Algebra II: Gatekeeper Course
An Examination of CST Proficiency Levels
in California and The Bay Area

by

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Abstract

This paper examines the Algebra II course and California Star Test (CST) proficiency levels in the San Francisco Bay Area and in the State of California. CST proficiency levels are examined by grade level for the State and nine counties of the San Francisco Bay Area region. Algebra II is shown to be one of the more complicated courses in the CSU and UC A-G eligibility courses for students in high school. This paper attempts to highlight the achievement gap of gender and socio-economic and race/ethnicity gaps in completion of the course. This paper examines completion rates by grade and discussions implications of these finding. Common Core standards and progression of math sequencing as well as CST standards are addressed and discussed in the context of their impact on successful curriculum outlines.

Chapter 1 Introduction

Algebra II is a high school mathematics course and is third in the traditional Algebra I, Geometry, Algebra II sequence. Algebra II is generally taken in the sophomore or junior year of high school and is required for California State University (CSU) and University of California (UC) eligibility. Many students successfully complete their first year of algebra (Algebra I) and go on and successfully complete their year of geometry. Then comes the gatekeeper course, Algebra II. There are many students who will take the course, do well, feel challenged and even enjoy the course. However, many students who enter the course having met the prerequisite classes will suddenly find themselves struggling in this class. Many will pass it successfully, but likely with tutoring and putting in plenty of time and energy. There are many others still, who find themselves failing and either moving out of the class to a lower level course or staying in and repeating the course the following year. Some students repeat the course and still don't pass.

This paper pays special attention to the students who do not fit the first scenario of successful completion in their first attempt at the course. Many students are put into a lower math class during the year or receive a low grade and need to repeat the course. I believe there are a majority of students struggling to get through this level of math and would like to explore who is struggling, why they are struggling and what we could possibly do about it.

There are students who are strong academically in a range of subjects, even math, until they get to this gatekeeper course. Why is it called it a gatekeeper? Because students need it to be accepted into California State University and University of California colleges, as well as many

private and out-of-state colleges. Without successful completion of Algebra II by junior year, college eligibility is threatened.

This paper examines CST data for California and nine Bay Area Counties to find differences in outcomes for students based on socio-economic status, gender, ethnicity and other variables. This chapter outlines the problem. Chapter Two reviews current literature and Chapter Three outlines the method used to create the findings in Chapter Four. Chapter Four of this paper presents data that shows the outcome results and Chapter Five discusses possible routes for future study and practice for districts, schools and teachers.

Statement of the Problem

Algebra II is a gatekeeper course for college bound students (Clotfeller, Ladd, Vigdor & National Bureau of Economic Research, 2012). There are many students meeting the college eligibility requirements for CSU and UC in all areas except mathematics. The problem is that the students successfully complete the prerequisites for Algebra II, sometimes with grades of A or B, but cannot successfully complete Algebra II. Schools and districts often create or have intervention systems in place to help struggling students. Sometimes the intervention is for students to move to a lower level math class and repeat the Algebra I material they had already successfully completed. Some remain in Algebra II but receive a low grade which requires them to repeat the course. This can severely impact their college acceptance prospects depending on their current grade level. This is a very critical course for juniors (grade 11) and seniors (grade 12) who are applying to colleges without successfully completing the course and with the low grade on their transcripts, which brings down their GPA, another critical component for college acceptance.

Purpose Statement

The purpose of this research is to highlight the problem of Algebra II as a gatekeeper course and examine ways to maintain the integrity of the curriculum while offering suggestions to restructure the course to potentially meet the needs of all students and narrow the existing achievement gaps.

Research Questions

1. Who is struggling in Algebra II?

2. What disparities exist in terms of demographic characteristics of students?

3. What do we do for those students who are struggling to pass and therefore limited in terms of college acceptance?

Theoretical Rationale

The basis for my thesis stems from the findings of two researchers, Stigler and Hiebert (2009), who wrote a book after reviewing results and videos of teachers teaching math around the world as part of The International Mathematics and Science Study (TIMSS). In their book, *The Teaching Gap*, Stigler and Hiebert (2009) find that the US method of teaching mathematics lies in a procedural and skills based approach for solving certain types of problems. In Japan, where TIMSS scores were much higher than in the US, educators focused more on problem solving and group. This really formed a connection for me about why some of our students may be struggling in higher-level mathematics in high school. Without a firm conceptual understanding of the mathematics, it is very difficult to keep learning more and more rules, steps, methods and tricks in order to solve for the well-known variable, 'x,' unless you have a strong natural aptitude.

As a current teacher of Algebra II, I hear frequent concerns from parents and students about their ability to pass the class. Some students have had to repeat all or part of Algebra I and

are now in their junior or senior year of high school and feeling a tremendous amount of anxiety about taking Algebra II. Others have taken intermediate algebra or have taken Algebra II unsuccessfully.

Assumptions

When students successfully complete prerequisite courses, they should be able to successfully complete the next course. There will be some students who really do need to take a difficult course twice, but most should complete the course with a C grade or higher. Completion rates should not vary by ethnicity or SES status if *all* students in the classroom have met the prerequisites.

Another assumption is that the curriculum of Algebra II does not need to review a great deal of Algebra I curriculum and it needs even less to cover a great deal of Pre-calculus curriculum, the next course in the mathematics sequence for students on the path to Calculus. This is especially true for students who are juniors or seniors who may choose to go the route of statistics in their next math courses and in their college majors. More majors are requiring statistics as part of the coursework so a Calculus driven curriculum may no longer serve students in the way it has in the past.

Because of this, a small amount of review at the start of the year and small amount of preview into advanced topics near the end of the year should be enough time to devote to topics not specifically part of the Algebra II curriculum. As new topics are introduced, many textbooks and teachers begin each chapter with previous material from Algebra I in the first section or as introductory material. Many also use the first chapter for review of previous work and the last chapter(s) as a preview to the next course.

Background and Need

Before star test scores (CST), AP courses and the No Child Left Behind act (NCLB), students generally started high school and were placed in their first algebra class as freshmen. They proceed up through the curriculum to geometry in sophomore year, Algebra II in junior year and landed at pre-calculus in their senior year if they successfully completed every course. They may have skipped pre-calculus if they did not want to take a fourth year math class. This was the standard path and it is what the new common core standards seem to be headed back towards. In the interim, we had students who were strong math students and were ready for Algebra I in eighth grade, who could start geometry in their freshman year and move through to AP Calculus in their senior year.

Today, more students take Algebra in eighth grade and are ready for advanced curriculum in their junior year and an AP math course in their senior year. More juniors in Algebra II would benefit from a curriculum that incorporates elements of a statistics path. Students have more choice about which courses they will take after Algebra II. Sophomores can choose to take Pre-Calculus, Statistics or AP Statistics in their junior year. Juniors can choose these same courses in their senior year. Seniors, moving on to college, may never need to take Pre-Calculus or Calculus courses. But, many, even science and math majors, will likely be required to take Statistics in college. So, it seems the current path to Calculus may be becoming outdated for many students. These may be the same students who struggle in Algebra II as juniors and seniors.

We currently find ourselves adopting new standards that define a slightly more moderate curriculum, that expands the focus of application and technology based problem solving. Critical thinking and reasoning skills will be emphasized in the next set of standards. It is expected that standardized tests will no longer be 100% multiple choice. There will be free-response questions

that are graded with a rubric. This is shift for mathematics in the Unites States, which has focuses on skill and drill, procedures and rules, without much emphasis on meaning, problem solving and sense making. The standards are still quite comprehensive and should well prepare students for their SAT tests and Algebra II and beyond.

The rest of this paper examines current literature on the topic of student outcomes in mathematics education, current data for California and the Nine-County San Francisco Bay Area, and suggests direction for further study and practices regarding Algebra II.

Chapter 2 Review of the Literature

In *The Teaching Gap* (Stigler & Hiebert, 2009) differences in teaching methods used in the United States, Germany and Japan are described and compared to outcomes in the Third International Mathematics and Science Study (TIMSS). The TIMSS compares science and math achievement using a video component and includes forty-one nations (Stigler & Hiebert, 2009). The authors of The Teaching Gap collaborated on the video study and later analyzed the results. They point out, after analyzing the techniques used by teachers in different countries, and therefore different cultural approaches to teaching, that although "the American teachers we observed were highly competent at implementing American teaching methods, the methods themselves were severely limited" (p.xviii). The teaching gap the authors refer to is not the gap in competence of teachers, but the gap in methods of teaching that occurs internationally. The focus of the analysis is on teaching methods in Germany, Japan and the United states, in eighth grade mathematics classrooms. The book examines reform efforts in the United States and "proposes a new plan for improving classroom teaching in the United States" (Stigler & Hiebert, 2009, p.xix).

One of the components of reform that may be missing in United States education reform efforts is what the Japanese teachers call lesson study. "In lesson study, groups of teachers meet regularly over long periods of time (ranging from several months to a year) to work on design, implementation, testing and improvement of one or several 'research lessons'" (Stigler & Hiebert, 2009, p.110). The first step in the lesson study process is to define the problem, which can be general or specific, i.e. increase engagement levels or improve a specific skill (Stigler &

Hiebert, 2009). The next step, once the learning goal is established – usually by the teacher's own choice in something they are challenged by – is to plan the lesson. The lesson is perceived as a "group product" even when only one teacher may actually teach the lesson (Stigler & Hiebert, 2009, p.113). "The initial plan that the group produces is often presented at a school-wide faculty meeting in order to solicit criticism" (Stigler & Hiebert, 2009, p.113). Teachers then go on to teach the lesson, evaluate the lesson and reflect on its effectiveness, revise the lesson, teach the revised lesson, evaluate and reflect and finally share the results (Stigler & Hiebert, 2009).

The National Center for Education Statistics has produces a report outlining the need for students who are planning to be eligible for college to enroll in eighth grade algebra and foreign language courses. Their findings show that the majority of students who enroll in eighth grade algebra courses and maintain a high level of mathematics achievement in high school apply to college at a higher rate over those students who achieve a high level of mathematics but did not enroll in algebra in eighth grade (72% as compared to 58%). Of those who enrolled in eighth grade algebra but achieved a low or middle level of mathematics achievement in high school approximately 55% applied to a four-year college. Those who did not enroll in eighth grade algebra and did not achieve a high level of mathematics completion in high school applied to four year colleges at a much lower rate of 24% to 29%This supports the idea that successful completion of high level mathematics in high school (high in this study is any class beyond Geometry), is a gatekeeper to four year colleges.

In Los Angeles County Unified School District, researchers found that Algebra II was the most difficult course to pass for college track student (Rickles & White, 2005, p.6). African American and Hispanic students as well as English Learners and special education students had

lower success rates for completing the A-G UC/CSU requirements while White and Asian students were more likely to complete the requirements (p.10). The report followed the progression of ninth graders enrolled in LAUSD schools in 2001 who would graduate in 2005. Of those students, 41% left the district before graduating, 7% were retained and 52% were enrolled in twelfth grade for the 2004-05 school year. Excluding special education students, 40% left the District, 6% were retained and 53% were enrolled in twelfth grade in 2004-05.

Of the 38,211 non-special education students in the 2001 ninth grade cohort, 29% were enrolled in all A-G courses by twelfth grade and 15% completed them with a grade of 'C' or better (Rickles & White, 2005). This 15% comprised 18% of the female students and 11% of the male students. The District is comprised largely of Hispanic students. Of the non-special education students in the ninth grade cohort, 70% are Hispanic and only 11% of them completed the A-G requirements with grades of 'C' or better. Of the other 30%, 13% of African American students, 38% of Asian students and 27% of white and all others met the A-G requirements with a grade of C or better.

In summary, the report found disparities for gender, race and ethnicity and special education classifications. English Language learners were also less likely to have met the A-G requirements with a grade of 'C' or better: 5% versus 18% for non-English learners. Only 2% of Special education students meet the A-G requirements with grades of 'C' or better (Rickles & White, 2005).

The Public Policy Institute of California report Higher Education for California: New Goals for the Master Plan, shows college eligibility rates for high school graduates by race, gender over time (Johnson, 2010). They show that there is a gap between females and males graduating with CSU/UC eligibility courses met in 2007: 15.3% of females versus 11.2 % of

males are UC eligible, while 37.6 % of females are CSU eligible and only 27.3% of males are. The same gap exists for race/ethnicity in 2007 where Asian students are much more likely to be eligible, 29.4% for UC and 50.9% for CSU, whites are 14.6% UC eligible and 37.1% CSU eligible, while Latino and African American students are very close at about6.5% UC eligible and approximately 23% eligible for CSU. These gender and race/ethnicity gaps have narrowed since 1996. Rates for Asians and Whites have been relatively stable since 1996, but have doubled for African Americans and Latinos for both UC and CSU eligibility.

San Diego Unified School District (2010) *Educational Opportunity Audit Report* shows disparities in race/ethnicity A-G eligibility for graduates, as well. Their online report on 9/30/12 shows graduation rates by race/ethnicity for students who meet A-G UC/CSU eligibility courses. Asians currently graduate with 58% of students meeting the requirements for UC/CSU, Whites are at 54%, African Americans are at 32% and Latino students are at 30%. These percentages have all increased over the past few years, but a clear gap exists between Whites/Asian and African American/Latino students.

