

**Request for Renewal of Approval of a 2nd-Party Assessment
Instrument: 2006 California Chemistry Diagnostic Test (CCDT)
Submitted by Rancho Santiago Community College District
For Santa Ana College and Santiago Canyon College
April 6, 2016**

Background

Rancho Santiago Community College District (RSCCD) uses a second-party test, the 2006 California Chemistry Diagnostic Test (CCDT) to assess students' preparedness to enroll in **Chemistry 210 (General, Organic and Biochemistry) and Chemistry 219 (General Chemistry)**. In February 2014, RSCCD was granted probationary status by the California Community Colleges Chancellor's Office to use the CCDT as a valid instrument to challenge the course prerequisite for Chemistry 210 and 219. The CCDT's probationary status expires in March 2016. And, although the CCCCO is not requiring or accepting ongoing validation documentation at this time (due to the temporary suspension of approval process for assessment instruments in order to allow colleges time to transition their current processes to the new CCCAssess), it is good practice to analyze data on an ongoing basis to support our colleges' continued use of these placement tools, as well as to support our accreditation efforts.

This report provides evidence to support the resubmission for full approval of the CCDT (version 2006) as a valid instrument to challenge the course prerequisite for **Chemistry 210 (General, Organic and Biochemistry) and Chemistry 219 (General Chemistry)**.

Based on the guidelines governing the full approval process set by the California Community College Chancellor's Office, this report documents the evidence supporting different types of validity/evidence such as content validity, cut score rationale, consequential validity, disproportionate impact and test bias.

RSCCD uses a common assessment system for its two colleges, Santa Ana College (SAC) and Santiago Canyon College (SCC), which enables students to attend classes at either one or both colleges without re-testing. The two colleges share the same curriculum/course content/delivery in their chemistry offerings. Demographically, gender and mean age within populations are similar; the predominant races (Latino, White, and Asian) are represented at each college similarly and distributions among populations studied are representative (see below). It is our determination that aggregate District data is appropriate for validation purposes.

Rancho Santiago Community College District																				
Parallel of Student Populations at Santa Ana College and Santiago Canyon College (Summer 2014 thru Fall 2015)																				
College Enrolled	Latino				White				Asian				Male				Mean Age			
	All Students	CA Chem Diag Exam	All Chem 210/219 Enrolled	Enrolled Chem 210/219 & Tested	All Students	CA Chem Diag Exam	All Chem 210/219 Enrolled	Enrolled Chem 210/219 & Tested	All Students	CA Chem Diag Exam	All Chem 210/219 Enrolled	Enrolled Chem 210/219 & Tested	All Students	CA Chem Diag Exam	All Chem 210/219 Enrolled	Enrolled Chem 210/219 & Tested	All Students	CA Chem Diag Exam	All Chem 210/219 Enrolled	210/Enrolled Chem 219 & Tested
SAC	45%	19%	54%	7%	17%	11%	10%	7%	9%	63%	26%	71%	59%	63%	51%	86%	31	23	24	22
SCC	44%	33%	43%	18%	35%	35%	30%	41%	9%	23%	11%	27%	57%	65%	54%	82%	25	20	22	20
Total	45%	27%	50%	14%	22%	25%	18%	28%	9%	39%	20%	44%	59%	64%	52%	83%	29	21	23	21

Chemistry 210/219 requires that entering students have successfully completed Chemistry 209 (Introductory Chemistry) AND Math 080/081 (Intermediate Algebra) or higher. A student who has not completed Chemistry 209 may, instead, enroll in Chemistry 219 with a passing score on the CCDT. Chemistry 210 has the general chemistry component that is at the level of Chemistry 219. As a result, students going into Chemistry 210 need to have the same preparations and skills as those going into Chemistry 219. Therefore, the course prerequisite is the same for both sets of students, which is either passing the CCDT or having successfully completed Chemistry 209. Since Chemistry 210 and 219 share the same prerequisite, data is not disaggregated by course.

