

# Content Alignment of High School and Community College Assessments in California

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*This study explores the degree of alignment between high school mathematics and language arts assessments and community college placement examinations in widespread use in California. The study was conducted in two stages. The first stage analyzed the variety of placement exams used to determine their core content. The second stage analyzed the content of the placement exams with respect to the content of high school exams using a content alignment methodology developed by Webb (1997, 1999). Results indicate that while some areas showed acceptable levels of content alignment, others did not, particularly in mathematics. Suggestions and recommendations to improve the alignment between secondary and post-secondary testing systems are provided.*

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## Introduction

Unfortunately, many students entering community college campuses today are not prepared for college-level coursework. According to a strategic planning research report entitled, *Environmental Scan: A Summary of Key Issues Facing California Community Colleges Pertinent to the Strategic Planning Process*, only about 9% of community college students in California place in math courses and about 27% of students place in English courses that are accepted as transferable courses to the University of California or California State University systems (Research and Planning Group for California Community Colleges, 2005). In contrast, more than 70% of students place in remedial math and 42% place in remedial English. This means that the vast majority of students are initially placed in courses for which they will not receive credit at a California State University or University of California campus if and when they choose to transfer, and new research suggests that few actually do transfer. (Shulock & Moore, 2007)

Having such large numbers of students take remedial courses is not without consequence. Students who start out in the remedial levels of math and reading courses have limited probability of attempting transfer-level courses at the community college. The likelihood of attempting a transfer-level English course after beginning in a reading fundamentals course at the community college is only 25% (Research and Planning Group for California Community Colleges, 2005). The numbers are more dismal for mathematics. The likelihood of taking a trans-

fer-level math course after starting in a basic level math course is only 10%. The Research Group report says, "Empirical evidence suggests that those who begin at the lowest levels of basic skills are unlikely to achieve a degree or transfer to a university" (p. 6). Given this evidence, there is reason to be concerned about the fact that so many students in the community colleges are not ready for the transition from high school to college-level work.

Much has been written about the poor transition for students between secondary and post-secondary educational systems in the United States (see for example, Conley, 2003a; Conley 2003b; Kirst & Bracco, 2004; Kirst & Venezia, 2004; Smith & Wertlieb, 2005; Venezia, Kirst, & Antonio, 2003). Some argue that the transition is affected by student expectations (Karp, Holmstrom & Gray, 1998; Smith & Wertlieb, 2005) and social concerns (Holmstrom, Karp, & Gray, 2002; Tan, 1996). Others point to more structural aspects, such as a lack of formal linkages between secondary and post-secondary systems in terms of governance structures (Conklin, 2005) and accountability, information, and data systems (Kirst & Bracco, 2004; Venezia, Kirst, & Antonio, 2003). The disconnection between high school and college is also reflected in academic content. In fact, a recent Quality Counts report from Education Week indicates that only 11 states have aligned their state high school assessments with postsecondary education (Education Week, 2007). Brown and Conley (2007) reviewed the alignment of the test content from 60 high school state assessments from 20 states and the knowledge and skills needed for university success and found modest but uneven align-

ment. While this study investigated the alignment between high school test content and the necessary knowledge and skills for success at top research universities across the country, it did not address the preparation needed for success in entry level courses at open access community colleges, nor did it include high school exams from California. To gain insight into the potential effect of subject matter discrepancies on the large number of California high school graduates needing remediation in math and reading in community college, this study of the alignment between the content of state mandated high school examinations and the content of placement tests used by the community colleges was undertaken.

## Purpose of This Study

The purpose of this study is to investigate the degree of alignment between the content of an array of placement examinations used in community colleges and key California Standards Tests (CST) in use in California high schools. This effort is similar in many ways to much of the content alignment work that has taken place regarding specific test content and university-level content standards (see for example, Brown & Conley, 2007; Conley, 2003a). It differs, however, in one important way. The placement assessments in this study are not being reviewed to determine their alignment with the knowledge and skills expected for future university success. Rather, these placement assessments are to be analyzed to determine their alignment with the specific content that students are expected to have already mastered in high school. More specifically, this study seeks to determine the degree of content alignment between the “de facto standards” needed for community college preparedness (as measured by a plethora of placement exams in use across the state) and the standards measured by the augmented CST in math and English language arts (ELA) in high school. It is important to note that this study is focused on content alignment of assessments used at the secondary and community college campuses, not on other issues that are also important for understanding the disjunction between these educational systems. Other factors such as inconsistent proficiency standards, communication between segments, inconsistency across campuses with respect to testing practices, the multiple pathways students undertake as they progress through community colleges, English proficiency development, and the self-monitoring of assessment systems, while important, are not the focus of this investigation.

