Pre-Calculus	>90%	Pre-Calculus	>90%
375	B	Pre-Calculus	>90%	Pre-Calculus	85%
375	C	Transferable General Education	79%	Pre-Calculus	73%
375	D	Transferable General Education	67%	Transferable General Education	53%
375	F	Intermediate Algebra	58%	Transferable General Education	<50%
275 (Below Basic)	A	Intermediate Algebra	88%	Transferable General Education	>90%
275	B	Intermediate Algebra	78%	Transferable General Education	78%
275	C	Intermediate Algebra	68%	Transferable General Education	65%
275	D	Intermediate Algebra	<50%	Intermediate Algebra	80%
275	F	Beginning Algebra	67%	Intermediate Algebra	73%
200 (Far Below Basic)	A	Intermediate Algebra	81%	Intermediate Algebra	>90%
200	B	Intermediate Algebra	71%	Intermediate Algebra	>90%
200	C	Intermediate Algebra	61%	Intermediate Algebra	86%
200	D	Beginning Algebra	52%	Intermediate Algebra	80%
200	F	Beginning Algebra	<50%	Intermediate Algebra	73%

Note: This table is provided for illustrative purposes only and should not be used for student placement or advising without local validation.

## **To what extent do student demographics and institution attended influence the levels of a student’s first attempted community college math and English courses and grades in those classes?**

Other factors can be important predictors of the level of and grade in the first attempted community college math and English course. These could include performance in 12th grade math (if taken), student demographics, and college attended. To explore the possible influence of these other variables, a set of Classification and Regression Trees or CART analyses (Breiman, et al. 1994) were constructed to predict initial community college course and grade in that course. The variables used are shown in Appendix C. The actual rule sets are shown in Appendix E. In general, the models were not strong but suggested factors that should be taken into consideration when advising and placing students.

### ***Math***

The CART analysis found that for students who took the Algebra I CST, the only predictive variable of the level of and grade in the first attempted college math course was the community college in which the student enrolled. Note that when considering information on students’ destination college, CST scores were not predictive of college outcomes for students who took Algebra I in 11th grade.

For students who took the Algebra II CST, the high school and community college attended were important predictors. Schools attended appeared less important for those taking the Algebra II CST than the Algebra I test. For those who took the Algebra II CST and excelled in 11th grade math, 12th grade math achievement was a relevant factor when predicting college math grades.

For students who took the Summative Math CST, the community college attended was a predictor of the level of first attempted community college math course. Grades in 12th grade math and the college attended were associated with college math grades.

Student characteristics including gender, ethnicity, parent education level, disability status, and time between high school and community college math attempts were not predictors of the level of and grade in college math.

### ***English***

The high school and community college attended were important predictors of the level of the first attempted community college English course. Important predictors of the grade received in that class included high school, 12th grade English grades, community college attended, and parent education level. More educated parents were associated with students earning higher college English grades in certain high school districts.

As with math, student performance and institutional characteristics were found to be important predictors of the level of and grade in the first attempted community college English course. The only student characteristic that predicted outcomes was parent education level, and then only for a particular subset of high school districts. Student characteristics such as gender, ethnicity, disability status, and time between high school and community college math attempts were not strong predictors of college class level or grade.

## Discussion

Findings from the study show promise for using 11th grade CST scores and grades in math and English as tools for placement in college courses. Positive but modest associations were found between these variables and the level of first course attempted and the grade received in community college math and English, for subpopulations of students. However, these relationships were not strong. Additional CART analyses indicated that the high schools and colleges attended were also important factors.

What are the reasons for these modest associations? First, factors other than academic ability, such as institutional characteristics and student characteristics (e.g., motivation, attendance, health) affect achievement. Additionally for math, multiple versions of the CST are taken by 11th graders, limiting the sample size for any particular test analysis, and thus narrowing the range of scores and abilities measured. Finally, because the CSTs were designed to align with K–12 standards, the 11th grade CST does not necessarily test the same content expected at community colleges.

Understanding the predictive value of CST scores and high school grades can provide early feedback to 11th grade students on their preparedness for various levels of community college English and math coursework. This information may be useful for certain groups of students, in particular, students achieving at higher levels. In a similar fashion, the California State University's (CSU) Early Assessment Program (EAP) uses an augmented version of the CST to inform students of their readiness for CSU English and math coursework (<http://www.calstate.edu/EAP/>). Other sources of information about student skills, motivations and social support are also important considerations. Educating students about high school coursework options that may help them avoid placement into remedial coursework in college could have many benefits. Students will come to college with an understanding of a realistic trajectory for their academic advancement. This may reduce remediation and increase the probability of success.

Ultimately, counselors and others should be cautious about using CST scores for placement decisions. An effective advising system also should take institutional factors into account, especially where there are curricular differences between schools. Further, the value of using high school test scores and grades in placement would improve greatly with increased alignment of math and English course content between high schools and community colleges, and among colleges. Improving entering student's placement levels in math and English by even one course will shorten their pathway to transfer and degree completion; as a result more community college students will enroll in four-year colleges and graduate.