Chapter 3 Method

The statistical component of this paper was completed by use of publically available data. No surveys were done to get input from teachers about their decision making processes, constraints by schools regarding scheduling or from students about their personal experiences. This research is solely about Algebra II proficiency rates and takes a closer look at those rates by County, ethnicity and socio-economic status. State level and county level data is used.

Data sources include California Department of Education (CDE, 2012) data sources. The primary data source used for the creation of the charts and graphs in Chapter 4 are Standardized Testing and Reporting (STAR) scores using reports run on Data Quest available at the CDE website. These data are readily available on the Testing and Accountability Tab of the CDE website and queries are made through a link to Data Quest (California Department of Education, 2010).

There are several other large publically available databases available for education research. The TIMSS study has created an International Data Explorer tool that allows a researcher to generate data reports on many aspects of student performance. The TIMSS study examined classrooms, students and teachers around the globe in fourth and eighth grade mathematics and science courses. The study surveyed schools, students, math teachers and science teachers. The eighth grade student survey was comprised of approximately twenty questions with sub-questions. The survey asked students about their activities at home, outside of school and their classes. They were asked about their math competency and attitudes and about instructional practices and use of classroom time. Teachers were asked about their teacher preparation programs, education, the school climate, and teaching practices. Because these data refer to eighth grade coursework, little of the data will be used in this report. The TIMSS

contribution comes mainly from the video analysis performed by Stigler and Hiebert and is reviewed in the literature review chapter of this paper. The data source and study are mentioned because they are suggested as resources for further study in the final section of this paper.

Other publically available data sites were examined. At NAEP, there is a video entitled the Condition of Education, an annual report generated by NEAP. Data and charts from that report were examined, but not included in this report.

All CDE data collected has been entered into excel files and summarized to show the reader the relationship between grade level and successful Algebra II completion rates. County and state level ethnicity, graduation rates, dropout rates and percent English language learner and percent of students receiving free and reduced meals at school is examined.

CST proficiency rates are assumed to correlate to successful completion of a course grade of C or better. This assumption allows for use of CST scores to compare proficiency rates in Chapter 4 of this paper with the assumption they are a proxy for grades issued by teachers. Grade data is not as readily available and is beyond the scope of this report. In Chapter 5, districts, schools and teachers are encouraged to examine grade data to see if it correlates with student's proficiency scores.
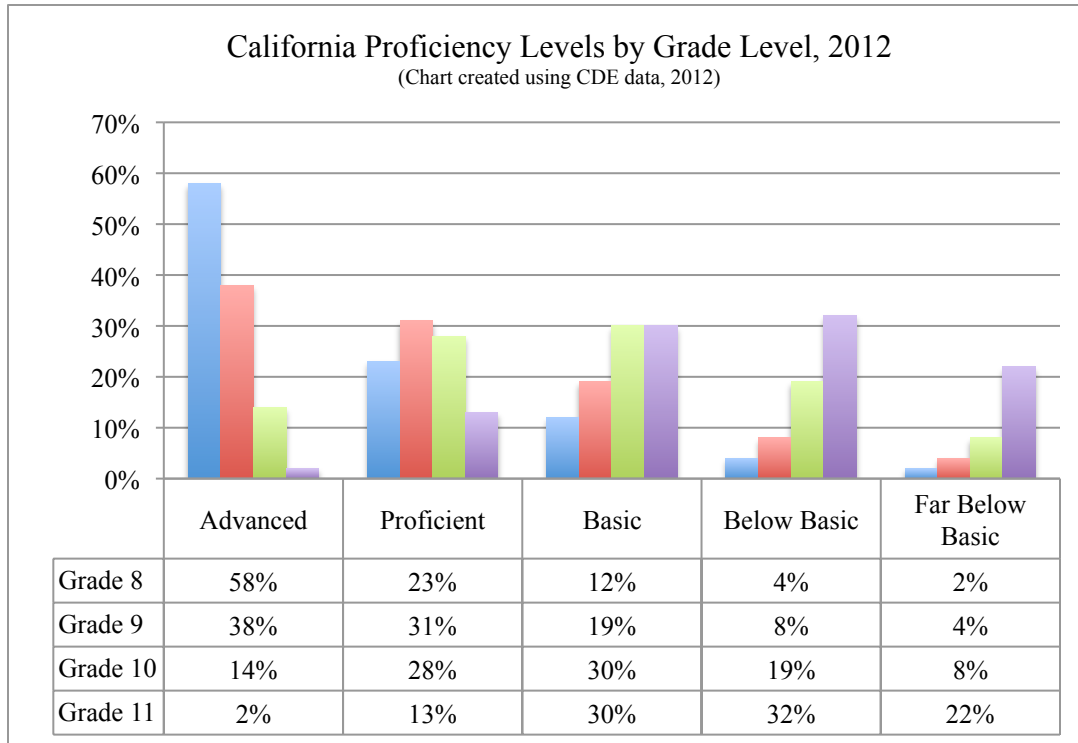
UC Census data is used to find demographic information for each county and for California. The California QuickFacts website provides user access to summary information on socio-economic data, demographics and other information for census areas. Data files were downloaded into excel to create tables of findings in Chapter 4 of this paper.

Chapter 4 Findings

This section examines data on proficiency rates for the CST Algebra II exam and student demographics for the State of California and the nine county Bay Area. Proficiency levels for each County and grade level of students is given, along with ethnicity distributions for eighth through eleventh grade students.

In all the proficiency distributions, the bulk of eleventh graders taking the CST score Basic, Below Basic, or Far Below Basic. Presumably some of those students had taken Algebra II in their sophomore year and are retaking the course, as discussed in the Los Angeles Unified School District report in Chapter 2, the literature review.

The data in the charts and tables in this section shows that as the grade level increases for taking the Algebra II CST, the proficiency level drops. We will see this trend continues despite ethnicity, socioeconomic status (SES) and English language learner status. In this report, the percent of students who are eligible for free and reduced price lunches is assumed to address SES levels.

California Proficiency Levels by Grade Level, 2012
(Chart created using CDE data, 2012)

	Advanced	Proficient	Basic	Below Basic	Far Below Basic
Grade 8	58%	23%	12%	4%	2%
Grade 9	38%	31%	19%	8%	4%
Grade 10	14%	28%	30%	19%	8%
Grade 11	2%	13%	30%	32%	22%

For the State of California, we see a strong trend for students in Algebra II: the younger the student, the higher the level of proficiency. It seems that this might speak to math aptitude, more than student demographics or teaching techniques as a main determinant in proficiency in Algebra II.

The blue bar in the above bar chart represents eighth graders. The red bar shows ninth grade results, green shows tenth grade, purple shows eleventh grade. We see that the younger the student, the more likely they will score advanced or proficient on the CST.

The bar chart below summarizes proficiency rates for the State of California and each County.

Percent of Proficient and Advanced Students in California and Nine Bay Area Counties, Grades 8-11, 2012
(Chart created using CDE data, 2012)

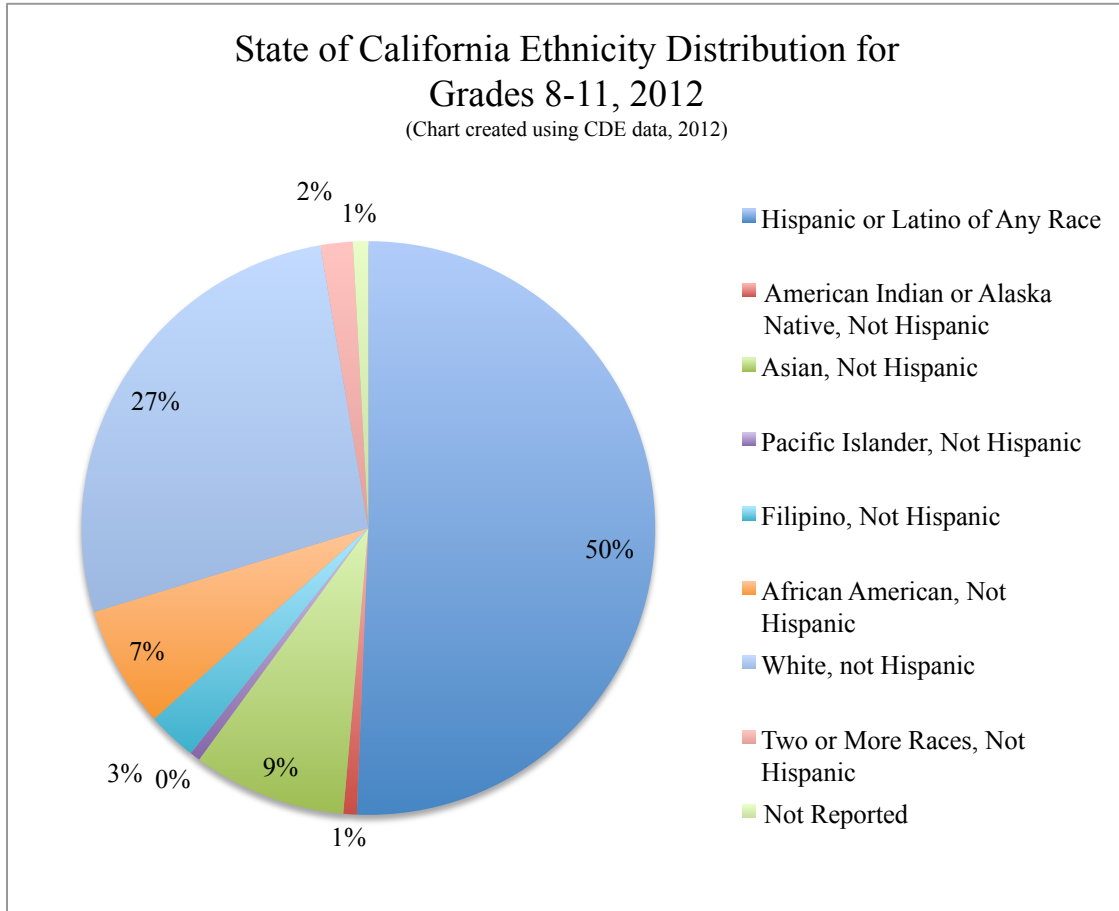|	CA	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
Grade 8	81%	81%			71%		100%	93%		
Grade 9	69%	76%	81%	83%	46%	78%	81%	83%	69%	79%
Grade 10	42%	44%	48%	60%	21%	48%	58%	53%	40%	44%
Grade 11	15%	12%	13%	16%	11%	19%	21%	17%	19%	19%

The blue bar shows the percent of eighth graders scoring Proficient or Advanced on CST for Algebra II for each region in 2012.The counties of Contra Costa, Marin, San Francisco, Solano and Sonoma have no data for eighth grade because the number of students in that grade who take the test is too small. The red bar reflects ninth graders and is higher than the green bar, representing tenth graders. Most students are on course to take Algebra II in tenth grade after taking geometry in ninth grade since most districts moved to having all eighth grade students take Algebra I. The eighth and ninth graders taking Algebra II are ahead of the regular path. The eleventh graders are a little behind the regular path. Twelfth graders are not included, though they do take the course. The CST only tests students through eleventh grade.

For each county, we see the same trend of younger students with higher proficiency levels. Ninth graders are more likely to score high than tenth graders, who are more likely to score higher than eleventh graders in every county and in the state.

State of California Ethnicity Distribution for Grades 8-11, 2012
(Chart created using CDE data, 2012)

- Hispanic or Latino of Any Race
- American Indian or Alaska Native, Not Hispanic
- Asian, Not Hispanic
- Pacific Islander, Not Hispanic
- Filipino, Not Hispanic
- African American, Not Hispanic
- White, not Hispanic
- Two or More Races, Not Hispanic
- Not Reported

California's eighth through eleventh grade students are largely of non-White Hispanic ethnicity. The next largest ethnic group is white, non-Hispanic. Nine percent of these students are Asian, not Hispanic and seven percent are African American, non-Hispanic. The County analysis shows different ethnic distributions that the state. However, the trend for CST proficiency in Algebra II is very similar for all regions.

The following table shows the disparities in achievement that exist between gender, ethnicity and economically disadvantaged students.

Characteristic	Grade 8	Grade 9	Grade10	Grade 11
Males % Proficient/Advanced	85	71	45	18
Females %Proficient/Advanced	79	67	40	14
English Learners	32	22	10	15
English Proficient, English only	83	70	33	16
Economically Disadvantaged	69	51	32	13
Not Economically Disadvantaged	86	79	50	19

Note: Table created using California Department of Education data, 2012

The above data show disparities between males and females, English language status and economic status. They all show a decrease in proficiency as grade level increases. Except for English learners all subgroups are above 50% proficient or advanced for grades 8 and 9. However, for the typical student taking the course in tenth grade, those levels are all below 50%. For eleventh grade students all proficiency levels are below 20%.

The data table on the following pages summarizes measures for the State and the nine county Bay Area. The table includes values for ethnicity, total students, percent English Language learners, percent of students on free and reduced lunch and proficiency levels on the CST exam for Algebra II.

Data Table

Data in the table below are used in the preceding and following tables to create charts and diagrams that show the comparisons (above) and distributions for each county for ethnicity (pie charts) and proficiency results (bar charts). The data is compiled here for easy comparison purposes.