The table below shows that the vast majority (97%, 866 of 934) of students complete the prerequisite chemistry course (Chemistry 209). Since Summer 2014, 68 students of the 934 enrolled in Chemistry 210/219 have been administered the CCDT (7%).

Santa Ana College and Santiago Canyon College			
Semester	Received Grade Chemistry 210/219	administered CCDT	
		count	percent
Summer 2014	52	3	6%
Fall 2014	265	13	5%
Spring 2015	265	21	8%
Summer 2015	51	3	6%
Fall 2015	301	28	9%
Total	934	68	7%

In accordance with the “*Standards, Policies and Procedures for the Evaluation of Assessment Instruments Used in the California Community College*” (March 2001 edition) campus responsibility for using a 2nd-party test not on the Chancellor’s approved list (locally-managed), the following validation activities have been addressed and/or conducted: 1) item-by-item analysis for content validity, 2) rationale for setting cut-scores, 3) consequential validity, 4) review or cite study of test bias, 5) plan to monitor disproportionate impact by ethnicity, age, and gender, disability and 5) ADA Accommodations provided.

Content Validity

In July 2015, 19 Chemistry 210/219 faculty members from both colleges convened to compile a list of minimum prerequisite skills to enroll in both chemistry courses based on the course outline for the previous level. Grids were developed, then, listing prerequisite skills on the vertical axis and CCDT items on the horizontal axis (2006 edition). Faculty members independently identified matches between each test item and the minimum prerequisite skill for course enrollment. These judgments were returned to the RSCCD Research Department for further analysis.

Twelve prerequisite skills were listed for Chemistry 210 (General, Organic and Biochemistry) and 219 (General Chemistry). Content validity activities confirmed by majority consensus that all skills are addressed by one or more test items.

Rancho Santiago Community College District
2006 California Chemistry Diagnostic Test
ITEM ANALYSIS OUTCOMES FOR CONTENT VALIDITY
Conducted July 2015

course level skills required at entry	Test Items that Address Skill Needed at Entry to Chemistry 210/219 (by majority: 10 or more)
	<i>(total faculty participants=19)</i>
students can use dimensional analysis and solve conversion problems and chemistry calculations	1,26,27,28,31,35,39,42,44
students know how to appropriately use significant figures in calculations	6,34,38,41
students can identify elements, compounds, and mixtures	3,5,16,21
students can relate the position of an element on the periodic table to identify periodic trends	20,21,22,23,24
students use introductory atomic theory to understand atomic structure	8,14,15,19,23
students have an understanding of valance electrons and how they are used to form molecules	15,17,18
students are able to write balanced chemical equations	10,12,13,25
students are able to use stoichiometry to calculate mole and mass relationships	4,9,11,25
students apply gas laws to relate the volume, pressure, temperature, and amount of gas to ideal gas systems	6,7,11,40
students know solution properties and can solve solution calculations such as molarity and percent composition.	26,27,28,29,36,43

Cut-Score Rationale:

The 1997 edition of the CCDT has been used to place students into Chemistry 219 (in lieu of successful completion of the prerequisite Chemistry 209 course) from Fall 2000 through Fall 2013. All Chemistry faculty members from both SAC and SCC convened in September 2013 to review both the 1997 and 2006 versions and unanimously agreed to migrate to the newer version of the exam.

Current cutoff score for Chemistry 210/219 is 29 out of 44. Chancellor's Office recommendation was to use the formal item-based judgmental process to establish the cut scores for both Chemistry 210 and 219. Fifteen faculty members responsible for teaching Chemistry 210 and 219 at SAC and SCC participated in this activity during Fall 2015 semester. Instructors independently judged each item on the CCDT and had to decide whether a minimally qualified student could answer correctly at each course level. The cut score was calculated by summing each rater's response (yes=1, no=0). Individual instructors' cut scores ranged from a low of 24 to a high of 35. The average score across participants was calculated (cutoff score=29). Based on the findings of the rating activity, the district will continue to use the current cutoff score of 29.