## References

- Alliance for Excellent Education (2006). Paying double, inadequate high school and community college remediation. Retrieved July 11, 2007, from <http://www.all4ed.org/publications/remediation.pdf>.
- Boylan, H. L., Bliss, L. B., & Bonham, B. S. (1997). Program components and their relationship to student performance. *Journal of Developmental Education*, 20 (3), 2-8.
- Breiman, L., Friedman, J., Olshen, R., & Stone, C. (1994). *Classification and regression trees*. Chapman and Hall: New York, NY.
- Brown, R. & Conely, D. (2007). Comparing state high school assessments to standards for success in entry-level university courses. Center for Educational Policy Research. Eugene, OR. Retrieved June 28, 2007, from <http://www.s4s.org/cepr.articles.php>.
- Brown, R. & Niemi, D. (2007). Investigating the alignment of high school and community college assessments in California. National Center for Public Policy in Higher Education. San Jose, CA.
- California Community Colleges (2006). System strategic plan. Retrieved June 28, 2007, from <http://strategicplan.cccco.edu>.
- California Community Colleges Data Mart (2008). Full Time Equivalent Students. Retrieved February 25, 2008, from <http://misweb.cccco.edu/mis/onlinestat/ftes.cfm>.
- Educational Testing Service (2004). California standardized testing program technical report.
- Educational Testing Service (2007). Standard testing and reporting program overview. Retrieved July 11, 2007, from <http://www.startest.org/cst.html>.
- Geiser, S., & Santelices, M. V. (2007). Validity of high-school grades in predicting student success beyond the freshman year: High-school record vs. standardized tests as indicators of four-year college outcomes. Research & Occasional Paper Series CSHE.6.07). Berkeley, CA: University of California, Center for Studies in Higher Education.
- Johnstone, R. (2004). Community College Pre-College Research Across California: Findings, Implications, and the Future. *iJournal*, 9.
- Legislative Analyst's Office (2008). Analysis of the 2008-09 Budget Bill: Education Retrieved February 25, 2008, from [http://www.lao.ca.gov/analysis\\_2008/education/ed\\_anl08023.aspx](http://www.lao.ca.gov/analysis_2008/education/ed_anl08023.aspx).
- Research & Planning Group/Center for Student Success (2005). Environmental scan: A summary of key issues facing California community colleges pertinent to the strategic planning process. Retrieved June 28, 2007, from <http://www.rpgroup.org>.

## Appendix A

### California Standards Test (CST) Reporting Clusters for 11th Grade English and High School Math

English CST Clusters
<ol style="list-style-type: none"> <li>1. Word Analysis and Vocabulary</li> <li>2. Reading Comprehension</li> <li>3. Literary Response and Analysis</li> <li>4. Written and Oral Language Conventions</li> <li>5. Writing Strategies</li> </ol>
General Math CST Clusters
<ol style="list-style-type: none"> <li>1. Number Sense: Rational Numbers</li> <li>2. Number Sense: Exponent, Powers, and Roots</li> <li>3. Algebra and Functions: Quantitative Relationships and Evaluating Expressions</li> <li>4. Algebra and Functions: Multi-step Problems, Graphing, and Functions</li> <li>5. Measurement and Geometry</li> <li>6. Statistics, Data Analysis, and Probability</li> </ol>
Algebra I CST Clusters
<ol style="list-style-type: none"> <li>1. Number Properties, Operations, and Linear Equations</li> <li>2. Graphing Systems of Linear Equations</li> <li>3. Quadratics and Polynomials</li> <li>4. Functions and Rational Expressions</li> </ol>
Geometry CST Cluster
<ol style="list-style-type: none"> <li>1. Logic and Geometric Proofs</li> <li>2. Volume and Area Formulas</li> <li>3. Angle Relationships, Constructions, and Lines</li> <li>4. Trigonometry</li> </ol>
Algebra II CST Cluster
<ol style="list-style-type: none"> <li>1. Polynomials and Rational Expressions</li> <li>2. Quadratics, Conics, and Complex Numbers</li> <li>3. Exponents and Logarithms</li> <li>4. Series, Combinatorics, and Probability and Statistics</li> </ol>
Summative High School Math CST Clusters
<ol style="list-style-type: none"> <li>1. Algebra I</li> <li>2. Geometry</li> <li>3. Algebra II</li> <li>4. Probability and Statistics</li> </ol>
Integrated Math I CST Clusters
<ol style="list-style-type: none"> <li>1. Algebra I: Number Proportions, Operations, and Linear Equations</li> <li>2. Algebra I: Graphing</li> <li>3. Algebra I: Quadratics and Polynomials</li> <li>4. Algebra I: Functions and Relations Expressions</li> <li>5. Geometry</li> </ol>

Integrated Math II CST Clusters
<ol style="list-style-type: none"><li>1. Algebra I</li><li>2. Geometry: Logic and Geometric Proofs</li><li>3. Geometry: Angle Relationships, Construction, and Lines</li><li>4. Trigonometry</li><li>5. Algebra II/Probability and Statistics</li></ol>
Integrated Math III CST Clusters
<ol style="list-style-type: none"><li>1. Geometry</li><li>2. Algebra II: Polynomials and Relations Expressions</li><li>3. Algebra II: Quadratics, Conics, and Statistics</li><li>4. Algebra II: Exponents and Logarithms</li><li>5. Algebra II: Series, Combinatorics, Probability and Statistics</li></ol>

Source: Educational Testing Service, California Standardized Testing Program Technical Report, November 2004