MEASURE	State	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
CST Proficiency for Algebra II 2012	Values below are for percent of students scoring proficient or advanced on the CST Algebra II for each grade level.									
% Proficient or Advanced 8th grade	81%	81%	n/a	n/a	71%	n/a	100%	93%	n/a	n/a
% Proficient or Advanced 9th grade	69%	76%	81%	83%	46%	78%	81%	83%	69%	79%
% Proficient or Advanced 10th grade	42%	44%	48%	60%	21%	48%	58%	53%	40%	44%
% Proficient or Advanced 11th grade	15%	12%	13%	16%	11%	19%	21%	17%	19%	19%
Ethnicity Grades 8-11	Values below are the percent of total enrollment for grades 8-11 for each region.									
Hispanic or Latino of Any Race	50.64	30.22	29.87	24.72	48.52	23.58	37.32	37.41	29.64	36.73
American Indian or Alaska Native, Not Hispanic	0.76	0.50	0.41	0.44	0.80	0.56	0.24	0.37	0.97	1.34
Asian, Not Hispanic	8.65	21.51	10.15	5.26	2.00	42.77	12.35	26.37	4.01	3.57
Pacific Islander, Not Hispanic	0.59	1.51	0.77	0.34	0.44	1.35	2.38	0.73	1.13	0.53
Filipino, Not Hispanic	2.79	5.65	4.44	0.65	5.92	5.68	7.98	5.21	9.65	0.97
African American, Not Hispanic	6.85	14.40	11.22	3.49	2.52	11.91	2.89	2.81	17.05	2.43

MEASURE	State	Alameda	Contra Costa	Marin	Napa	San Francisco	San Mateo	Santa Clara	Solano	Sonoma
White, not Hispanic	27.05	22.82	39.66	59.94	34.50	8.86	28.15	24.29	29.59	51.04
Two or More Races, Not Hispanic	1.82	2.54	3.05	3.44	4.34	1.34	7.47	2.29	7.04	2.76
Not Reported	0.86	0.85	0.43	1.72	0.96	3.95	1.22	0.52	0.93	0.64
Total Enrollment	6,217,002	216,194	168,228	30,574	20,582	56,758	92,097	266,256	64,494	70,867
Percent UC/CSU eligible	36.3	47.5	40.3	59.3	38.4	53.9	40.1	48.9	27.6	27.4
4-Year Drop-out Rate	17.4	17.1	12	5.7	16.3	14.8	11.7	13.6	18.7	16.7
% Free & Reduced Price Meals	56.7	42.2	37.7	25.5	42.4	61.2	36.5	38.0	44.4	44.9
% English Learners	17.0	18.6	17.3	12.8	18.2	28.8	19.7	22.8	13.3	19.5

Note: Table created using California Department of Education data, 2010-2012

The following pages display data for each County makes comparisons to the State values. We see that although county and state level data vary, the outcome for students at the various grade levels is very similar.
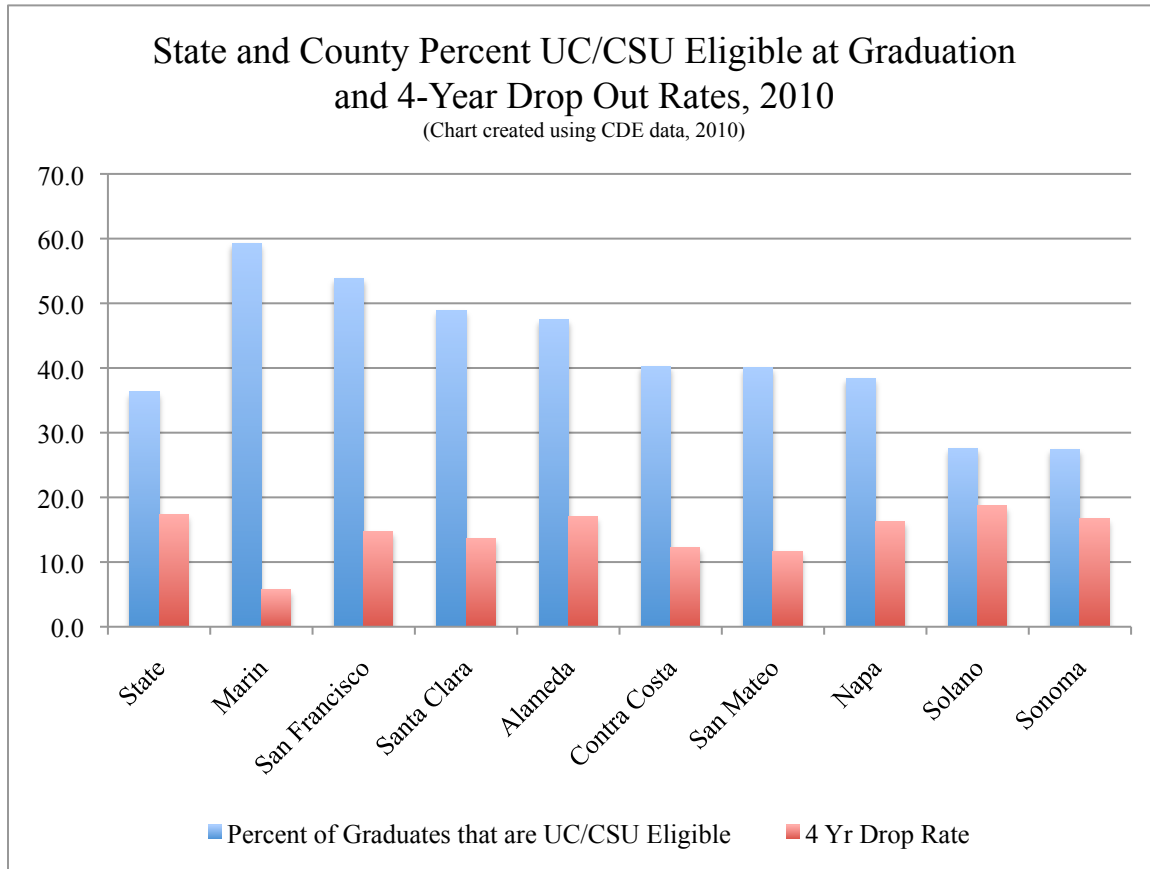
Percent English Learner and Percent Free or Reduced Price Meals

The following table shows the percent of students who are English learners and the percent of

students who receive free and reduced price meals for each County and for the State.

Percent English Learner and Percent Free and Reduced Lunch for California and the Nine-County Bay Area, 2011
(Chart created using CDE data, 2011)

Most Counties in the Bay Area have fewer English learners than the rest of the state. San

Francisco has more English Learners and more students on free or reduced meals. The other Bay

Area Counties have more students on free or reduced meals except for Marin and Solano

counties. Contra Costa has about the same percentage of students receiving free or reduced meals

as the State. Despite disparities from over 60% of Students receiving free and reduced price

meals to about 25%, outcomes for proficiency are similar. Despite disparities in the percent of

English Learners from about 28% to about 13%, we see the same proficiency trends.

Graduation and Drop-out Rates

State and County Percent UC/CSU Eligible at Graduation
and 4-Year Drop Out Rates, 2010
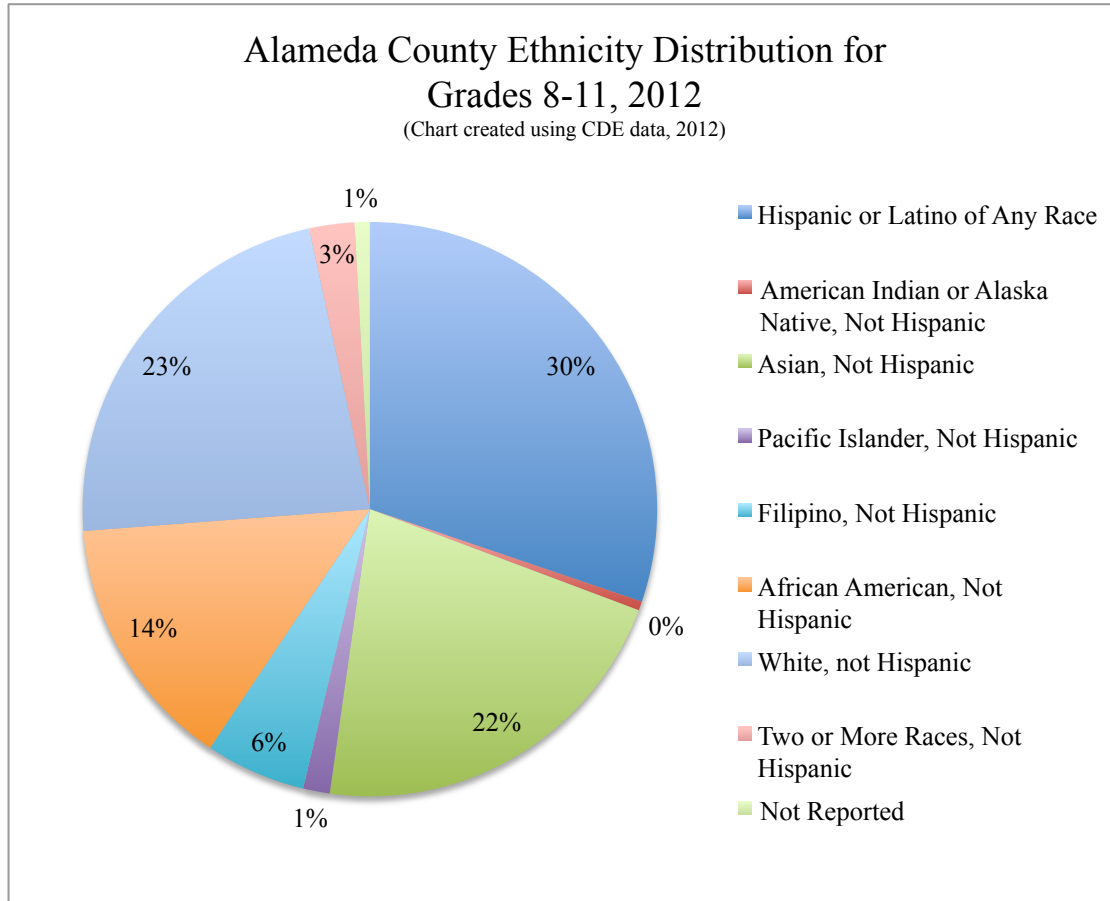(Chart created using CDE data, 2010)

The State's drop-out rate is about 18%. Marin has the lowest drop-out rate in the 9-County Bay area region and Solano has the highest in the region, though only slightly higher than the State average. Most of the 9 Bay area Counties have lower drop-out rates than the State. Most counties also graduate more students that are UC/CSU eligible than does the State. The two counties that have a lower rate of UC/CSU eligible students are Solano and Sonoma.
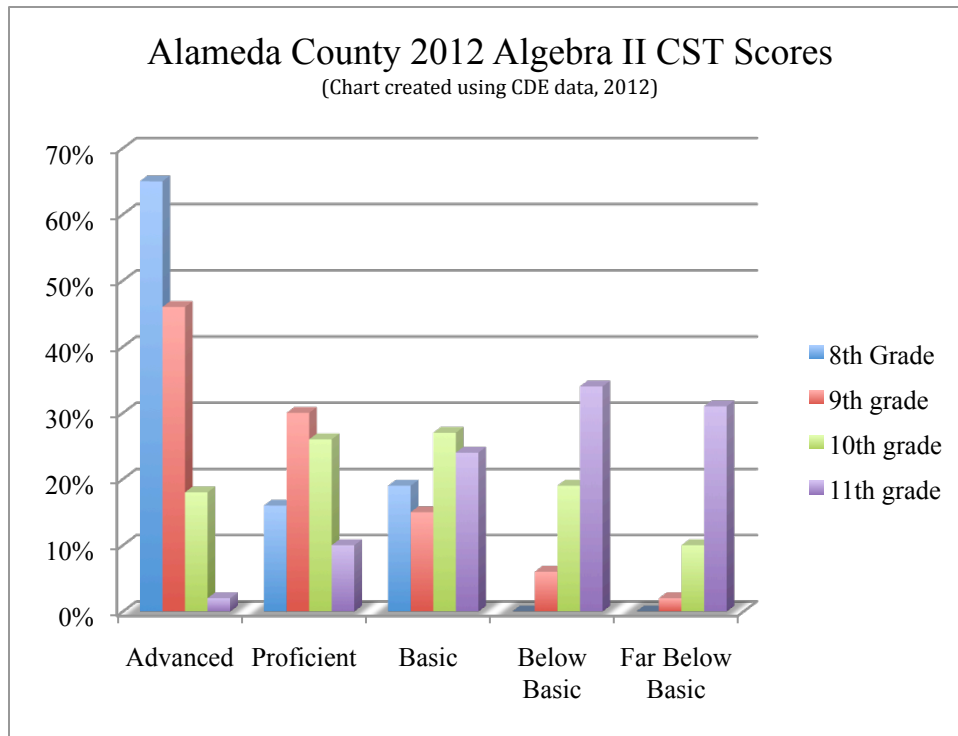
Again, as with the last set of measures, despite the differences in these rates we see similar proficiency trends for students.

Alameda County

The following pie chart shows the ethnic distribution for students in alameda county in grades 8 through 11 for 2012. We see that Alameda is one of our most diverse counties in terms of ethnicity.