## Methodology

In the first phase of this study, placement exams in widespread use across the California Community College

system were identified for inclusion in the study. These assessments were then subjected to a content analysis methodology to reduce this collection of test elements to a “corpus” of community college placement objectives. This approach was taken because there is a vast variety of placement tests used in community colleges across the state; and, by looking at the most prevalent ones used and the material they cover collectively, we get a better picture of the diverse expectations student face upon entering the community college system.

The second phase of this project utilized data from the content analysis phase in an alignment rating workshop in which subject matter experts made judgments about the degree of alignment between the corpus of California Community College placement objectives (CCC objectives) and elements addressed by the augmented California Standards Tests (CST) elements given in California high schools. The augmented CST tests used in this study included the Algebra II and Summative High School Mathematics test, and the Grade 11 test in ELA; these tests are part of the Early Assessment Program (EAP), which is a program developed by the California Department of Education, State Board of Education, and the California State University (CSU) system “designed to determine students’ readiness to do college-level work in ELA and/or mathematics while they are in their junior year of high school, and to align the CSU placement standards with the K-12 standards in English-language arts and mathematics” (Early Assessment Program Frequently Asked Questions, n.d.). These tests were chosen for inclusion in this study because they reflect the subject matter material students are expected to master in the latter years of high school (i.e., California standards for 11th grade) as well as material deemed important for placement decisions at campuses within the California State University system. Each of the mathematics exams is course specific, whereas the non-augmented form of the ELA test is given to all 11<sup>th</sup>-grade students in California public high schools.

### *Phase I – Content Analysis of CCC Placement Exams*

A review of placement test usage at the community college campuses in California revealed a vast assortment of placement tests in use across the state. However, most placement testing involved a small subset of placement exams (see Table 1). The most commonly used assessments were the Accuplacer Computerized Placement Tests (CPT), a group of tests created by The College Board, and the Compass battery of computer adaptive tests developed by American College Testing (ACT). In addition, in the area of mathematics, the Mathematics Diagnostic Testing Program (MDTP) assessments developed by faculty from the University of California and California State Univer-

sity systems were widely used. Similarly, in ELA, the California Test of English Placement (CTEP), which was developed by community college faculty, was frequently used on community college campuses.

From this group of tests, a total of 16 tests (7 in ELA, 9 in mathematics) were content analyzed. For the computer adaptive tests (various CTP/ Accuplacer and ACT/ Compass tests), it is not possible to evaluate specific test forms since the items presented to each student differ depending on the student’s estimated ability level. Rather, the confidential test specifications and test blueprints for several tests were analyzed. These included three Accuplacer/CPT tests in math (Arithmetic, Elementary Algebra, College-Level Math), two in language arts (Accuplacer/CPT Reading Comprehension and Accuplacer/CPT Sentence Skills) along with four ACT/ Compass math tests (Numerical Skills/Pre-Algebra, Algebra, College Algebra, and Geometry) and two ACT/ Compass tests in language arts (ACT/Compass Reading Comprehension and ACT/Compass Writing Skills). Access to the secured test details was obtained through written agreements with the test publishers. For the MDTP and CTEP placement exams, actual test forms were analyzed. For the adaptive tests, content statements from the test specifications and blueprints were merged into our content summaries from actual test forms, as described below.

### Phase 1 — Content Analysis Participants

Three analysts evaluated the content of items for placement tests we were able to obtain from publishers. For some tests we could only obtain general blueprints, and we merged content statements from those documents into our content summaries, as described below. All content analysts had extensive previous experience in analyzing the content of curricula, standards, and tests, and

**Table 1. Approximate Number of Placement Tests Administered by Test Type Analyzed**

Community College Placement Test	No. of Administrations
<b>Mathematics</b>	
CPT Arithmetic, Elementary Algebra, College-Level Math	200,865
MDTP Algebra Readiness and Elem Algebra	102,779
ACT Compass Numerical Skills/Pre-Algebra, Algebra, College Algebra, Geometry	57,708
<b>ELA</b>	
CPT Reading Comprehension, Sentence Skills	327,126
CTEP Sentence Structure and Grammar, Sentence and Syntax Skills	103,811
ACT Compass Reading Comprehension, Compass Writing Skills	90,162
CTEP Reading Comprehension	68,898