**Appendix B***California Standards Test (CST) Proficiency Levels By Scaled Scores*

High School CST Test	CST Proficiency Level				
	Far Below Basic	Below Basic	Basic	Proficient	Advanced
11th Grade English	150 – 258	259 – 299	300 – 349	350 – 395	396 – 600
General Mathematics	150 – 256	257 – 299	300 – 349	350 – 413	414 – 600
Algebra I	150 – 252	253 – 299	300 – 349	350 – 427	428 – 600
Geometry	150 – 246	247 – 299	300 – 349	350 – 417	418 – 600
Algebra II	150 – 256	257 – 299	300 – 349	350 – 415	416 – 600
Summative High School Mathematics	150 – 234	235 – 299	300 – 349	350 – 419	420 – 600
Integrated Mathematics 1	150 – 248	249 – 299	300 – 349	350 – 424	425 – 600
Integrated Mathematics 2	150 – 257	258 – 299	300 – 349	350 – 417	418 – 600
Integrated Mathematics 3	150 – 251	252 – 299	300 – 349	350 – 427	428 – 600

Source: 2006 STAR Post-Test Guide

## Appendix C

### Variables Used in Analyses

#### Dependent Variables

*(where shown, numbers indicate values used for ranking or dummy coding)*

- Level of First Attempted Community College Math Course
  - 1 = Basic Math (Basic Skills)
  - 2 = Pre-Algebra (Basic Skills)
  - 3 = Beginning Algebra/Geometry (Basic Skills)
  - 4 = Intermediate Algebra (Precollegiate)
  - 5 = Statistics/Transfer level math (College)
  - 6 = Advanced Algebra/Pre-Calculus (College)
  - 7 = Calculus/Other higher math (College)
- Level Of First Attempted Community College English Course
  - -3 = Three or more levels below college English
  - -2 = Two levels below college English
  - -1 = Precollegiate English
  - 0 = College English
- Grade Points In First Attempted Community College Math or English Course

#### Independent Variables

*(where shown, numbers indicate values used for ranking or dummy coding)*

- 11th Grade CST Scaled Score
- 11th Grade CST Cluster Scores
- 11th Grade Class Grade Points
- 12th Grade Class Indicator (Math Only)
  - -1 = Did not take math in senior year
  - 0 = Took math in senior year but did not succeed (grade of C or better)
  - 1 = Successfully completed senior year math with a grade of C or better
- 12th Grade Class Grade Points
- Year Enrolled In 11th Grade
  - One Of Four Years From 2002–2003 to 2005–2006
- Time (In Years) Between High School and Community College Class Attempts
- Gender
  - 0 = Female
  - 1 = Male
- English Proficiency Status
  - 1 = English Language Learner
  - 2 = Redesignated Fluent English Proficient
  - 3 = Initially Fluent English Proficient
  - 4 = English Only (Native English Speaker)

- Parent Education Level
  - 0 = Not a High School Graduate
  - 1 = High School Graduate
  - 2 = Some College
  - 3 = College Graduate
  - 4 = Graduate School
- Home Language
  - 1 = English
  - 0 = Not English
- Ethnicity
  - Asian/Pacific Islander
  - African-American
  - Hispanic
  - Native American
  - Other
  - White, non-Hispanic
- Disability Status
  - Learning Disability
  - Other Disability
  - No Known Disability
- High School District Pseudo Code
- Community College Pseudo Code

## Appendix D

### *Regression Equations for Example “Cut Score” Guide*

Regression equations used for example “cut score” placement guides. All models are significant at the  $p=0.05$  level. Independent variables were entered in the equation and non-significant coefficients are shown as zeroes. For the example tables, first a regression predicting math rank was used and then the second regression predicting success rates was used for that predicted course rank. Community college course level regressions were within CST test subject forms (for math) and community college course grade regressions were within CST test subject form (for math) and community college course rank. Math regressions used a 9 point ranking scheme that separated Beginning Algebra and Geometry and Calculus and other higher math. Note that these equations are given for illustrative purposes and should not be used for placement without local validation.  $R^2$  values are generally low in part due to the reduction in data points when conducting regressions within test forms and community college course levels. Also, some of the variables used are rank order variables that are not ideal for linear regression analysis. A more robust “cut score” guide could be derived from a larger data set.

#### **Dependent Variables**

Community College Course Rank = Rank

Community College Course Success Rate = Success in ...

#### **Independent Variables**

11th Grade CST Score = CST

11th Grade Class Grade Points = GPA

#### **Algebra II**

Rank =  $0.370 + 0.013 \cdot \text{CST} + 0.34 \cdot \text{GPA}$  ( $R^2 = 0.20$ )

Success in Beginning Algebra =  $-0.155 + 0.003 \cdot \text{CST} + 0.072 \cdot \text{GPA}$  ( $R^2 = 0.10$ )

Success in Intermediate Algebra =  $0.204 + 0.001 \cdot \text{CST} + 0.101 \cdot \text{GPA}$  ( $R^2 = 0.08$ )

Success in General Education Transferable Math =  $0.537 + 0 \cdot \text{CST} + 0.128 \cdot \text{GPA}$  ( $R^2 = 0.07$ )

Success in Pre-Calculus =  $0.191 + 0.001 \cdot \text{CST} + 0.126 \cdot \text{GPA}$  ( $R^2 = 0.08$ )