Alameda County Ethnicity Distribution for Grades 8-11, 2012
(Chart created using CDE data, 2012)

Legend:
- Hispanic or Latino of Any Race
- American Indian or Alaska Native, Not Hispanic
- Asian, Not Hispanic
- Pacific Islander, Not Hispanic
- Filipino, Not Hispanic
- African American, Not Hispanic
- White, not Hispanic
- Two or More Races, Not Hispanic
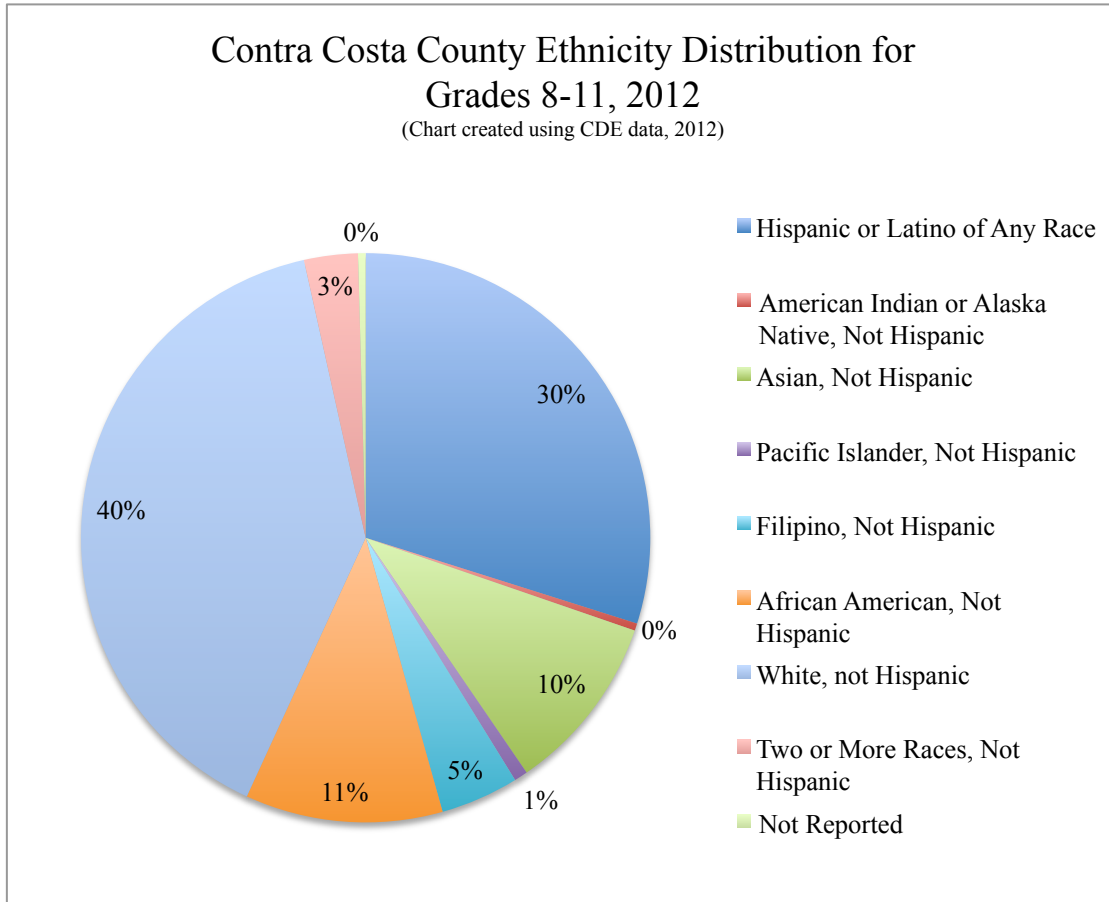- Not Reported

Alameda's proficiency rates by grade level exceed the state for grades eight, nine and ten, but is three percent below the State average for eleventh graders.

Alameda County 2012 Algebra II CST Scores
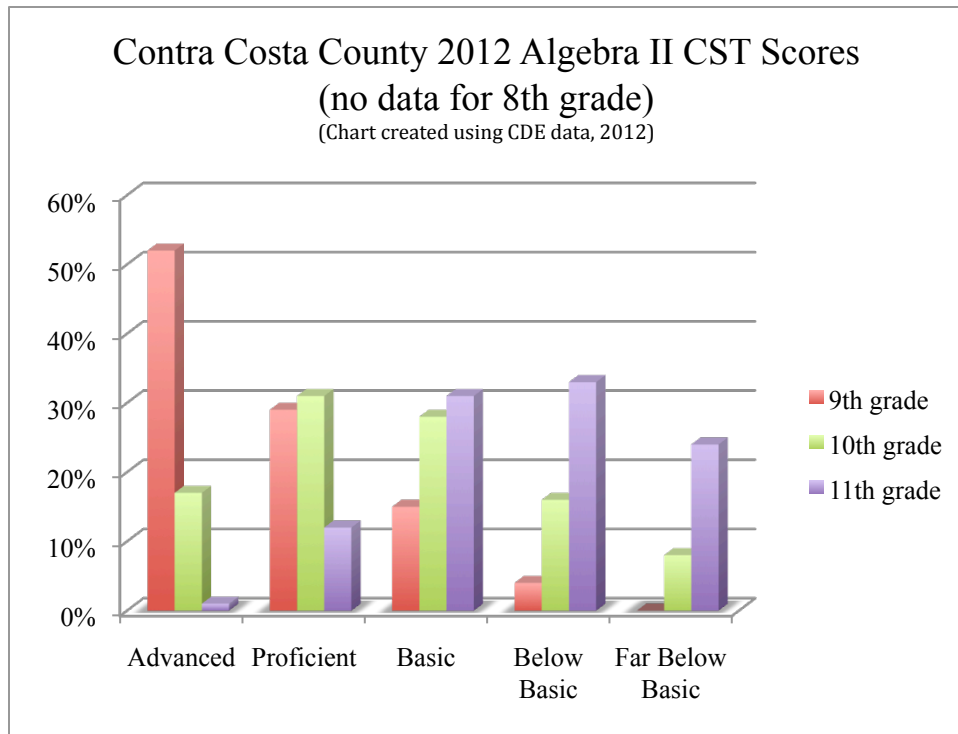(Chart created using CDE data, 2012)

We see the familiar trend for lower grade students and higher grad students. The bulk of students in grade 8 score proficient or advanced on the CST for Algebra II. Ninth graders also have a downward trend: most ninth graders taking the CST Algebra II test score advanced or proficient, with the percent of Basic scores at about 15% and those scoring below basic at less than 10%. However, for tenth graders, the bulk of student score basic or proficient. For eleventh graders, the bulk score Below Basic or Far Below Basic.

Contra Costa County

Contra Costa County has a diverse student population with the majority of students identified as

White, not Hispanic (40%) or Hispanic or Latino of Any Race (30%).

Contra Costa County Ethnicity Distribution for Grades 8-11, 2012
(Chart created using CDE data, 2012)

Legend:
- Hispanic or Latino of Any Race
- American Indian or Alaska Native, Not Hispanic
- Asian, Not Hispanic
- Pacific Islander, Not Hispanic
- Filipino, Not Hispanic
- African American, Not Hispanic
- White, not Hispanic
- Two or More Races, Not Hispanic
- Not Reported

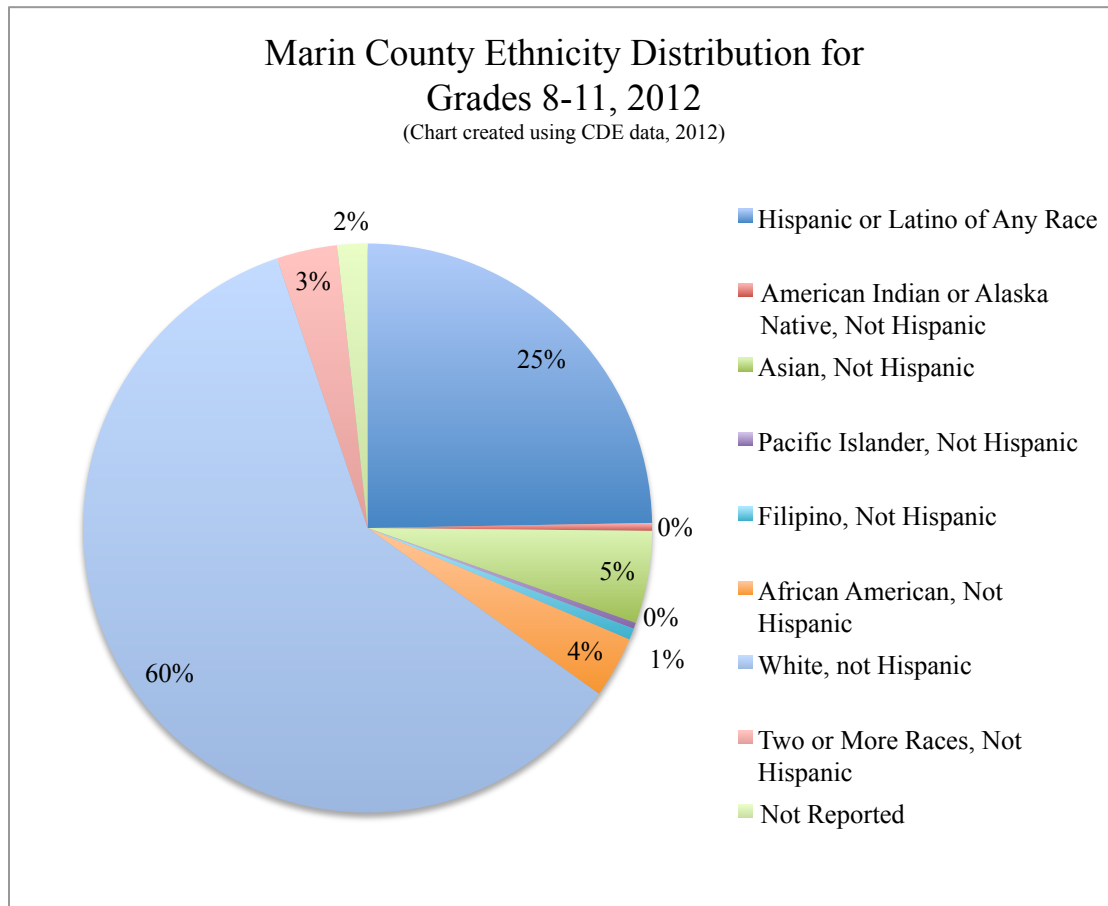Pie chart values: 0%, 3%, 30%, 0%, 10%, 1%, 5%, 11%, 40%

Compared to California, Contra Costa County shows higher proficiency rates for ninth

and tenth graders, but lower proficiency rates for eleventh graders. Contra Costa had too few

eighth graders taking the CST Algebra II to report. Contra Costa also has a higher rate of

students graduating UC/CSU eligible and a lower drop-out rate than the state. They have fewer

students receiving free and Reduced Price Meals (37.7% compared to 56.7%) and about the same

percentage of English Learners.

Contra Costa County 2012 Algebra II CST Scores
(no data for 8th grade)
(Chart created using CDE data, 2012)

Contra Costa show that most ninth graders score advanced on the CST for Algebra II, while most tenth graders score Proficient. Eleventh graders mostly score Below Basic, Basic or Far below Basic. Contra Costa had too few eighth graders taking the CST Algebra II to be able to include them in this analysis.
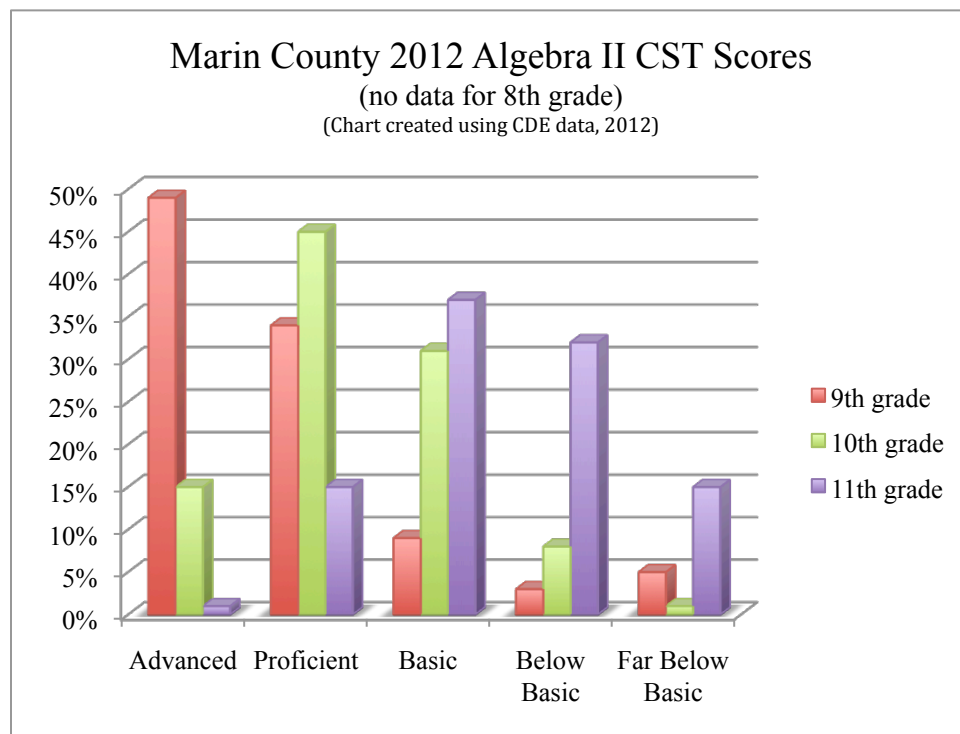
Marin County

Marin County had a population of predominantly White, non-Hispanic students (60%) in grades 8-11 in 2011-12. The next largest ethnicity group in Marin is Hispanic or Latino of Any Race (25%).