Consequential-Related Validity:

Consequential-related validity was measured by administering a student and instructor questionnaire. Students placed into Chemistry 210/219 courses in Fall 2015 and Spring 2016 as a result of passing the CCDT with a score of 29 or more were asked (at the fourth week of the semester) if they believed they were placed into an appropriate chemistry course level; their instructors were also asked to assess the appropriateness of their students' course level advisements individually.

The response choices were:

- Under-prepared for the course. Probably should have been placed into a lower level.
- Adequately prepared for the course. Student was placed into the appropriate level.
- Over-prepared for the course. Probably should have taken a higher level course.

The data indicate that 94% (15 of 16) and 100% of faculty and students, respectively, judged their placement into Chemistry 201/219 to be appropriate based on the students' chemistry skills. The results meet the threshold of 75% recommended by the Chancellor's Office. However, data is being used with caution due to low count. We will continue to gather data in the following semesters.

Validation of Placement Tools: CCDT (2006 version)

Ratings of Appropriateness

	N	student under-prepared	student adequately prepared	student over-prepared
Student Self-Rating	16	0%	100%	0%
Instructor Rating	16	6%	94%	0%

Review for Test Bias

A bias panel, comprised of 18 Chemistry Department faculty members from both Santa Ana College and Santiago Canyon College, convened to conduct a logical review of each test item for gender, race, and cultural bias. Panel members were representative of the student and community populations that our district serves; demographic characteristics of panel members are shown below.

The panel was reminded that test items were to be examined for fairness from the perspective of their own group membership (ethnic/cultural) for bias, offensiveness or insensitivity (ethnic, cultural, gender, or linguistic). The panel reviewed each test item and returned its findings to the Chemistry Department Chairs.

	SAC Test Bias Panel Members	SCC Test Bias Panel Members
Gender		
Male	6	5
Female	4	3
Age		
<35		2
35-45	3	4
46-59	7	2
60+		
Ethnicity		
African-American	1	
Asian	4	2
Latino	1	2
Middle Eastern		2
White	4	2

Panel members agree that all questions on the test are exclusive of any reference outside chemistry and mathematical skill sets. Panel members agree unanimously that there is no cultural, gender, or racial bias in the questions.

Disproportionate Impact

The California Chemistry Diagnostic Test (CCDT) is fully approved by the California Community Colleges Chancellor's Office (CCCCO) for use in placing students into Chemistry 210/219 courses at Rancho Santiago Community College District (RSCCD) colleges: Santa Ana College (SAC) and Santiago Canyon College (SCC). This study is part of an ongoing effort to ensure equity in placement testing by evaluating whether student placements significantly differ by age, ethnicity, gender, and disability.

Assessment results of students who tested during Spring 2014 through Fall 2015 were analyzed utilizing the EEOC1 guidelines suggested by California Community Colleges Chancellor's Office (CCCCO). The tested population composed of 157 SAC/SCC students who took the CCDT test (2006 version). For the purpose of this analysis, disproportionate impact is analyzed for placement into Chemistry 210/219. A comparison was made between the placement rate of each subgroup and the placement rate of the reference group multiplied by 80%. The subgroup with the highest count was chosen as the reference group. Demographic groups falling below the 80% threshold indicate disproportionate impact and are highlighted. If disproportionate impact is observed, faculty and staff will further investigate findings and develop plans to correct the disparity.

Disproportionate Impact by Age

Students between the ages of 18 and 21 represented the majority of the sampled population (68%, 107 of 157) and used as the standard for comparison. For placement into chemistry courses, all of the age subgroups exceeded the 80% thresholds; therefore, there is no discernable disproportionate impact.