Data provided by the California Community College Chancellor’s Office website regarding students enrolled during 2005-2006 academic year ([www.cccco.edu](http://www.cccco.edu)).

in conducting alignments of tests, curricula, and standards. Training to do the analysis consisted of reviewing examples of items from the tests to be analyzed, discussing how the content of each item should be described, and then individually evaluating the content of several sample items. In some cases the skills necessary to identify incorrect answers were also described. This happened, for example, when an item required identification of an incorrect or untrue statement. Another instance of items requiring students to recognize incorrect answers was the cloze (fill in the blank to complete a sentence) items used in language arts testing.

*Reliability checks.* To check the consistency of content analyses by different analysts, several items from each type of test were evaluated by two analysts and the results compared. For a given item, each descriptive content statement (or descriptor) for one analyst that closely resembled a descriptor generated by the other rater was counted as a match. A descriptor by either rater that did not closely resemble any descriptor by the other rater was counted as a mismatch. When conducting the reliability checks, several additional conventions were observed. First, if one analyst had combined two skills, such as: “Find the meaning of a word in a written passage and find a synonym,” while another had split these into two separate skills, a separate agreement rating was assigned for each part—resulting in two instances of agreement in this example. In cases where one analyst described a more general skill and another recorded that general skill, in addition providing detailed descriptors of the skill that went beyond the level of generality originally agreed upon, we counted the analysts’ statements as matching on the general level. Because many items required multiple descriptors to capture their content, a single item could potentially involve several descriptor matches and/or mismatches.

To check reliability in math, 20 items were evaluated by two analysts, producing a 95% level of agreement between the analysts: out of 43 possible descriptor matches for the 20 items, there were 41 matches and 2 mismatches. Given this high level of agreement, the remaining math items were analyzed by one person. In reading and language arts, 20 items (10 reading and 10 language arts) were also analyzed by two persons. Out of 48 possible descriptor matches for these items, there were 41 matches and 7 mismatches, for an overall agreement level of 85%. The remaining items were analyzed by one person. In many cases the mismatches found in reliability checks were a result of one rater neglecting to include for one or two items a general descriptor that occurred across a broad set of items (e.g., recognize correct sentences); this type of error of omission had no effect on the final content summary, since descriptors were not repeated in that summary.

*Summarizing the content.* After the content of the various tests for each subject area (reading, language arts, and

mathematics) had been analyzed, the content for each area was compiled into a single list. To accomplish this, we first generated category headings to capture the different types of content across tests in the subject area. Under each category heading we then assembled relevant content descriptors from each test, in addition to descriptors taken directly from the blueprints of tests for which we could not obtain items. The purpose of organizing content in this way was to simplify the task of matching content statements to those in the high school test documents; an alignment rater could look for content under headings such as “percents and decimals” or “punctuation,” rather than having to scan through a long list of unordered content descriptors. After compiling descriptors, we eliminated redundant content (that is, content descriptors that used similar or identical language to capture the same skills or elements of knowledge) to arrive at the most concise list of content for each subject area.

### *Phase 2 - Alignment Rating Process*

*Alignment Workshop Participants.* Community college and university faculty were recruited to serve as participants in the alignment rating workshop. All raters had experience with state high school assessments or direct involvement teaching entry-level community college courses. Training consisted of practice sessions in which training items were rated and discussed. From these training sessions, scoring criteria and decision rules were developed and refined by the researchers, then applied consistently during actual ratings. The ratings for mathematics were conducted by a mixture of four community college and university faculty and the ratings for ELA were conducted by a group consisting of five community college faculty members from the Southern California region.

*Alignment Rating Activities.* The alignment rating workshop involved three rating activities. The raters first reviewed and scored each of the California Community College (CCC) standards on a five-point scale adapted from Marzano (2001) to determine the depth of knowledge of each standard. The points of the scale were Retrieval, Comprehension, Analysis, Utilization, and Goal Setting/Monitoring. Marzano’s scale is designed to reflect increasing cognitive complexity, more sophisticated uses of knowledge, and progressively higher levels of meta-cognitive functioning. The raters then used the five-point scale to assign a depth-of-knowledge rating to each augmented CST assessment element within a discipline.