Marin County Ethnicity Distribution for Grades 8-11, 2012
(Chart created using CDE data, 2012)

Compared to the State, Marin had higher proficiency rates for all grades, 9-11. For grade 9, 83% of students scored advanced, compared with 69% statewide. For tenth graders, 60% scored advanced as compared with 42% statewide. However, for eleventh graders, Marin faired only 1% higher than the state, 16% advanced as compared with 15% statewide.
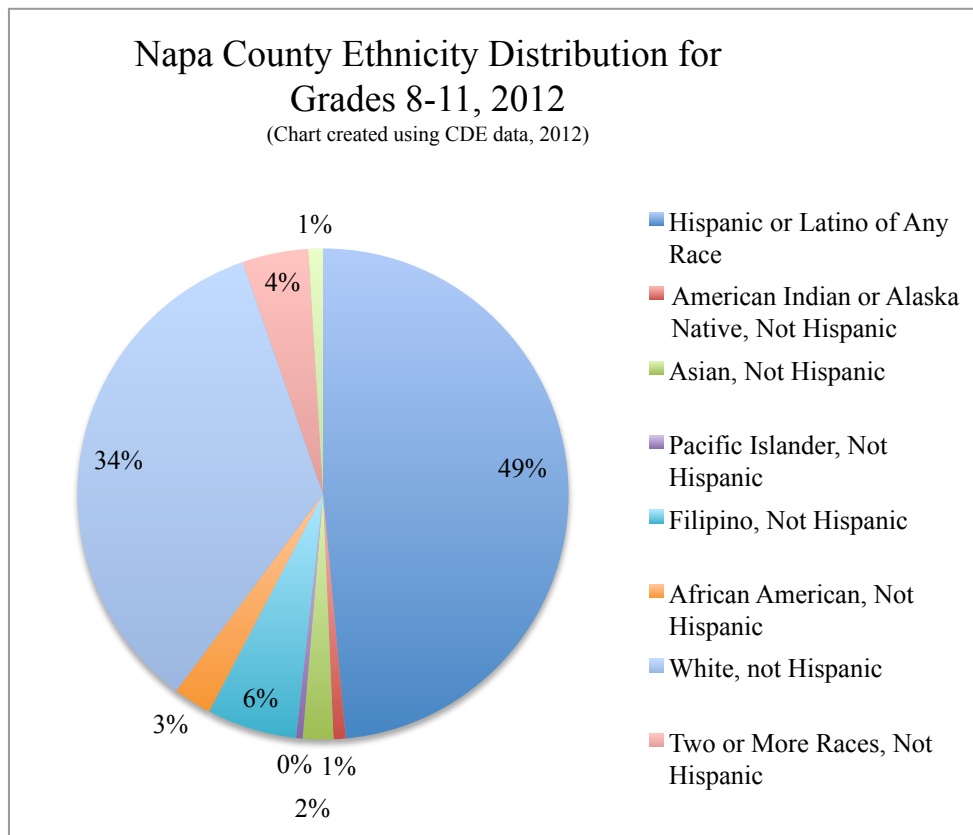
Marin has a much lower dropout rate than the state, 5.7% to 17.4%. Of graduates, 59% are UC/CSU eligible as compared with 36.3% statewide. Marin also has a lower percentage of students qualifying for Free or Reduced Price meals, 25.5% as compared to 56.7 percent for the state, and 12.8% of Marin's students are English Learners ads compared to 17% for the state.
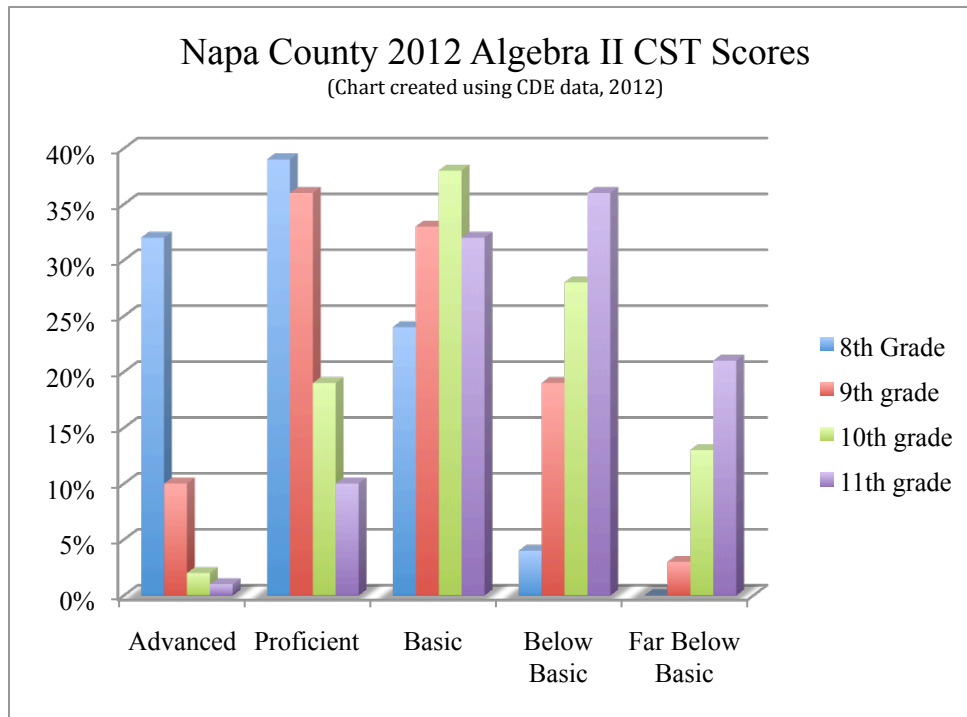

Most of Marin's ninth graders taking the CST for Algebra II score advanced or proficient. Most tenth graders score Proficient or Basic. Most eleventh graders score, Basic or Below Basic. Marin did not have enough eighth grade students taking the CST for Algebra II to be included in this analysis.

Napa County

Napa County has an ethnic distribution similar to the State, but with a larger percent of White, non-Hispanic students.
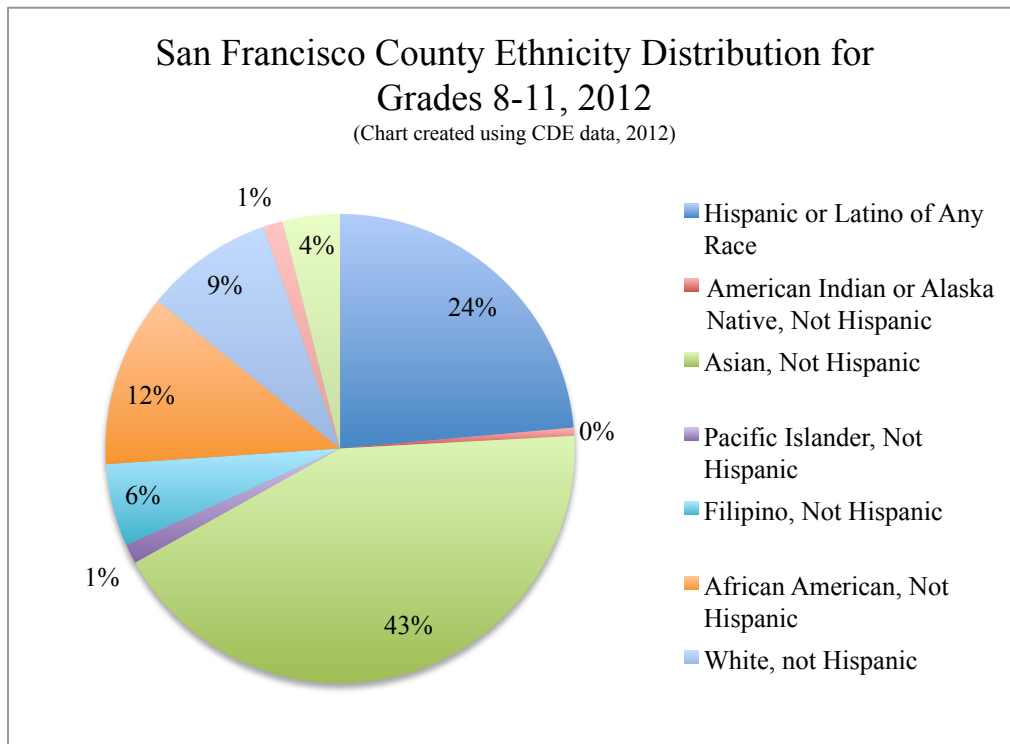

Napa County has a lower percentage of students on Free and Reduced meals, and a higher percentage of students who graduate UC/CSU eligible. However, the percentage of students who score proficient or advanced on the CST is lower than the state for each grade level.
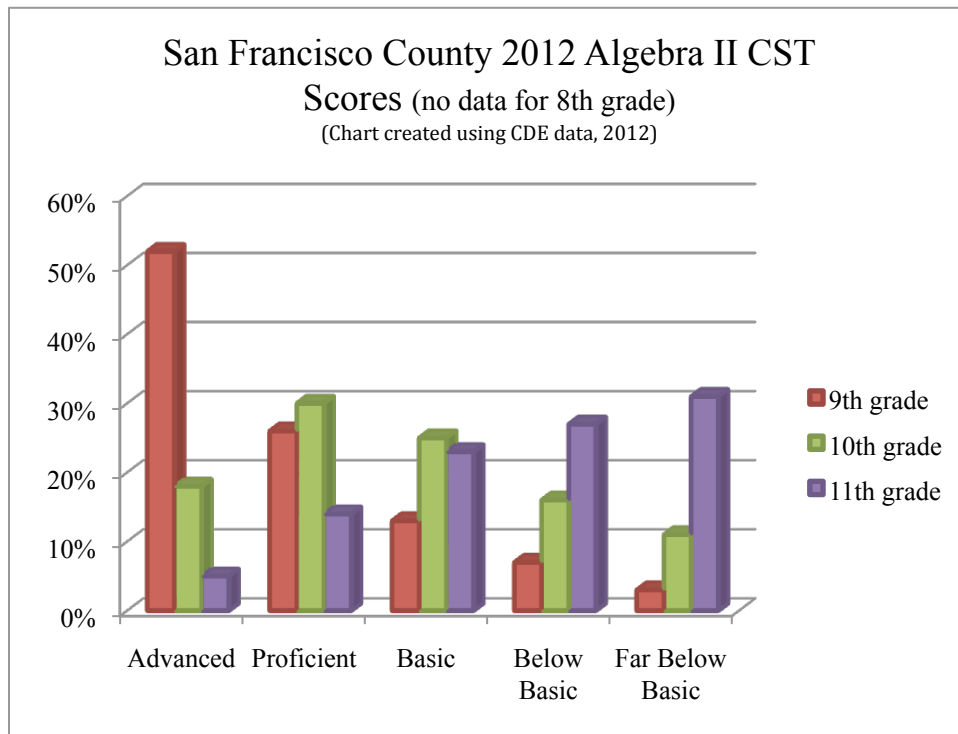
Napa's trend for grade and proficiency level is similar to the other regions. Napa has higher percents of students performing at lower levels on the CST. Napa has a higher percentage of English learners than the state, 18.2% compared to 17.0% for the State. Napa has consistently lower CST scores than the state and the other Bay area Counties for all grade levels.

San Francisco County

San Francisco County has the largest percentages of English Learners and students on Free and Reduced Price Meals than any of the other Counties or the State. It also has the second highest percent of students who graduate UC/CSU eligible and has a lower dropout rate then the state (14.8%, compared to 17.4% for the State).