CCDT Pass Rates by Age Group (cut-score of 29), 2014-15

Age Group	Total Count n	Passing Rate %
17 years old or younger	10	40%
18-21 (majority)	107	36%
22+	40	33%
<i>80% of Placement Rate for Majority</i>	<i>80% of 36%=29%</i>	

¹ The "80% Rule" methodology compares the percentage of each disaggregated subgroup attaining an outcome to the percentage attained by a reference subgroup. The methodology is based on the Equal Employment Opportunity Commission (EEOC) 80% Rule, outlined in the 1978 Uniform Guidelines on Employee Selection Procedures, and was used in Title VII enforcement by the U.S. Equal Opportunity Commission, Department of Labor, and the Department of Justice.

<http://extranet.cccco.edu/Portals/1/TRIS/Research/Accountability/GUIDELINES%20FOR%20MEASURING%20DISPROPORTIONATE%20IMPACT%20IN%20EQUITY%20PLANS.pdf>

Disproportionate Impact by Ethnicity

Asian/Pacific Islander were the majority group with a passing rate of 49%, which was used as the standard for comparison. Both Latino and White students placed into Chemistry 210 and 219 courses at 23 and 3 percentage points lower than the 80% of placement rate for the majority group, indicating disproportionate impact. The placement rates for the other ethnic subgroups exceeded the 80% threshold.

CCDT Pass Rates by Ethnicity/Race (cut-score of 29), 2014-15

	Total Count	Passing Rate
Ethnicity/Race	n	%
African-American	3	67%
Latino	49	16%
Asian/Pac.Islander (majority)	53	49%
White	39	36%
Other/Non-Respondents	13	46%
<i>80% of Placement Rate for Majority</i>	<i>80% of 49%=39%</i>	

When using the White group as a majority group, as recommended by the Chancellor’s Office, the 80% threshold criteria is 29%. Even with the definition of majority group as White, the evidence suggests there may be disproportionate impact of the test on Hispanic students when the cutoff score of 29 is used. However, the data should be interpreted with caution as the sample size in all ethnic groups is small.

Disproportionate Impact by Gender

Male students comprised slightly over half of the sampled population at both SAC and SCC (53%) and were used as the standard for comparison. The minority group, female students, passed at a rate of 22%, 26 percentage points lower than the 80% threshold; therefore there may be a disproportionate impact of the CCDT on gender groups when the cutoff score is 29.

CCDT Pass Rates by Gender (cut-score of 29), 2014-15

	Total Count	Passing Rate
Gender	n	%
Female	74	22%
Male (majority)	83	48%
<i>80% of Placement Rate for Majority</i>	<i>80% of 48%=39%</i>	

Disproportionate Impact by Disability

SAC and SCC have very few disabled students (1%) in comparison to the general student body. Students with no disabilities were used as the standard for comparison. Data shows no evidence of disproportionate impact for placement into chemistry courses; however, there is insufficient number of students (two students) to draw any conclusions.

CCDT Pass Rates by Disability (cut-score of 29), 2014-15

Disability	Total Count n	Passing Rate %
Non-DSPS (majority)	155	35%
DSPS	2	50%
<i>80% of Placement Rate for Majority</i>		<i>80% of 35%=28%</i>

Conclusion:

Disproportionate impact was conducted for placements into Chemistry 210/219 courses during Spring 2014-Fall 2015 period. Results of the analysis suggested that disproportionate impact on CCDT placement exists for impacted groups. Specifically, there is a disproportionate impact for female, Latino and White students. In the light of these findings, the chemistry faculty will convene a taskforce to assess the full impact of these findings and provide suggestions for improvement when appropriate. It is important that the student assessment center and research office continue to monitor these data and share results with the chemistry faculty on a regular basis (no more than every three years as dictated by law). The chemistry department faculty will consider thoughtfully the impact on students by gender, age, ethnicity, and special needs. Both colleges will develop plans to remedy the disproportionate impact on Latino, White and female students. Discussions in meetings should be documented and care taken to limit any disproportionate impact.