The third rating task required raters to review each augmented CST element to determine whether it addressed one or more of the CCC objectives. Each augmented CST element was rated against each CCC standard and a determination was made as to whether that element addressed each CCC objective. In that way, an augmented

CST element may be linked to any number of CCC objectives depending on its content coverage. The result of these three analyses was a matrix for each rater (CCC objectives by augmented CST assessment elements) that identified which augmented CST element addressed which CCC objective, how many CCC objectives within a content area were addressed by how many high school test elements, and which CCC objectives were not addressed by any augmented CST elements. That is, for each CCC content grouping, the number of augmented CST assessment elements addressing it, as well as the number of objectives addressed by specific assessment elements, could be identified. From these ratings, several alignment values are then calculated and compared to recommended criterion values from prior alignment research (Webb, 1997, 1999).

*Alignment Criteria Values.* This process of content focus alignment (Webb, 1997, 1999) yields scales to which criterion values are applied to reach overall conclusions about how well the corpus of CCC standards align with high school test content. The four alignment criteria analyzed were Categorical Concurrence (the number of matches between CCC objectives and augmented CST content), Depth of Knowledge (the cognitive complexity of test elements in relation to CCC objectives), Range of Knowledge (the spread of test content across CCC objectives), and Balance of Representation (the ways in which test elements that matched a CCC objective distributed onto CCC objectives within a CCC content area grouping).

*Categorical Concurrence.* Raters first determined Categorical Concurrence, the match between the CCC objectives and each element from the high school assessments. The goal is to determine the extent to which the assessments cover areas deemed important to community college success as measured by placement exams. Raters were asked to identify which (if any) CCC objectives were addressed by each augmented CST element. These ratings were then summarized across raters to determine the average number of elements for each augmented CST assessment addressing one or more CCC objective. This criterion could range from 0 to the total number of elements included on the high school test. The recommended benchmark for this alignment criterion is that at least six items on average are aligned to each CCC grouping of objectives (Webb, 1999).

*Depth-of-Knowledge Consistency.* Recall, each augmented CST element and each CCC objective was given a Depth-of-Knowledge rating by each rater. Where categorical concurrence was established, the Depth-of-Knowledge raters between these components were compared. If the augmented CST element was rated at the same or higher level of cognitive complexity as the CCC objective with which it corresponded, a relationship was noted. Keeping with Webb’s methodology, for this analysis the Depth-of-Knowledge consistency is measured as the percentage

of matches between augmented CST elements and CCC objectives wherein the augmented CST element had an equivalent or higher Depth-of-Knowledge rating than the corresponding CCC objective. Values for this criterion range from 0 to 1.0, with a recommended benchmark greater than or equal to .50 (Webb, 1999). That is, for the augmented CST assessment to be considered adequately aligned to the community college objectives with respect to Depth of Knowledge, for at least half of the augmented CST to CCC matches, the augmented CST component should be at or above the cognitive complexity level of the corresponding CCC objective.

*Range of Knowledge.* Range of Knowledge was determined by tallying the number of CCC objectives that were addressed by one or more elements on the high school assessment. This criterion gives an estimate of the breadth of knowledge addressed by the high school tests. Webb describes the range-of-knowledge criterion as a means “to judge whether a comparable span of knowledge expected of students by a standard is the same as, or corresponds to, the span of knowledge that students need in order to

correctly answer the assessment items/activities” (Webb, 1999, p. 8). This metric is created by calculating the percentage of objectives within a standard addressed by the assessment items for each rater. These rater estimates are then averaged across raters for a summary Range-of-Knowledge value. This criterion’s value ranges from 0 to 1.0, with a recommended benchmark greater than or equal to .50. For the augmented CST tests to be considered adequately aligned to the CCC objectives with respect to Range of Knowledge, at least half of the objectives within a CCC grouping should be addressed. In this study, the number of objectives for a given grouping varied from 3 to 71 in ELA. The ELA content groups and the number of objectives in each are displayed in Table 2. These include: Sentence Structure, Grammar, Syntax, and Usage, Punctuation, Rhetorical Skills, Organization, Style. In Reading, the content groupings include: Vocabulary and Sentence Relationships, Literal Comprehension, Main Ideas, Supporting Ideas, Inferences, Applications. The number of objectives in the math content groupings, displayed in Table 3, ranged from six to twenty in the following content groupings: Whole Numbers and Fractions; Decimals and Percents; Applications and Interpreting Tables/Graphs; Integers and Rational Numbers; Algebraic Expressions and Operations; Operations with Exponents; Equations, Inequalities, and Word Problems; Functions; Trigonometry; Geometry; Graphing, Applications and Other Algebra Topics.