#### **Summative Math**

Rank =  $3.262 + 0.008 \cdot \text{CST} + 0.117 \cdot \text{GPA}$  ( $R^2 = 0.122$ )

Success in Intermediate Algebra =  $0.73 + 0 \cdot \text{CST} + 0.065 \cdot \text{GPA}$  ( $R^2 = 0.03$ )

Success in General Education Transferable Math =  $0.537 + 0 \cdot \text{CST} + 0.122 \cdot \text{GPA}$  ( $R^2 = 0.12$ )

Success in Pre-Calculus =  $0.191 + 0 \cdot \text{CST} + 0.118 \cdot \text{GPA}$  ( $R^2 = 0.10$ )

#### **English**

Rank =  $-3.576 + 0.008 \cdot \text{CST} + 0.078 \cdot \text{GPA}$  ( $R^2 = 0.23$ )

Success in course 2 levels below transfer English, =  $0.468 + 0 \cdot \text{CST} + 0.066 \cdot \text{GPA}$  ( $R^2 = 0.03$ )

Success in course 1 level below transfer English =  $0.540 + 0 \cdot \text{CST} + 0.097 \cdot \text{GPA}$  ( $R^2 = 0.06$ )

Success in Transfer Level English =  $0.273 + 0.001 \cdot \text{CST} + 0.102 \cdot \text{GPA}$  ( $R^2 = 0.10$ )

## Appendix E

### *Classification and Regression Trees (CART)*

For predictions of course level, numbers in parentheses show counts and empirical confidence levels, respectively. Risk is the percent of cases incorrectly classified by the CART. For predictions of class grade point, the number in parentheses shows counts. CARTs are a form of decision tree that provide a set of “if...then” type rules to predict categories or values based upon predictor variables. The numbering scheme of each rule set is hierarchical. For math, results for the Algebra I, Geometry, Algebra II, and Summative Math CST forms are shown. SPSS Clementine 10.1 was used to conduct the CART analyses.

#### **Algebra I CST Form**

##### *CART Predicting First Community College Math Level*

1. Community College Pseudo Code in [ 4 6 10 12 13 15 16 20 29 30 39 44 46 52 53 57 60 ] [ Mode: 2, Pre-Algebra ] => 2, Pre-Algebra (236; 0.445)
2. Community College Pseudo Code in [ 14 18 21 26 41 51 61 ] [ Mode: 3, Beginning Algebra/Geometry ] => 3, Beginning Algebra/Geometry (117; 0.735)

*Risk = 0.46*

##### *CART Predicting First Community College Math Grade Point*

1. Community College Pseudo Code in [ 16 20 21 29 30 44 53 57 ] [ Ave: 1.863, Effect: 0.517 ] => 1.863 (124)
2. Community College Pseudo Code in [ 4 6 10 12 13 14 15 18 26 39 41 46 51 52 60 61 ] [ Ave: 1.051, Effect: -0.295 ] => 1.051 (217)

*r = 0.30*

**Geometry CST Form***CART Predicting First Community College Math Level*

1. Community College Pseudo Code in [ 6 12 14 15 21 26 29 30 41 52 ] [ Mode: 3, Beginning Algebra/Geometry ] (406)
  - 1.1. 11th Grade Math Grade  $\leq 1.47$  [ Mode: 3, Beginning Algebra/Geometry ]  $\Rightarrow$  3, Beginning Algebra/Geometry (131; 0.733)
  - 1.2. 11th Grade Math Grade  $> 1.47$  [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (275; 0.422)
2. Community College Pseudo Code in [ 4 5 10 11 13 16 20 25 31 39 44 51 57 61 ] [ Mode: 2, Pre-Algebra ] (382)
  - 2.1. 11th Grade Math CST Scaled Score  $\leq 295.500$  [ Mode: 2, Pre-Algebra ] (247)
    - 2.1.1. Community College Pseudo Code in [ 4 5 57 ] [ Mode: 3, Beginning Algebra/Geometry ]  $\Rightarrow$  1, Basic Math (53; 0.358)
    - 2.1.2. Community College Pseudo Code in [ 10 11 13 16 20 25 39 51 61 ] [ Mode: 2, Pre-Algebra ]  $\Rightarrow$  2, Pre-Algebra (194; 0.485)
  - 2.2. 11th Grade Math CST Scaled Score  $> 295.500$  [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (135; 0.407)

*Risk=0.52**CART Predicting First Community College Math Grade Point*

1. 11th Grade Math Grade  $\leq 2.08$  [ Ave: 1.423, Effect: -0.297 ] (451)
  - 1.1.1. Community College Pseudo Code in [ 6 10 12 14 15 16 21 25 26 51 52 57 ] [ Ave: 1.235, Effect: -0.188 ]  $\Rightarrow$  1.235 (258)
  - 1.1.2. Community College Pseudo Code in [ 4 5 11 13 20 29 31 39 41 61 ] [ Ave: 1.674, Effect: 0.251 ]  $\Rightarrow$  1.674 (193)
2. 11th Grade Math Grade  $> 2.08$  [ Ave: 2.138, Effect: 0.418 ] (321)
  - 2.1.1. Community College Pseudo Code in [ 4 6 13 16 20 29 44 ] [ Ave: 2.451, Effect: 0.313 ]  $\Rightarrow$  2.451 (184)
  - 2.1.2. Community College Pseudo Code in [ 5 10 11 12 14 15 21 25 26 39 41 51 52 57 61 ] [ Ave: 1.718, Effect: -0.42 ]  $\Rightarrow$  1.718 (137)