San Francisco County Ethnicity Distribution for Grades 8-11, 2012

(Chart created using CDE data, 2012)

Legend:
- Hispanic or Latino of Any Race
- American Indian or Alaska Native, Not Hispanic
- Asian, Not Hispanic
- Pacific Islander, Not Hispanic
- Filipino, Not Hispanic
- African American, Not Hispanic
- White, not Hispanic

Pie chart values: 24%, 0%, 43%, 1%, 6%, 12%, 9%, 1%, 4%

San Francisco County 2012 Algebra II CST Scores (no data for 8th grade)
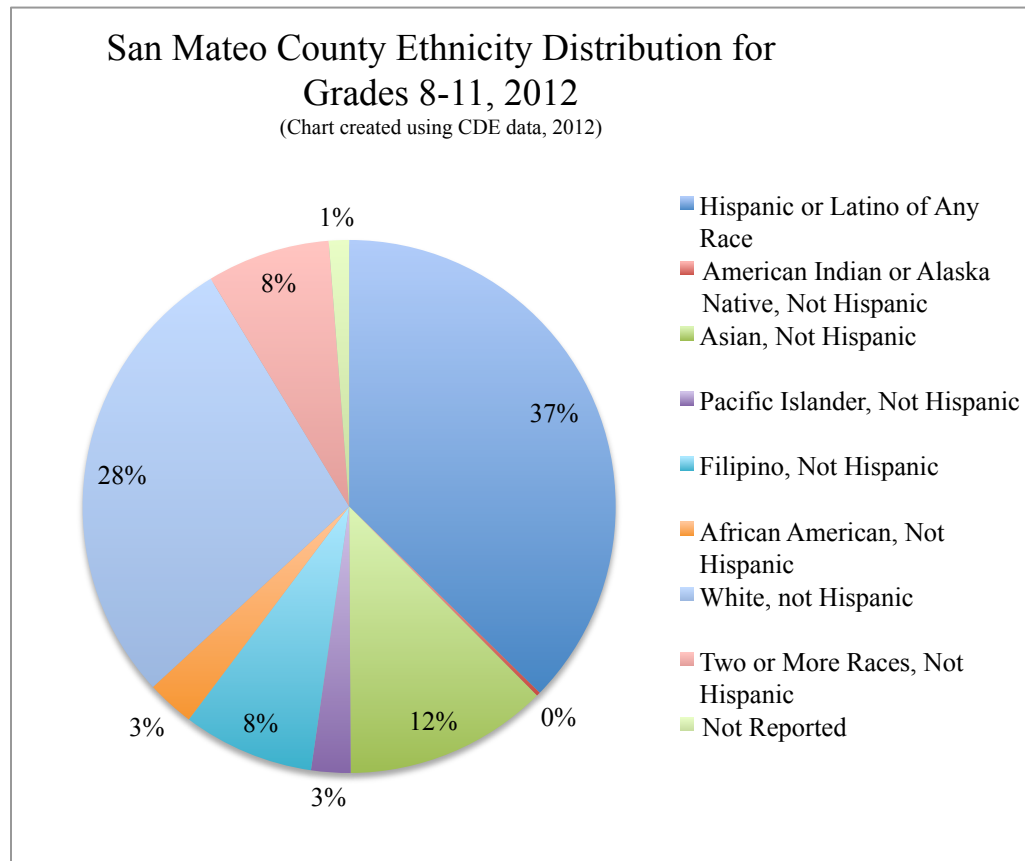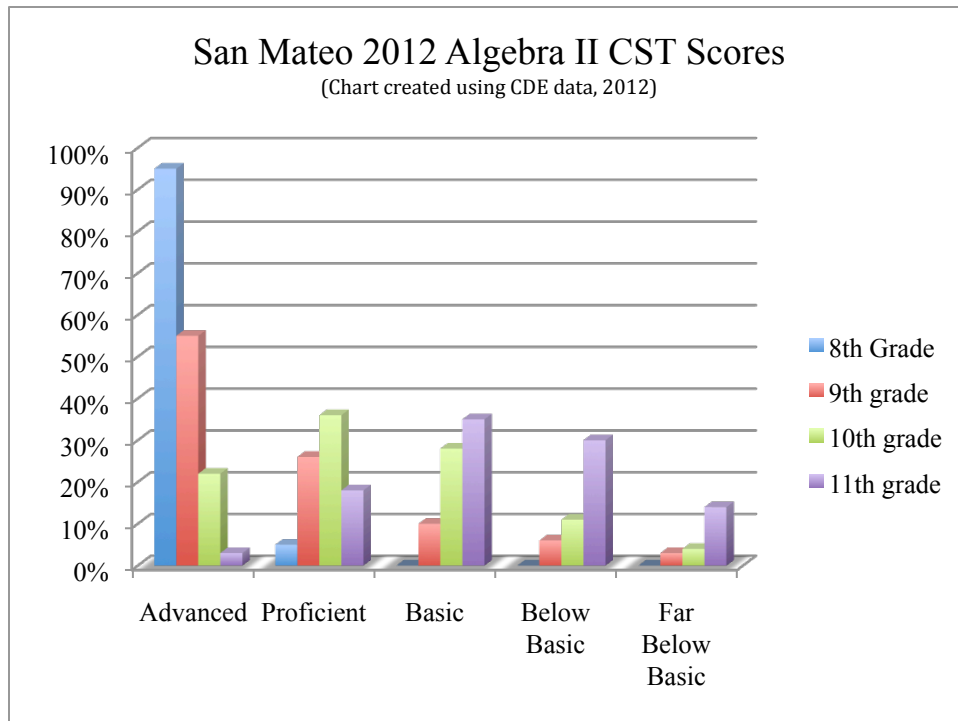(Chart created using CDE data, 2012)

San Francisco has one of the higher percentages of students in eleventh grade who score proficient or advanced on the CST Algebra 2 exam. The highest county is San Mateo, at 21%, and then Solano and Sonoma, also at 19%.

San Mateo County

In San Mateo County, 40.1% of students graduate UC/CSU eligible. The dropout rate is 14.8% and the percentage of students on free and reduced price meals is 36.5%, compared to 56.7% for the State. San Mateo has a higher percent of English learners than the State, 19.7% compared to 17.0% for the State.

San Mateo County Ethnicity Distribution for Grades 8-11, 2012
(Chart created using CDE data, 2012)

Legend:
- Hispanic or Latino of Any Race
- American Indian or Alaska Native, Not Hispanic
- Asian, Not Hispanic
- Pacific Islander, Not Hispanic
- Filipino, Not Hispanic
- African American, Not Hispanic
- White, not Hispanic
- Two or More Races, Not Hispanic
- Not Reported

San Mateo 2012 Algebra II CST Scores
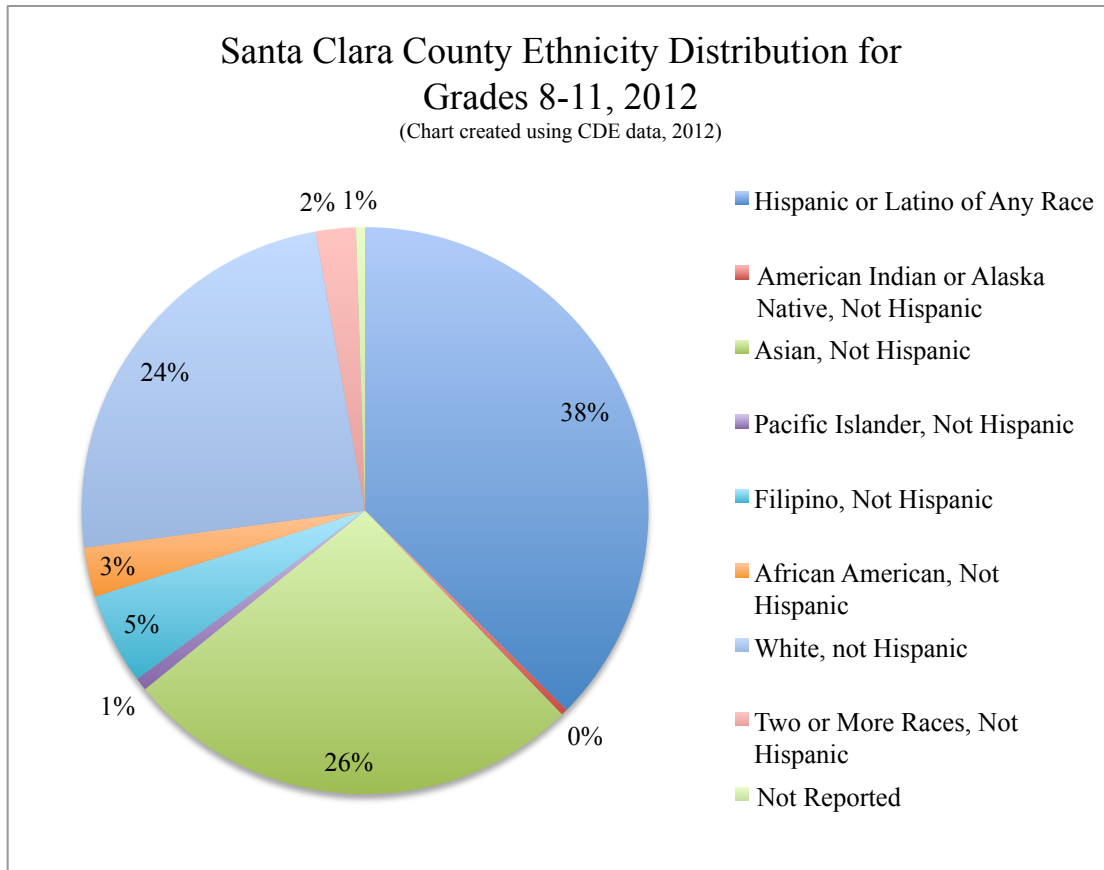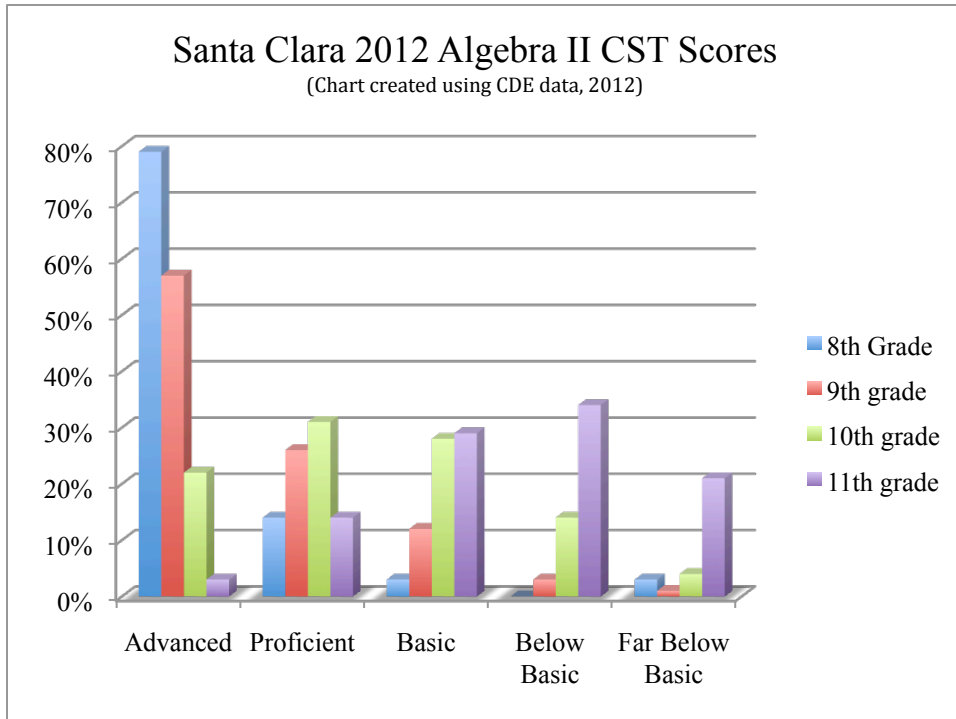(Chart created using CDE data, 2012)

San Mateo has one of the highest CST proficiency levels at every grade compared to the state and the other counties. For eleventh graders, San Mateo has the highest percentage of proficient or advanced students at 21%. This is still much lower than the tenth graders, 58%, and the ninth graders, 81%.

Santa Clara County

Santa Clara County has a diverse ethnic mix of students. The three largest ethnicities are

Hispanic (38%), Asian, not Hispanic (26%), and White, not Hispanic (24%).

Santa Clara County Ethnicity Distribution for Grades 8-11, 2012
(Chart created using CDE data, 2012)

Legend:
- Hispanic or Latino of Any Race
- American Indian or Alaska Native, Not Hispanic
- Asian, Not Hispanic
- Pacific Islander, Not Hispanic
- Filipino, Not Hispanic
- African American, Not Hispanic
- White, not Hispanic
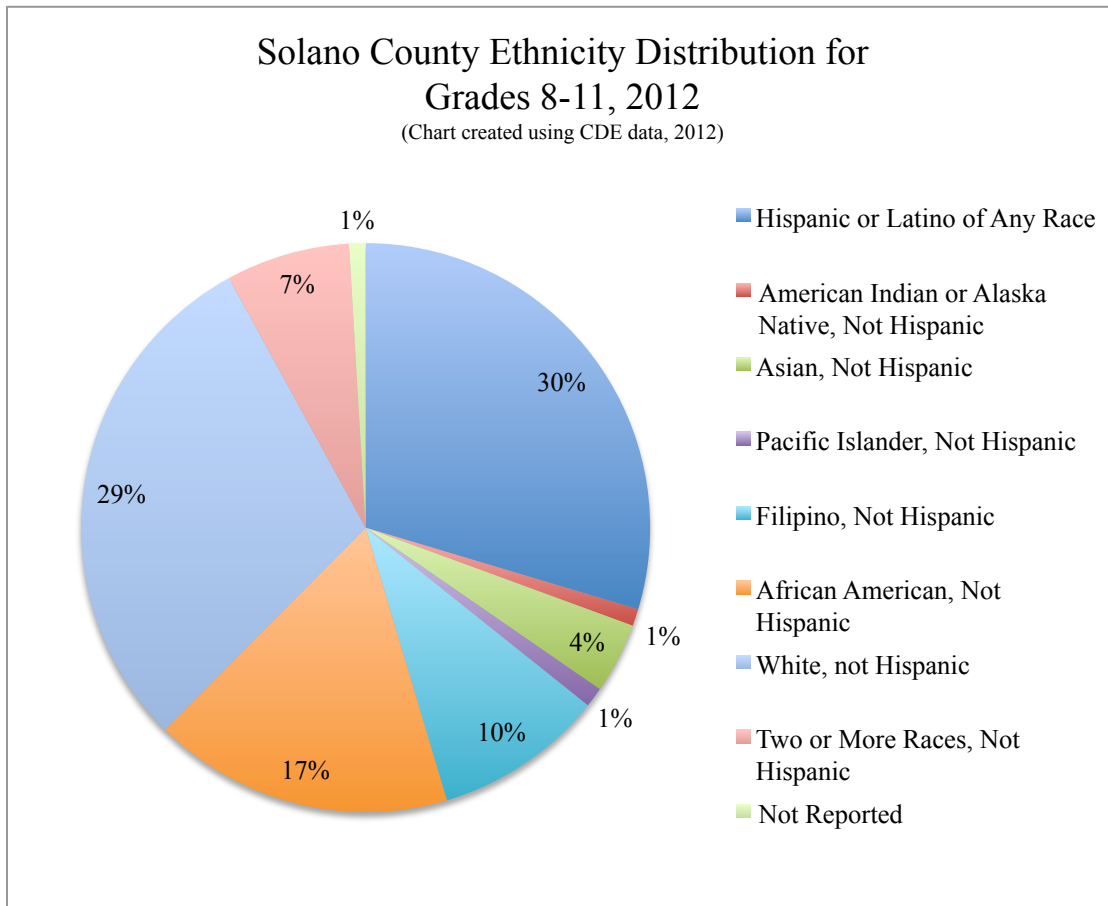- Two or More Races, Not Hispanic
- Not Reported

Santa Clara has 38% of its students eligible for free and reduced price meals, 19.7% designated

as English learners and 48.9 percent graduating UC/CSU eligible.