*Balance of Representation.* Balance of Representation identified how those items that matched specific CCC objectives were distributed onto the CCC objectives they matched. This criterion indicates the extent to which assessment items are evenly distributed across objectives. Like the Depth-of-Knowledge and Range-of-Knowledge criteria, Balance of Representation is expressed via an index score from 0 to 1.0, but has a recommended benchmark of .70 rather than .50. This higher threshold is established to ensure that reasonably good overlap exists between the test elements and the CCC objectives overall.

**Table 2. Number of CCC Objectives by Content Grouping**

Community College Content Area	No. of Objectives
<b>Language</b>	
Sentence Structure, Grammar, Syntax, and Usage	71
Punctuation	19
Rhetorical skills	3
Organization	5
Style	7
<b>Reading</b>	
Vocabulary and Sentence Relationships	4
Literal Comprehension	12
Main Ideas	4
Supporting Ideas	4
Inferences	19
Applications	3

**Table 3. Number of CCC Objectives by Content Grouping**

Community College Content Area	No. of Objectives
<b>Mathematics</b>	
Whole Numbers and Fractions	20
Decimals and Percents	16
Applications and Interpreting Tables/Graphs	14
Integers and Rational Numbers	6
Algebraic Expressions and Operations	16
Operations with Exponents	8
Equations, Inequalities, and Word Problems	11
Functions	9
Trigonometry	8
Geometry	16
Graphing	16
Applications and Other Algebra Topics	15

## Results

### *Reliability of Ratings*

The Depth-of-Knowledge ratings for the CCC objectives and the augmented CST content elements obtained in the first two rating exercises were analyzed for rater agreement. These analyses utilized generalizability theory (Shavelson & Webb, 1991) to investigate the consistency of ratings. The generalizability coefficient (g-coefficient) is comparable to the more common reliability coefficient from classical test theory and indicates the percent of variability in the scores that are due to systematic influences. Relative g-coefficients provide estimates of consistency of

rank ordering elements by raters, whereas absolute g-coefficients provide estimates of consistency of the value of elements across raters. Estimated g-coefficients for the CCC ratings were found to be lower than the estimated g-coefficients for the ratings of augmented CST elements. However, in both cases, generalizability coefficients exceeded the minimally acceptable threshold of .70 and were often closer to or above the more desirable threshold of .80, even for the slightly more stringent absolute g-coefficients (see Table 4).

### Categorical Concurrence

Ratings of categorical concurrence produced interesting results (see Tables 5 and 6 for summaries of alignment ratings for ELA and mathematics, respectively). In the area of ELA, we found that the elements of the augmented CST Grade 11 ELA test were aligned quite well to all of the content groupings for the CCC placement exams, using Webb's criterion of having at least 6 items per grouping to establish sufficient coverage of the content. The augmented CST test had the strongest categorical concurrence in the area of sentence structure, grammar, syntax, and usage, primarily due to the fact that this CCC content grouping had substantially more elements (71) than did the other content groupings. However, even in CCC content groupings with a more modest number of elements, there was still substantial alignment. In the area of inferences, for example, there are but 19 elements in the content grouping, but there was an average of 107 matches between these 19 elements and the 28 standards comprising the augmented CST test.

The categorical concurrence results were not as strong in the area of mathematics as they were in ELA. Whereas every content grouping in ELA showed sufficient alignment on the categorical concurrence metric, the same can be said for less than half of the content groupings in mathematics. Specifically, the augmented CST tests showed sufficient categorical concurrence alignment in the areas of algebraic expressions and operations; equations, inequalities, and word problems; functions; geometry; and applications and other algebra topics. But they did not adequately align in the areas of whole numbers and fractions; decimals and percents; applications and interpreting tables/graphs; integers and rational numbers; operations with exponents; trigonometry; or graphing.

Thus, it appears from a content standpoint, there are many more elements addressed by the placement tests used at the community colleges than high school assessments. It may be that some of these topics like whole numbers and fractions or decimals and percents are covered in courses that precede the courses for which these end-of-course assessments are targeted. However, this does not explain the lack of concordance in areas like trigonometry graphing, and operations with exponents.