*r=0.35*

**Algebra II CST Form***CART Predicting First Community College Math Level*

1. 11th Grade Math CST Scaled Score  $\leq 316.500$  [ Mode: 4, Intermediate Algebra ] (974)
  - 1.1. Community College Pseudo Code in [ 5 12 13 16 20 25 39 41 50 57 60 ] [ Mode: 4, Intermediate Algebra ] (382)
    - 1.1.1. Community College Pseudo Code in [ 12 13 16 41 50 ] [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (128; 0.555)
    - 1.1.2. Community College Pseudo Code in [ 5 20 25 39 57 60 ] [ Mode: 4, Intermediate Algebra ] (254)
      - 1.1.2.1. Ethnicity in [ "African-American" "Hispanic" "Native American" ] [ Mode: 3, Beginning Algebra/Geometry ]  $\Rightarrow$  2, Pre-Algebra (106; 0.311)
      - 1.1.2.2. Ethnicity in [ "Asian/Pacific Islander" "Other" "White, non-Hispanic" ] [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (148; 0.466)
  - 1.2. Community College Pseudo Code in [ 4 6 10 11 14 15 21 26 29 30 51 61 ] [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (592; 0.326)
2. 11th Grade Math CST Scaled Score  $> 316.500$  [ Mode: 6, Pre-Calculus ] (343)
  - 2.1. 12th Grade Math Grade  $\leq 2.12$  [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (100; 0.48)
  - 2.2. 12th Grade Math Grade  $> 2.12$  [ Mode: 6, Pre-Calculus ] (243)
    - 2.2.1. Parent Education Level in [ "College Graduate" "Graduate School" "High School Graduate" ] [ Mode: 6, Pre-Calculus ]  $\Rightarrow$  6, Pre-Calculus (161; 0.429)
    - 2.2.2. Parent Education Level in [ "Not a High School Graduate" "Some College" ] [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (82; 0.317)

*Risk=0.61**CART Predicting First Community College Math Grade Point*

1. 11th Grade Math Grade  $\leq 2.41$  [ Ave: 1.932, Effect: -0.229 ] (744)
  - 1.1. Community College Pseudo Code in [ 11 12 14 16 21 26 39 41 51 60 ] [ Ave: 1.655, Effect: -0.277 ] (359)
    - 1.1.1. 11th Grade Math Grade  $\leq 1.82$  [ Ave: 1.427, Effect: -0.228 ]  $\Rightarrow$  1.427 (211)
      - 1.1.1.1. Community College Pseudo Code in [ 12 21 26 39 41 ] [ Ave: 1.5, Effect: -0.48 ]  $\Rightarrow$  1.5 (54)
      - 1.1.1.2. Community College Pseudo Code in [ 11 14 16 51 60 ] [ Ave: 2.255, Effect: 0.276 ]  $\Rightarrow$  2.255 (94)
    - 1.1.2. 11th Grade Math Grade  $> 1.82$  [ Ave: 1.98, Effect: 0.325 ] (148)
      - 1.2.1.1.1. 11th Grade Math CST Scaled Score  $\leq 288.500$  [ Ave: 1.894, Effect: -0.132 ]  $\Rightarrow$  1.894 (177)
      - 1.2.1.1.2. 11th Grade Math CST Scaled Score  $> 288.500$  [ Ave: 2.274, Effect: 0.247 ]  $\Rightarrow$  2.274 (95)
      - 1.2.1.2. 12th Grade Math Grade  $> 2.53$  [ Ave: 2.452, Effect: 0.346 ]  $\Rightarrow$  2.452 (62)
  - 1.2. Community College Pseudo Code in [ 4 5 6 10 13 20 25 29 30 44 50 57 61 ] [ Ave: 2.19, Effect: 0.259 ] (385)
    - 1.2.1. Community College Pseudo Code in [ 4 5 6 20 29 44 50 57 ] [ Ave: 2.106, Effect: -0.085 ] (334)
      - 1.2.1.1. 12th Grade Math Grade  $\leq 2.53$  [ Ave: 2.027, Effect: -0.079 ] (272)
        - 1.2.1.1.1. 11th Grade Math CST Scaled Score  $\leq 288.500$  [ Ave: 1.894, Effect: -0.132 ]  $\Rightarrow$  1.894 (177)
        - 1.2.1.1.2. 11th Grade Math CST Scaled Score  $> 288.500$  [ Ave: 2.274, Effect: 0.247 ]  $\Rightarrow$  2.274 (95)
        - 1.2.1.2. 12th Grade Math Grade  $> 2.53$  [ Ave: 2.452, Effect: 0.346 ]  $\Rightarrow$  2.452 (62)
    - 1.2.2. Community College Pseudo Code in [ 10 13 25 30 61 ] [ Ave: 2.745, Effect: 0.555 ]  $\Rightarrow$  2.745 (51)
2. 11th Grade Math Grade  $> 2.41$  [ Ave: 2.472, Effect: 0.311 ] (547)
  - 2.1. 11th Grade Math Grade  $\leq 3.32$  [ Ave: 2.308, Effect: -0.163 ] (372)
    - 2.1.1. Community College Pseudo Code in [ 10 11 12 14 15 16 21 26 30 39 ] [ Ave: 2.045, Effect: -0.263 ]  $\Rightarrow$  2.045 (156)
    - 2.1.2. Community College Pseudo Code in [ 4 5 6 13 20 29 41 51 57 61 ] [ Ave: 2.499, Effect: 0.19 ]  $\Rightarrow$  2.499 (216)
  - 2.2. 11th Grade Math Grade  $> 3.32$  [ Ave: 2.819, Effect: 0.347 ] (175)
    - 2.2.1. 12th Grade Math Grade  $\leq 2.95$  [ Ave: 2.505, Effect: -0.314 ]  $\Rightarrow$  2.505 (58)
    - 2.2.2. 12th Grade Math Grade  $> 2.95$  [ Ave: 2.974, Effect: 0.156 ]  $\Rightarrow$  2.974 (117)