Santa Clara 2012 Algebra II CST Scores
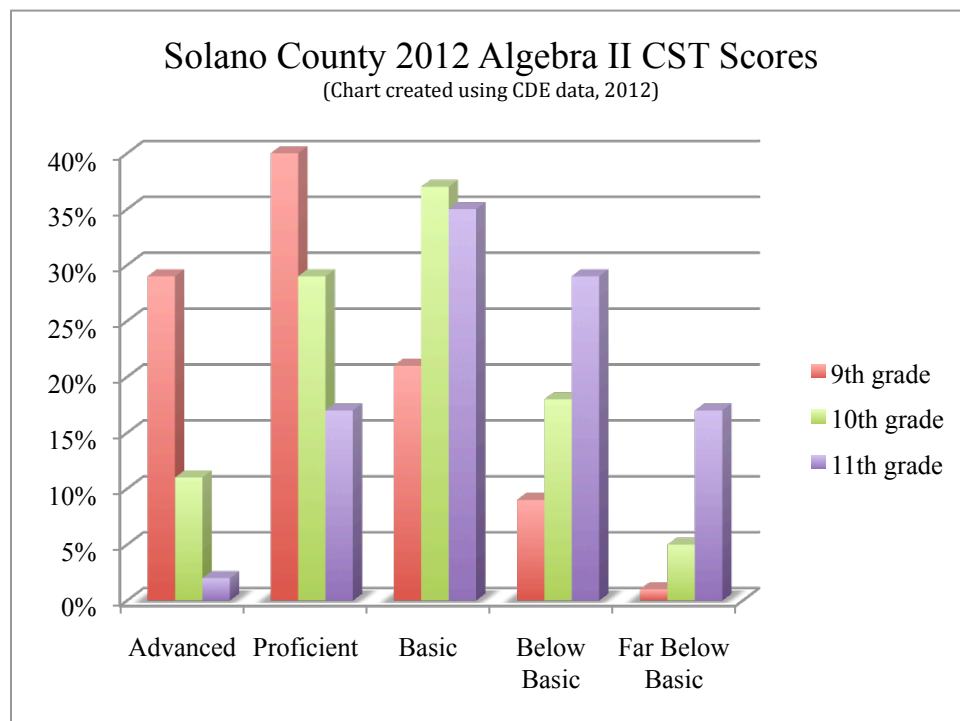(Chart created using CDE data, 2012)

Despite the overall high percentages of students who score proficient or advanced on the CST, the same trend by grade level exists for Santa Clara as the state and the other counties. We see the bulk of eleventh graders scoring in the basic and below categories for the CST.

Solano County

Solano County has the largest African American, not Hispanic, student population. It also has the largest Filipino, not Hispanic, population, while having a significant Hispanic population and White, not Hispanic population.

Solano County Ethnicity Distribution for Grades 8-11, 2012
(Chart created using CDE data, 2012)

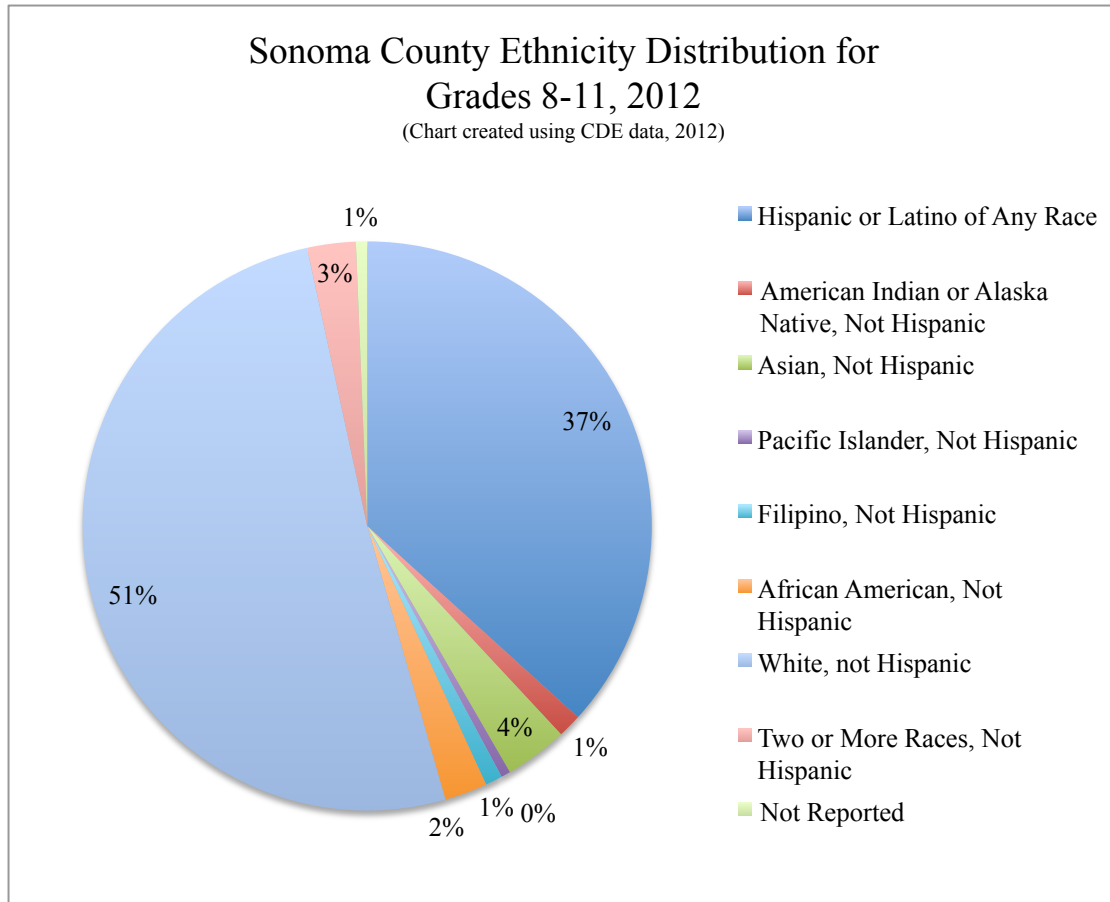| Percentage	Category
30%	Hispanic or Latino of Any Race
1%	American Indian or Alaska Native, Not Hispanic
4%	Asian, Not Hispanic
1%	Pacific Islander, Not Hispanic
10%	Filipino, Not Hispanic
17%	African American, Not Hispanic
29%	White, not Hispanic
7%	Two or More Races, Not Hispanic
1%	Not Reported

Solano County has a higher dropout rate than the State, 18.7% compared to 17.0% and a lower percentage of students graduating UC/CSU eligible, 27.6% compared to 36.3%. The county also has lower percentages of student eligible for free or reduced price meals and designated English language learners.

Solano County 2012 Algebra II CST Scores
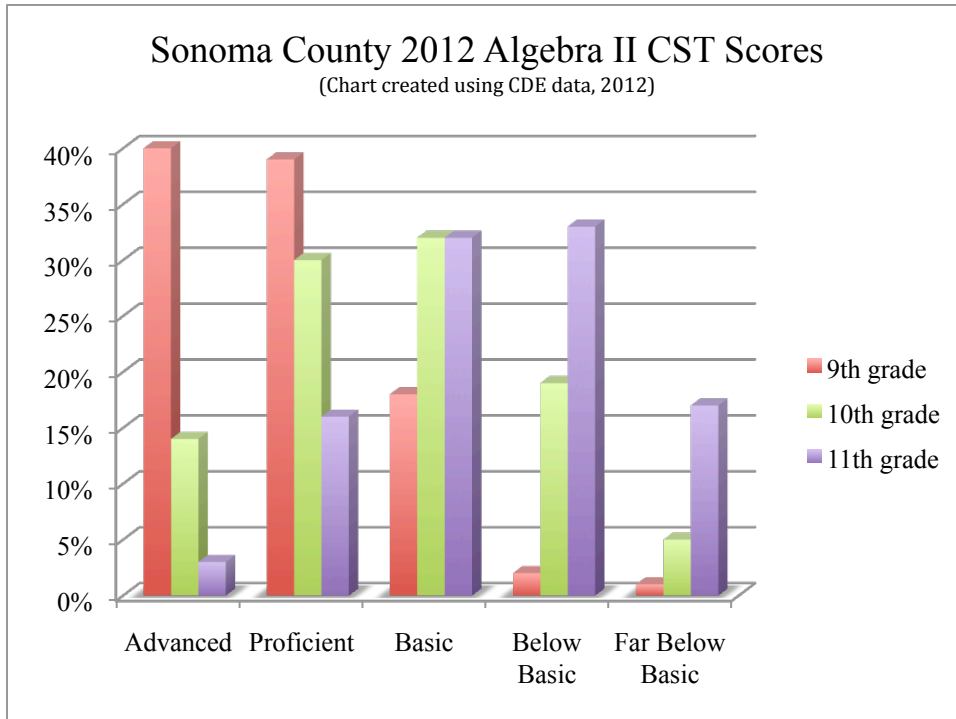(Chart created using CDE data, 2012)

CST results for Solano County are very similar to those of the state as a whole. The difference is in the eleventh grade, where 19% of Solano County students scored proficient or above, compared with 15% for the State.

Sonoma County

Sonoma County has a largely White, not Hispanic, student population. It also has a large

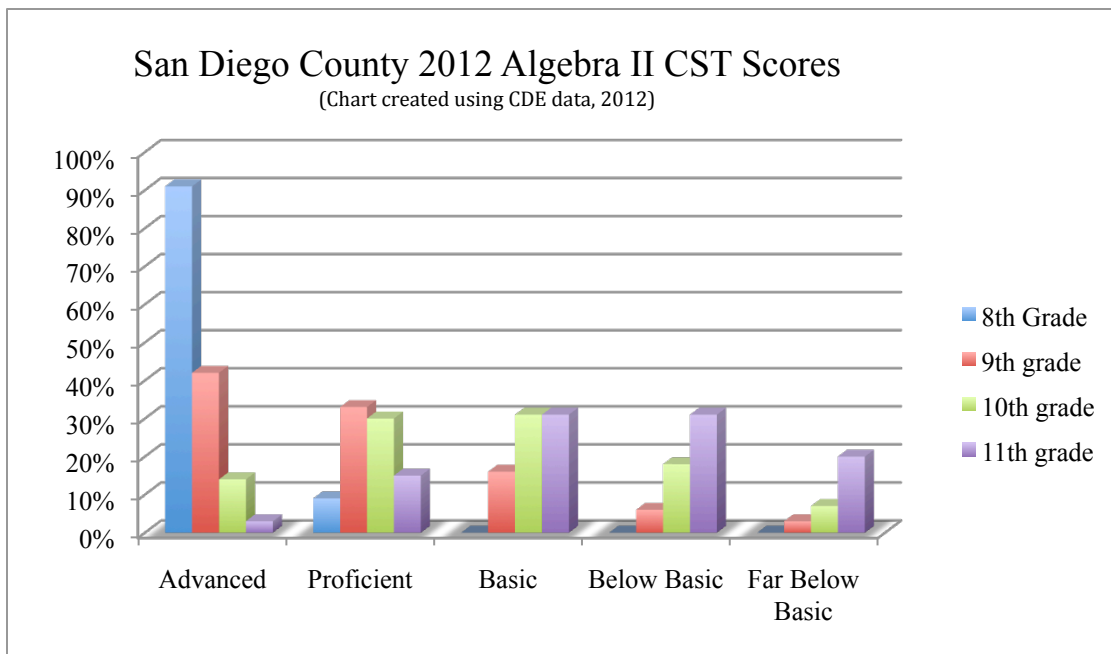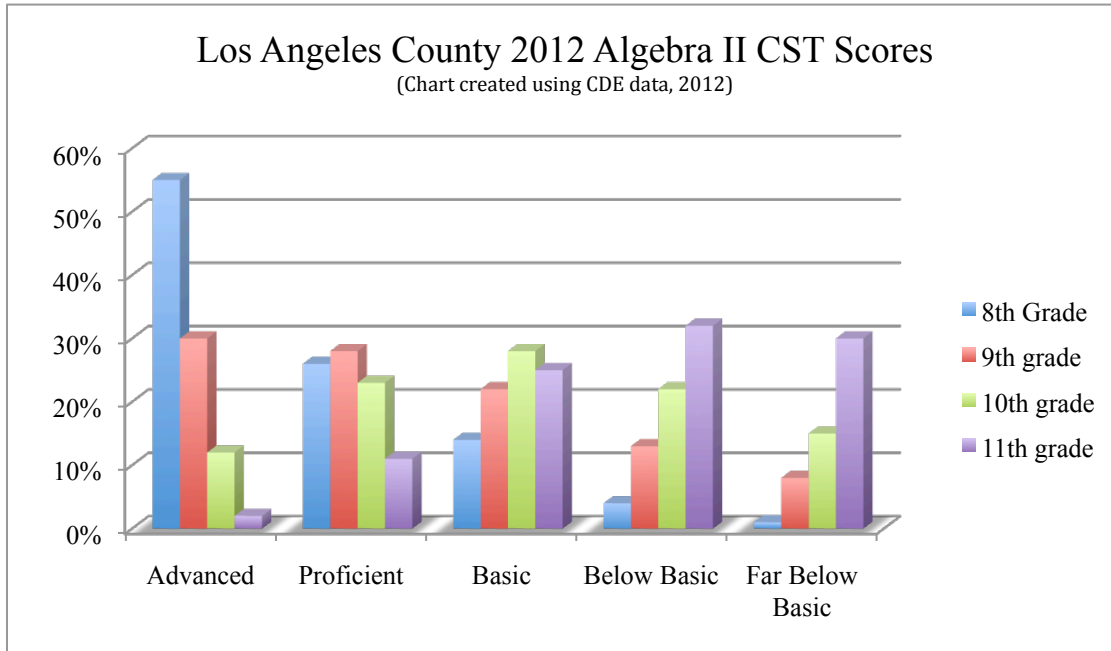Hispanic population. These two ethnicities constitute 88% of students.