### Depth-of-Knowledge Consistency

The depth-of-knowledge measure of alignment is useful for determining whether the elements on the augmented CST exams that are matched to objectives from the placement exams have a comparable (or higher) level of cognitive demand than do the objects to which they are matched. In the case of ELA, the augmented CST elements aligned well with the placement objectives in all but one content grouping (see Tables 5 and 6). In rhetorical skills, the augmented CST elements were found to have an equal or higher level of cognitive demand than the placement

**Table 4. Reliability of Depth-of-Knowledge Ratings**

Subject Area	Relative g-coefficient	Absolute g-coefficient
<b>Mathematics</b>		
CCC Objectives	.79	.79
Augmented CST Elements	.91	.90
<b>ELA/Reading</b>		
CCC Objectives	.73	.72
Augmented CST Elements	.81	.79

**Table 5. Summary of Alignment Ratings for ELA**

Community College Content Area	Categorical Concurrence <sup>a</sup>	Depth of Knowledge <sup>b</sup>	Range of Knowledge <sup>c</sup>	Balance of Representation <sup>d</sup>
<b>Language</b>				
Sentence Structure, Grammar, Syntax, and Usage	66.60*	83.55%*	86.20%*	0.92*
Punctuation	26.40*	59.73%*	100.00%*	0.99*
Rhetorical skills	15.00*	49.39%	100.00%*	0.92*
Organization	16.60*	90.78%*	100.00%*	0.92*
Style	27.40*	83.14%*	100.00%*	0.93*
<b>Reading</b>				
Vocabulary and Sentence Relationships	13.80*	70.71%*	80.00%*	0.94*
Literal Comprehension	68.80*	93.46%*	91.67%*	0.82*
Main Ideas	14.60*	100.00%*	60.00%*	0.93*
Supporting Ideas	14.60*	87.23%*	100.00%*	0.97*
Inferences	107.00*	78.83%*	91.58%*	0.84*
Applications	14.80*	92.80%*	60.00%*	0.95*

NOTES:

<sup>a</sup> Criterion value for this measure is at least 6.0;

<sup>b, c</sup> Criterion value for these measures is at least 50%;

<sup>d</sup> Criterion value for this measure is at least 70% ;

\* indicates sufficient values to reflect acceptable alignment.

objectives for 49.39% of the ratings, which is just slightly below the threshold of 50% Webb recommends for demonstrating sufficient depth-of-knowledge alignment. In all other content groupings, the values well exceeded this recommended benchmark, thereby demonstrating sufficient depth-of-knowledge alignment in most areas of language arts and reading. That is, the high school tests appear to be addressing the topics they share with the placement tests at a sufficient level of cognitive demand.

For mathematics, similar results were obtained. With the exception of the areas for which no depth-of-knowledge ratings could be calculated because no matches were obtained (i.e., whole numbers and fractions; decimals and percents), the high school test content showed sufficient depth-of-knowledge alignment with the community college placement exams. In many cases, all of the matches in a content grouping showed that the cognitive demand of the augmented CST elements met or exceeded the cognitive demand of the CCC placement test objectives. Thus, it appears the depth-of-knowledge measures indicate sufficient alignment between the augmented CST test content and the CCC placement tests in both ELA and mathematics.

### Range of Knowledge

The ratings for range of knowledge differ from the ratings of categorical concurrence in that they show not how many matches between the augmented CST elements and the CCC objects were obtained, but how many of the objectives within a content grouping were matched to an augmented CST element. This gives a sense of how broadly covered the CCC placement objects are by the augmented CST elements. In the case of ELA, all of the content groupings showed sufficient range-of-knowledge alignment (see

Tables 5 and 6). That is, the majority of objectives within each CCC placement test content grouping was matched to at least one augmented CST element. Such was not the case with mathematics.

The math tests showed sufficient range-of-knowledge alignment in only 4 of the 12 CCC placement test content groupings. These included: algebraic expressions and operations; equations, inequalities, and word problems; functions; and geometry. The augmented CST tests did not show sufficient range-of-knowledge alignment in the areas of whole numbers and fractions; decimals and percents; applications and interpreting tables/graphs; integers and rational numbers; operations with exponents; trigonometry; graphing; or applications and other algebra topics. These results for range-of-knowledge alignment are consistent with the results for categorical concurrence in finding that many areas of mathematics that are addressed in the placement exams used by community colleges in California are not tested by these end-of-course high school assessments, resulting in weak alignment across the systems.