*r=0.37*

**Summative Math CST Form***CART Predicting First Community College Math Level*

Time between high school and community college math attempts  $\leq -1.750$  [ Mode: 3, Beginning Algebra/Geometry ]  
 $\Rightarrow$  3, Beginning Algebra/Geometry (82; 0.671)

1. Time between high school and community college math attempts  $> -1.750$  [ Mode: 6, Pre-Calculus ] (876)
  - 1.1. Community College Pseudo Code in [ 4 12 13 15 16 20 27 46 50 57 ] [ Mode: 6, Pre-Calculus ] (267)
    - 1.1.1. 11th Grade Math CST Scaled Score  $\leq 290$  [ Mode: 4, Intermediate Algebra ]  $\Rightarrow$  4, Intermediate Algebra (109; 0.376)
    - 1.1.2. 11th Grade Math CST Scaled Score  $> 290$  [ Mode: 6, Pre-Calculus ]  $\Rightarrow$  6, Pre-Calculus (158; 0.494)
  - 1.2. Community College Pseudo Code in [ 5 6 10 11 14 18 21 25 26 29 30 39 41 51 61 ] [ Mode: 6, Pre-Calculus ] (609)
    - 1.2.1. 11th Grade Math CST Scaled Score  $\leq 346$  [ Mode: 6, Pre-Calculus ]  $\Rightarrow$  6, Pre-Calculus (399; 0.371)
    - 1.2.2. 11th Grade Math CST Scaled Score  $> 346$  [ Mode: 7, Calculus and above ] (210)
      - 1.2.2.1. Time between high school and community college math attempts  $\leq 0.250$  [ Mode: 6, Pre-Calculus ]  $\Rightarrow$  5, General Education Transferable (65; 0.415)
      - 1.2.2.2. Time between high school and community college math attempts  $> 0.250$  [ Mode: 7, Calculus and above ]  $\Rightarrow$  7, Calculus and above (145; 0.545)

*risk = 0.55*

*CART Predicting First Community College Math Grade Point*

1. 11th Grade Math Grade  $\leq 2.465$  [ Ave: 2.235, Effect: -0.411 ]
  - 1.1. Community College Pseudo Code in [ 4 5 6 11 12 14 15 16 20 25 29 30 39 41 51 57 ] [ Ave: 2.129, Effect: -0.105 ]  $\Rightarrow$  2.129
  - 1.2. Community College Pseudo Code in [ 10 13 21 26 42 61 ] [ Ave: 2.763, Effect: 0.528 ]  $\Rightarrow$  2.763
2. 11th Grade Math Grade  $> 2.465$  [ Ave: 2.89, Effect: 0.245 ]
  - 2.1. 11th Grade Math Grade  $\leq 3.725$  [ Ave: 2.757, Effect: -0.133 ]
    - 2.1.1. 11th Grade Math CST Scaled Score  $\leq 295$  [ Ave: 2.51, Effect: -0.247 ]  $\Rightarrow$  2.51
    - 2.1.2. 11th Grade Math CST Scaled Score  $> 295$  [ Ave: 2.873, Effect: 0.116 ]
      - 2.1.2.1. Community College Pseudo Code in [ 4 10 11 13 16 20 21 26 41 46 50 57 ] [ Ave: 3.125, Effect: 0.252 ]  $\Rightarrow$  3.125
      - 2.1.2.2. Community College Pseudo Code in [ 5 6 12 14 15 18 25 29 30 39 51 61 ] [ Ave: 2.735, Effect: -0.138 ]  $\Rightarrow$  2.735
  - 2.2. 11th Grade Math Grade  $> 3.725$  [ Ave: 3.364, Effect: 0.474 ]
    - 2.2.1. 11th Grade Math CST Scaled Score  $\leq 367.500$  [ Ave: 2.948, Effect: -0.416 ]  $\Rightarrow$  2.948
    - 2.2.2. 11th Grade Math CST Scaled Score  $> 367.500$  [ Ave: 3.695, Effect: 0.33 ]  $\Rightarrow$  3.695