Alternative Assessment Procedures

Alternative assessment procedures are provided at RSCCD for persons with impaired sensory, manual, or speaking skills who cannot take the District placement tests under standard conditions as follows:

- **Accommodation for Hearing Impairment**
 - Signers are provided
 - Instructions are given in writing

- **Accommodation for Visual Impairment**
 - Questions are read to students
 - Visual enlargement equipment is provided
 - MDTP (math) test is given in Braille version
 - Screen reading program combined with a sound card

- **Accommodation for Other Physical Impairment**
 - Testing facilities are accessible
 - Accommodations arranged on an individual basis by Testing Coordinator as necessary

- **Accommodation for Learning Disability**
 - Adjustments in allocated time (up to twice the standardized time) can be made

The alternative assessment procedures have been scrutinized by faculty members with expertise and experience working with students with disabilities. Faculty members have determined that the alternative assessment procedures yield test scores with appropriate characteristics based upon the rationale that the accommodations made for placement testing are congruent with the test-taking facilitation and the provision of services for students with disabilities in the instructional setting mandated in Section 560026 of the Title V.

Alternative assessment procedures are provided in the Disabled Students' Center and the Testing Center at both SAC and SCC.

RSCCD Content Validity Form (CCDT version 2006)
CHEMISTRY 210/219
Conducted July 2015

course level skills required at entry	Test Item Addresses Skill Needed at Entry to Course Level (tally of participant faculty judgements/n=19)																																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	
students can use dimensional analysis and solve conversion problems and chemistry calculations	18	9	0	6	0	0	0	0	4	1	6	0	0	0	0	0	0	0	0	0	0	0	0	0	8	12	13	13	8	0	12	0	0	5	15	0	0	1	16	4	4	13	9	13	
students know how to appropriately use significant figures in calculations	8	4	1	3	0	14	1	0	1	7	2	0	0	0	0	0	0	0	0	0	0	0	0	3	5	5	5	4	0	6	0	1	14	7	0	0	19	9	2	18	9	4	9		
students can identify elements, compounds, and mixtures	5	4	18	6	17	2	4	3	2	4	2	2	2	0	0	18	3	2	0	0	15	4	2	2	0	0	0	3	1	8	3	0	1	0	0	1	1	0	0	0	0	0	0	0	
students can relate the position of an element on the periodic table to identify periodic trends	1	1	2	1	6	1	6	4	1	0	0	1	1	1	8	1	5	3	4	15	10	17	11	17	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
students use introductory atomic theory to understand atomic structure	0	0	0	0	0	0	0	18	0	1	0	0	0	0	19	15	2	3	1	17	8	3	1	15	7	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0
students have an understanding of valance electrons and how they are used to form molecules	0	0	0	0	0	0	0	1	0	0	0	0	0	0	2	13	1	18	12	3	4	1	0	5	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
students are able to write balanced chemical equations	0	0	0	0	0	0	0	0	4	11	2	17	19	0	0	0	0	0	0	0	0	1	0	0	0	15	2	0	0	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
students are able to use stoichiometry to calculate mole and mass relationships	4	7	2	14	0	0	0	2	15	7	12	2	0	0	0	0	0	0	0	0	0	0	0	14	6	4	6	3	3	1	1	0	0	0	0	0	0	0	0	1	0	0	2	1	0
students apply gas laws to relate the volume, pressure, temperature, and amount of gas to ideal gas systems	0	0	0	0	0	15	16	0	0	0	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	17	1	0	0	0
students know solution properties and can solve solution calculations such as molarity and percent composition.	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	8	18	17	18	19	9	8	0	0	0	0	0	10	2	0	0	0	0	2	15	5

The above table shows the number of faculty (out of 19) who identified a match between CCDT test items and course level skills required at entry. The highlighted cells identify counts with a majority consensus (more than 10).