### Balance of Representation

The results for the balance-of-representation alignment metric show that in the area of ELA the augmented CST elements were adequately distributed across the objectives within each CCC placement test content grouping (see Table 5). None of the content groupings in either language or reading had a balance-of-representation value below the recommended threshold of .70. This suggests that the augmented CST elements did not cluster unexpectedly on a few of the objectives within a content grouping, but rather they were spread across the objectives within each group. Thus, as with categorical concurrence, depth-

of-knowledge consistency, and range of knowledge, it appears the high school test content in ELA is adequately aligned with the content of placement exams used in California Community Colleges with respect to balance of representation.

Good balance-of-representation alignment between augmented CST test content and CCC placement objectives was also found in the area of mathematics (Table 6). As was the case in ELA, all of the content groupings for CCC placement tests in mathematics matched to augmented CST content showed balance of representation measures in ex-

**Table 6. Summary of Alignment Ratings for Mathematics**

Community College Content Area	Categorical Concurrence <sup>a</sup>	Depth of Knowledge <sup>b</sup>	Range of Knowledge <sup>c</sup>	Balance of Representation <sup>d</sup>
<b>Mathematics</b>				
Whole Numbers and Fractions	0.00	N/A	0.00%	N/A
Decimals and Percents	0.00	N/A	0.00%	N/A
Applications and Interpreting Tables/Graphs	2.75	87.50%*	8.93%	0.96*
Integers and Rational Numbers	0.75	100.00%*	12.50%	1.00*
Algebraic Expressions and Operations	21.00*	100.00%*	71.88%*	0.85*
Operations with Exponents	1.75	100.00%*	18.75%	0.96*
Equations, Inequalities, and Word Problems	12.50*	89.58%*	59.09%*	0.84*
Functions	11.00*	79.57%*	58.33%*	0.78*
Trigonometry	3.75	100.00%*	43.75%	0.96*
Geometry	14.75*	87.75%*	67.19%*	0.90*
Graphing	4.25	100.00%*	25.00%	0.96*
Applications and Other Algebra Topics	6.50*	92.46%*	26.67%	0.83*

**NOTES:**

<sup>a</sup>Criterion value for this measure is at least 6.0;

<sup>b, c</sup> Criterion value for these measures is at least 50%;

<sup>d</sup> Criterion value for this measure is at least 70% ;

\* indicates sufficient values to reflect acceptable alignment.

cess of the .70 recommended threshold for demonstrating adequate alignment. This suggests that where matches between augmented CST content and CCC placement test content were observed within a content grouping, the matches were distributed across the objectives adequately rather than clustering on a limited number of objectives. Thus, the content of the augmented CST high school assessments shows good alignment to the community college placement tests with respect to balance-of-representation and depth-of-knowledge consistency, but fails short in some areas with respect to categorical concurrence and range-of-knowledge alignment.

## Discussion

The results of this alignment study suggest that the augmented California Standards Tests in English language demonstrate sufficient alignment with the objectives measured by the most prevalent placement exams in use on California Community College campuses. Results differed across subject areas. Whereas the ELA test showed strong alignment in all four areas across content groupings, the math tests showed adequate alignment values only with respect to depth-of-knowledge consistency and balance of representation, falling short in many content areas in terms of categorical concurrence and range-of-knowledge alignment. Some mathematics topics covered by the placement exams are simply not addressed by the augmented CST tests. These tended to be either lower level mathematics concepts such as whole numbers or fractions, or they involved topics beyond the level of Algebra II, such as trigonometry. This may have resulted from the greater number and wider variety of placement exams evaluated in mathematics relative to ELA.

It is also important to keep in mind that this study analyzed the alignment of content from two math tests (augmented versions of the Algebra II and Summative High School Mathematics assessments) that are part of the Standardized Testing and Reporting system for California's secondary education, but are not the only math tests for 11<sup>th</sup>-grade students. These are end-of-course exams that are only taken by students taking specific courses, unlike the Grade 11 CST in ELA that is given to all students in the 11th grade.