*r=0.37*

## 11th Grade English CST Form

### *CART Predicting First Community College English Level*

1. 11th Grade English CST Scaled Score  $\leq$  355 [ Mode: -1 ] (2,961)
  - 1.1. High School District Pseudo Code in [ 1 9 13 14 16 20 ] [ Mode: -1 ] (1,097)
    - 1.1.1. Community College Pseudo Code in [ 1 3 5 7 14 22 37 40 41 47 53 ] [ Mode: -1 ] (464)
      - 1.1.1.1. 11th Grade English CST Scaled Score  $\leq$  291.500 [ Mode: -2 ]  $\Rightarrow$  -2 (173; 0.509)
      - 1.1.1.2. 11th Grade English CST Scaled Score  $>$  291.500 [ Mode: -1 ]  $\Rightarrow$  -1 (291; 0.601)
    - 1.1.2. Community College Pseudo Code in [ 2 10 11 15 18 24 26 27 39 45 48 49 50 51 54 55 56 62 65 ] [ Mode: -1 ] (633)
      - 1.1.2.1. Community College Pseudo Code in [ 50 ] [ Mode: -3 ]  $\Rightarrow$  -3 (130; 0.569)
      - 1.1.2.2. Community College Pseudo Code in [ 2 10 11 15 18 24 26 27 39 45 48 49 51 54 55 56 62 65 ] [ Mode: -1 ]  $\Rightarrow$  -1 (503; 0.626)
  - 1.2. High School District Pseudo Code in [ 2 5 8 10 11 12 15 19 24 ] [ Mode: 0 ] (1,864)
    - 1.2.1. 11th Grade English CST Scaled Score  $\leq$  331.500 [ Mode: -1 ] (1,235)
      - 1.2.1.1. Community College Pseudo Code in [ 22 25 36 41 46 47 52 61 ] [ Mode: -2 ] (591)
        - 1.2.1.1.1. English Proficiency in [ ELL, R-FEP ] [ Mode: -2 ]  $\Rightarrow$  -2 (167; 0.569)
        - 1.2.1.1.2. English Proficiency in [ I-FEP, English Only ] [ Mode: -1 ]  $\Rightarrow$  -1 (424; 0.375)
      - 1.2.1.2. Community College Pseudo Code in [ 1 4 5 6 7 11 17 24 27 37 45 50 51 54 55 56 57 60 62 63 ] [ Mode: -1 ] (644)
        - 1.2.1.2.1. Community College Pseudo Code in [ 1 5 6 7 17 24 56 57 ] [ Mode: 0 ]  $\Rightarrow$  0 (110; 0.482)
        - 1.2.1.2.2. Community College Pseudo Code in [ 4 11 27 37 45 50 51 54 55 60 62 63 ] [ Mode: -1 ]  $\Rightarrow$  -1 (534; 0.515)
    - 1.2.2. 11th Grade English CST Scaled Score  $>$  331.500 [ Mode: 0 ] (629)
      - 1.2.2.1. Community College Pseudo Code in [ 1 8 12 17 19 22 24 27 37 39 45 52 55 56 60 61 ] [ Mode: 0 ]  $\Rightarrow$  0 (502; 0.62)
      - 1.2.2.2. Community College Pseudo Code in [ 2 9 10 36 41 46 50 51 54 62 ] [ Mode: -1 ]  $\Rightarrow$  -1 (127; 0.535)
2. 11th Grade English CST Scaled Score  $>$  355 [ Mode: 0 ] (1,739)
  - 2.1. High School District Pseudo Code in [ 1 9 13 14 16 ] [ Mode: -1 ] (527)
    - 2.1.1. 11th Grade English CST Scaled Score  $\leq$  374.500 [ Mode: -1 ]  $\Rightarrow$  -1 (225; 0.591)
    - 2.1.2. 11th Grade English CST Scaled Score  $>$  374.500 [ Mode: 0 ] (302)
      - 2.1.2.1. Community College Pseudo Code in [ 3 40 51 53 54 55 ] [ Mode: -1 ]  $\Rightarrow$  -1 (107; 0.551)
      - 2.1.2.2. Community College Pseudo Code in [ 5 6 11 15 18 41 45 47 50 62 ] [ Mode: 0 ]  $\Rightarrow$  0 (195; 0.692)
  - 2.2. High School District Pseudo Code in [ 2 5 8 10 11 12 15 19 24 ] [ Mode: 0 ] (1,212)
    - 2.2.1. Community College Pseudo Code in [ 5 41 47 49 51 54 55 62 ] [ Mode: -1 ]  $\Rightarrow$  -1 (54; 0.63)
    - 2.2.2. Community College Pseudo Code in [ 1 2 6 10 12 17 18 22 24 26 35 36 37 39 40 45 46 48 52 56 60 61 65 ] [ Mode: 0 ]  $\Rightarrow$  0 (1,158; 0.829)