Sonoma County has a higher percentage of English Learners than the State, 19.5% compared to

17.0%, and a higher percentage lower percentage of students eligible for free and reduced price

lunch than the state, 44.9% compared to 56.7% for the state. Sonoma has a lower dropout rate,

16.75 compared to 17.4% and a lower percentage of students graduating UC/CSU eligible,

27.4% compared to 36.3% for the State.

Sonoma County 2012 Algebra II CST Scores
(Chart created using CDE data, 2012)

■	9th grade	
■	10th grade	
■	11th grade	

Categories: Advanced, Proficient, Basic, Below Basic, Far Below Basic

Sonoma has a higher percentage of students scoring proficient or advanced on the CST than the

state, at every grade level, but still the trend continues for the higher-grade students.
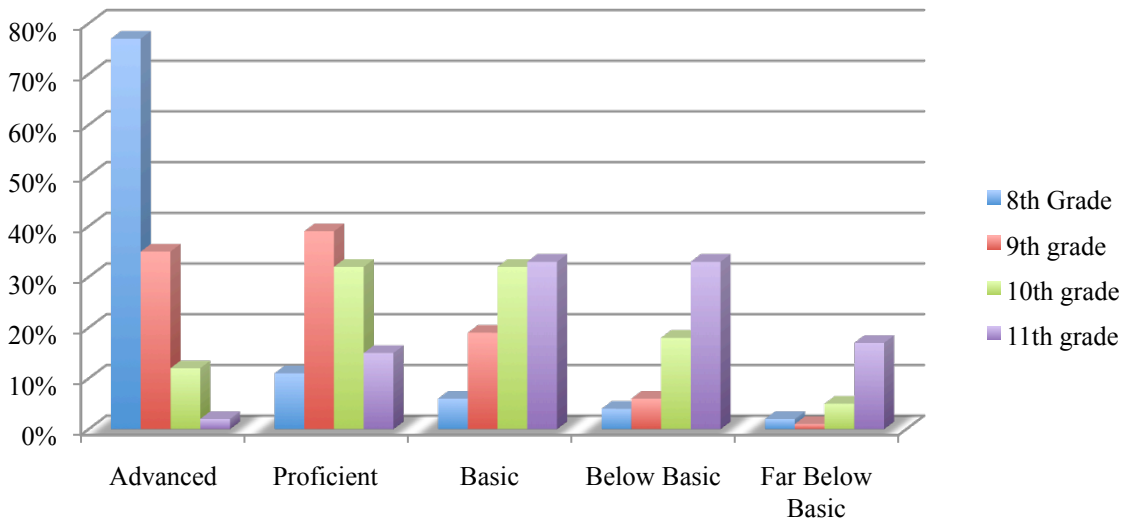
Other Counties

Proficiency levels in other counties across the state have a similar pattern. Here are Los Angeles,
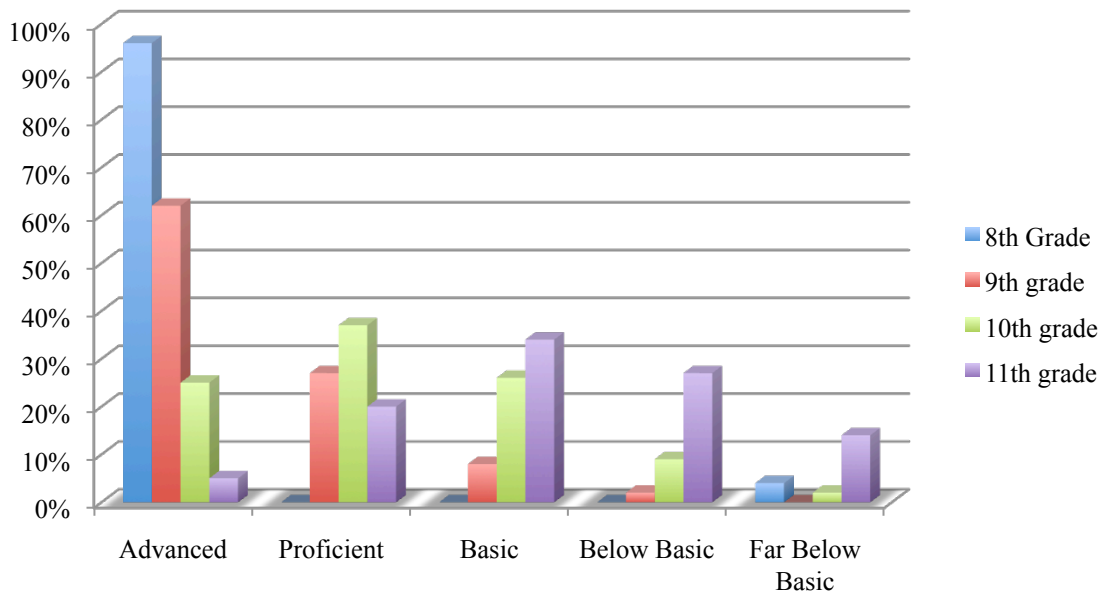
San Diego, Sacramento and Orange Counties:

Los Angeles County 2012 Algebra II CST Scores
(Chart created using CDE data, 2012)

San Diego County 2012 Algebra II CST Scores
(Chart created using CDE data, 2012)

Sacramento County 2012 Algebra II CST Scores
(Chart created using CDE data, 2012)

Orange County 2012 Algebra II CST Scores
(Chart created using CDE data, 2012)

Chapter 5 Discussion

The findings for the State and the nine Bay Area Counties suggest that the earlier a student takes Algebra II, the more successful they are on the CST Algebra II exam. This should not be a call to get students to take math classes earlier. However, considering the high rates of low proficiency by older students, particularly eleventh graders, it seems an examination of our approach to the course is called for. Why is there such a large discrepancy in proficiency rates amongst students at different grade levels? There is certainly something to different math aptitudes amongst students, just as there are for all topics and skills. However, these drop-offs by grade level do not occur in the English Language Arts CSTs. So what is going on with Algebra II?

This trend seems very strong despite differences in the student make-up of each county. Do eleventh, and presumably twelfth grade students need a different approach to mastering the Algebra II curriculum? Are there specific traits these students share that suggest a different approach to curriculum delivery? If so, what would that be? Perhaps narrowing curriculum in terms of fewer topics or an increase in instructional minutes? Place emphasis on applied problems and relationships, as described in the Japanese school example from The Teaching Gap? Increased technological learning tools, such as calculators, excel, online learning? Teaching techniques that are different? It is assumed that there are already a variety of teaching techniques being used by a number of teachers. However, the overall results for students show a strong pattern of mastery for earlier grades and non-mastery for later grades.

It would be interesting to see if these students do better with regular access to calculators. I think many teachers do not use them much because of an ingrained focus on skill and procedure development and memorization. The newly adopted Common Core standards seem to be an attempt to have the math make sense and expand critical thinking skills while increasing

the use of technology. It seems there is an increased emphasis in modeling situations with

mathematical models. Will this emphasis help to create connections for these students?

Instead of emphasizing background skills in the first months of school, should teachers

just start teaching at a high level expecting students to be prepared? One advantage to this

approach would be more time to learn new topics. One disadvantage is that students may have

forgotten their pre-requisite skills. Could a 'refresher course' be offered after school or in the two

weeks before school starts? Perhaps a district or school team could develop an online option for

students. The students could be responsible for 'boning up' on the pre-requisite skills and

perhaps take an assessment in the first few days of school. Students in need of background

material refreshing could be put into intervention right away. Perhaps the new standards will

help to address this because more algebra and statistics will be emphasized in the traditional

geometry year.

We are sitting on the eve of change in mathematics education. There will surely be

teachers who are slow to embrace and execute the changes. There will be others who dive in,

who will learn by doing and revise their approach from unit to unit and year to year.

Currently, there is a growing community of educators who are trying to adopt a flipped

teaching model where students are exposed to new concepts before coming to class. This

approach may help students have time to digest the information before they meet with the

teacher to do problem solving. Websites such as that created by Salmon Khan are excellent

resources for students to learn new and forgotten concepts. Students can view videos for free,

repeat sections they need to hear again and go to class feeling more prepared.

The proficiency data strongly suggests that older students may require a different

approach than younger students. Despite differences in ethnicity, socioeconomic status, dropout

rates and graduation rates in the nine counties and the state, outcomes were very consistent. Even the top proficiency group, San Mateo County, reached a proficiency rate of only 21% for their juniors.

What can school districts do? Examine your grades and proficiency rates on CST exams. Are they correlated? Look at your older students at each high school in your district. Are there differences in proficiency rates? Open a discussion with your faculty. Discuss your proficiency rates and grade levels and grade distributions for each school and grade.

What can schools do? Schools can look at their repeat rates for Algebra II. Look at D and F grades by grade level. How do you decide whether a student is successful? Can you look at those success measures by grade level? Can you design programming to allow for different grades into different sections of Algebra II if you see differenced in success rates by grade level?

What can teachers do? Teachers can be very aware of who their older students are. Be aware they may not ask questions and may give the impression they do not need help. If they are not asking questions, be sure to check in with them as you circulate during practice times. Partner them with a stronger student who is close in age. Recognize your core learning outcomes desired for students and clearly articulate those. Stay in contact with parents and counselors of these students if you start to see warning signs. Warning signs are lack of homework completion, low test scores, a sudden dip in either of the above. Those dips will be hard for these students to recover from. Give frequent feedback to struggling students. The feedback should be specific to their stopping points in problem solving. Are they getting stuck when a problem turns to a fractional computation? Have a study guide ready for that. So many publishers provide these supplementary materials with the text, that you could probably find something without too much searching. Recognize that students may not know how to search for these things on their own,

nor might they be able to clearly see what specific skill they need to work on. Recognize these students may need positive encouragement in the areas where they are successful. Be aware of all or nothing grading practices on assessments. These students may be more prone to giving up if they feel like they will be severely penalized by small arithmetic errors.

Notice how long the section for what teachers can do is compared to that for districts and schools. That is because teachers are on the front line. The problem is right in front of them. Districts and schools will take longer to respond and act, because they can only deal with the problem at a few times during the year. Policies will take a long time to change, student scheduling and programming happens at one main point during the year. Drastic changes to scheduling can mess with the entire schedule for the school, making changes tough to do.

All of the above suggestions for teachers are well-documented intervention methods that I have not thought up on my own. Many teachers are already employing some or all of these measures at one time or another. The situation may call for more substantial changes in content, pedagogy and definition of a modern mathematics education. I do not suggest throwing out the bulk of the content, just finding ways to increase accessibility to the curriculum, allowing for time to explore relationships in algebraic concepts and expand critical thinking skills while contracting skill and drill, procedure dominated curriculum.

Do schools group all student grade levels in one class? This may have a negative impact on the older students. They may feel they do not want to ask questions because they are older and feel they should be ahead of the younger students. I know this to be true for several of my students in Algebra II. Would grouping freshmen and sophomores in one class and juniors and seniors in another class allow for better differentiation of curriculum and teaching techniques?

The data clearly show the younger students do better, most likely due to calculation based math aptitude than to teaching techniques.

In conclusion, there is a cliff that older students fall off of in Algebra II. Students talk about it, parents talk about it and educators need to talk about it. It is a strange pattern when you think about how everyone in an Algebra II class has met the pre-requisites, yet your grade level is correlated with your chance of success. If these students have been held back from taking the course so they will be successful in the class, why are they not successful?

We need to think about what skills we really expect students to master at this level of mathematics. What do colleges really need? What are the career and college major choices students are making when they leave high school? A curriculum focused on expectations of Calculus success is not serving the student who will not be taking Calculus. If all college majors required it, it would make sense to keep the course highly rigorous. However, they do not, which makes you wonder who is monitoring the gate and why.

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