In fact, these math tests are taken by relatively few high school students. In 2006, of 1,731,267 students tested in high school mathematics, only 99,315 (5.7%) took the Summative High School Math Test and only 213,708 (12.3%) took the Algebra II assessment. Most of the students tested in high school math are tested on either the Algebra I test (706,416 or 40.8%), the Geometry Test (359,802 or 20.8%), or the General Mathematics test (338,766

or 19.6%). There is, however, considerable overlap in content between the Summative High School Math Test and both the Algebra I test and the Geometry Test

Not only do relatively few students take the Summative High School Mathematics Test and the Algebra II test each year, but those who take the test do not perform particularly well on it. According to recent data from the California Department of Education (CDE) website, less than half (46%) of the students taking the Summative High School Mathematics Test performed at or above the proficient level in 2006, while about 28% performed at the basic level, indicating that about a quarter of the students performed below the basic level of achievement. Only about a quarter of students taking the Algebra II test achieve at or above proficient (could do initial caps for proficient and basic – just need to be consistent throughout – let me know your preference), with another 27% scoring at the basic level, suggesting that nearly half of all students taking the Algebra II test failed to score at least at the basic level of achievement (see Table 7). So, while the test content of these two high school tests may be modestly aligned to some topics examined by community college placement exams, relatively few students are actually taking these tests and even fewer are mastering the material they cover. As a result, it is unsurprising to see a large proportion of students relegated to remedial mathematics courses once they arrive at community college campuses.

However, the alignment between high school assessments and college placement exams is good in ELA. So if the tests in ELA are well aligned across high school and community college systems, then why do so many students require remediation? While alignment between the Grade 11 ELA test in high school and the content of community college placement exams appears strong, the preparation of high school students in terms of mastering that content is seriously lacking. Only 36% of students taking the Grade 11 ELA test in 2006 reached the level of proficient or better, with another 24% scoring at the basic level indicating about two-thirds of the students did not master the material sufficiently to be deemed proficient, and roughly 40% of students score at a level below basic achievement. So, while high school students may be in-

**Table 7. Statewide Proficiency Rates for CST Tests 2006**

CST Test	% Basic	% Proficient or Above
<b>Mathematics</b>		
Algebra II	27	25
Summative High School Math	28	46
<b>ELA</b>		
Grade 11	24	36

NOTE: Data obtained from California Department of Education website [www.cde.ca.gov](http://www.cde.ca.gov).

structured in and tested on subject matter content that aligns well with the expectations at community colleges, alignment alone is insufficient to stem the rising need for remediation. These results suggest that alignment between high school tests and community college placement examinations may be a necessary but insufficient condition to adequately prepare students for the transition from secondary to post-secondary education.

One suggestion for improving the disjunction between high school and community college is to make clear to students early in their educational careers, perhaps as early as middle school, what is expected of them upon enrollment at community colleges by developing continuity across the high school, community college, and four-year college systems. Just as the University of California and the California State University systems have prepared a list of course requirements for admission eligibility, community colleges could outline the expected levels of preparation for students to undertake college credit-bearing coursework and how that relates to what they need to do in high school. While creating such a set of criteria would require consistency across the community college campuses and would be a challenging undertaking, merely establishing such expectations is not enough. This information would then need to be communicated to students, parents, high school counselors, and high school district curriculum personnel on a consistent and ongoing basis.

One way of sending a uniform message and generating consistent expectations across community college campuses is to make common the placement testing practices the campuses employ. This might mean determining a limited set of existing assessments to be used, or developing a placement test battery specifically for community colleges. Such a dramatic shift from existing practices would require involvement at the state level, with the California Community College Board of Governors playing a major role in establishing a consistent and coherent placement testing policy. Additional research should be conducted into the alignment of community college placement tests and other existing placements, such as the English placement test and the Entry-Level Math Test in use at the other college systems in the state, as well as the alignment between placement tests and the skills actually addressed in community college classrooms.

It is also advisable to bring leaders in K-12 education into the discussion. The State Board of Education and the Community College Board of Governors could work collaboratively to address the problem of aligning the systems from both perspectives. Such an effort could have a far-reaching impact. Much attention is paid to preparing students for the University of California and the California State University systems, either through focusing on A-G course requirements, encouraging advanced placement/honors course taking, or emphasizing SAT test

performance. It is time we make a comparable effort to send clear signals, properly inform, and prepare those students who will enroll at community college campuses, especially since they constitute the vast majority of college students in California.

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