*Risk = 0.56*

*CART Predicting First Community College English Grade Point*

1. 11th Grade English Grade  $\leq$  2.429 [ Ave: 1.952, Effect: -0.485 ] (1,734)
  - 1.1. 11th Grade English Grade  $\leq$  0.919 [ Ave: 1.538, Effect: -0.414 ] (310)
    - 1.1.1. Community College Pseudo Code in [ 1 5 11 19 22 27 36 37 40 52 55 57 60 ] [ Ave: 1.81, Effect: 0.272 ]  $\Rightarrow$  1.81 (209)
      - 1.1.1.1. Community College Pseudo Code in [ 7 17 24 46 50 53 54 56 62 ] [ Ave: 0.975, Effect: -0.562 ]  $\Rightarrow$  0.975 (101)
  - 1.2. 11th Grade English Grade  $>$  0.919 [ Ave: 2.042, Effect: 0.09 ] (1,424)
    - 1.2.1. High School District Pseudo Code in [ 2 8 9 11 19 ] [ Ave: 2.409, Effect: 0.367 ]  $\Rightarrow$  2.409 (339)
    - 1.2.2. High School District Pseudo Code in [ 1 10 12 13 14 15 20 24 ] [ Ave: 1.927, Effect: -0.115 ] (1,085)
      - 1.2.2.1. Community College Pseudo Code in [ 3 10 22 39 54 62 ] [ Ave: 1.419, Effect: -0.508 ]  $\Rightarrow$  1.419 (86)
      - 1.2.2.2. Community College Pseudo Code in [ 1 2 5 9 11 14 17 27 37 41 46 47 49 50 51 52 53 55 56 60 61 65 ] [ Ave: 1.971, Effect: 0.044 ] (999)
        - 1.2.2.2.1. 11th Grade English CST Scaled Score  $\leq$  324 [ Ave: 1.833, Effect: -0.138 ]  $\Rightarrow$  1.833 (502)
        - 1.2.2.2.2. 11th Grade English CST Scaled Score  $>$  324 [ Ave: 2.11, Effect: 0.14 ]  $\Rightarrow$  2.11 (497)
2. 11th Grade English Grade  $>$  2.429 [ Ave: 2.721, Effect: 0.284 ] (2,966)
  - 2.1. 11th Grade English Grade  $\leq$  3.345 [ Ave: 2.523, Effect: -0.198 ] (1,726)
    - 2.1.1. High School District Pseudo Code in [ 2 5 8 9 11 12 15 16 ] [ Ave: 2.734, Effect: 0.21 ] (925)
      - 2.1.1.1. 11th Grade English CST Scaled Score  $\leq$  300.500 [ Ave: 2.374, Effect: -0.36 ] (174)
        - 2.1.1.1.1. Community College Pseudo Code in [ 6 7 36 37 40 46 52 54 55 ] [ Ave: 2.639, Effect: 0.266 ]  $\Rightarrow$  2.639 (97)
        - 2.1.1.1.2. Community College Pseudo Code in [ 1 5 45 51 53 56 60 ] [ Ave: 2.039, Effect: -0.335 ]  $\Rightarrow$  2.039 (77)
      - 2.1.1.2. 11th Grade English CST Scaled Score  $>$  300.500 [ Ave: 2.817, Effect: 0.083 ]  $\Rightarrow$  2.817 (751)
    - 2.1.2. High School District Pseudo Code in [ 1 10 13 14 19 20 24 ] [ Ave: 2.28, Effect: -0.243 ] (801)
      - 2.1.2.1. Ethnicity in [ 2 3 5 ] [ Ave: 2.123, Effect: -0.157 ]  $\Rightarrow$  2.123 (358)
      - 2.1.2.2. Ethnicity in [ 1 4 6 ] [ Ave: 2.407, Effect: 0.127 ]  $\Rightarrow$  2.407 (443)
  - 2.2. 11th Grade English Grade  $>$  3.345 [ Ave: 2.996, Effect: 0.275 ] (1,240)
    - 2.2.1. Community College Pseudo Code in [ 5 11 12 17 23 26 27 37 39 40 41 45 46 47 50 51 53 55 56 ] [ Ave: 2.791, Effect: -0.205 ] (656)
      - 2.2.1.1. 11th Grade English CST Scaled Score  $\leq$  350.500 [ Ave: 2.59, Effect: -0.201 ]  $\Rightarrow$  2.59 (318)
      - 2.2.1.2. 11th Grade English CST Scaled Score  $>$  350.500 [ Ave: 2.98, Effect: 0.189 ] (338)
        - 2.2.1.2.1. Community College Pseudo Code in [ 46 50 55 ] [ Ave: 2.641, Effect: -0.339 ]  $\Rightarrow$  2.641 (85)
        - 2.2.1.2.2. Community College Pseudo Code in [ 5 11 17 23 26 37 39 40 41 45 47 51 53 56 ] [ Ave: 3.094, Effect: 0.114 ]  $\Rightarrow$  3.094 (253)
    - 2.2.2. Community College Pseudo Code in [ 1 3 18 22 24 36 48 52 54 60 61 62 65 ] [ Ave: 3.226, Effect: 0.23 ] (584)
      - 2.2.2.1. 11th Grade English Grade  $\leq$  3.706 [ Ave: 3.071, Effect: -0.155 ] (339)
        - 2.2.2.1.1. 11th Grade English CST Scaled Score  $\leq$  399.500 [ Ave: 2.979, Effect: -0.092 ]  $\Rightarrow$  2.979 (280)
        - 2.2.2.1.2. 11th Grade English CST Scaled Score  $>$  399.500 [ Ave: 3.508, Effect: 0.438 ]  $\Rightarrow$  3.508 (59)
      - 2.2.2.2. 11th Grade English Grade  $>$  3.706 [ Ave: 3.441, Effect: 0.215 ]  $\Rightarrow$  3.441 (245)

 $r=0.41$