Peer Groups for Comparing the Completion Rate in the 2018 Scorecard

Background

In 2004, state legislation prompted the design and implementation of a performance measurement system for the California Community Colleges (CCC) known as the Accountability Reporting for the Community Colleges (ARCC). The California Community College system is the largest postsecondary educational system in the world, serving more than 2.1 million students in 2016-17, with 114 colleges campuses spread across 72 districts. The locally controlled colleges, each with multiple and complex missions, provide a variety of educational programs to a diverse student population in assorted communities throughout California.

California has recognized student and community diversity among its colleges and the importance of accounting for this diversity when comparing institutional performance. The diverse academic and economic environments of the students served by a college are important factors affecting individual student achievements and overall institutional performance. In evaluating performance, the Chancellor's Office has historically captured institutional differences through adjustment factors or selection variables. In 2007, ARCC used peer grouping to examine a college's performance for each of the seven college level indicators in the accountability report.

The development of the peer groups for each indicator included the selection of the most appropriate variables using bivariate correlations and hierarchical regression. This process assured that the environmental factors had an empirical, as well as a theoretical relationship with the performance indicator. To identify the members of each particular peer group, a classifications method known as cluster analysis was used. Using the same methodology for peer grouping as previous but with updated predictor variables, the Chancellor's Office has produced a new set of peer groups for the Completion Rate. The colleges can use the peer groups for comparing themselves on this indicator with similar colleges for evaluative purposes.

Methodology

A preliminary step to finding the peer group for each college was to develop regression models to identify a parsimonious set of uncontrollable factors that predicted the Completion Rate. The potential uncontrollable factors, or predictor variables, were initially identified through an extensive literature review and have continued to be refined over the years. The factors that affect the outcome had to lie beyond the control of each college administration (uncontrollable

factors often referred to as "environmental factors") and be available through a feasible data source that the Chancellor's Office (CCCCO) can use.

Using the parsimonious set of uncontrollable factors identified by regression modeling, cluster analysis (a standard multivariate statistical tool) was used to identify those colleges that most closely resemble the college of interest in terms of these uncontrollable factors on the specific performance metric.

Cluster analysis is a well-developed quantitative method of identifying groups of entities from a population of entities. Major references for cluster analysis became available to researchers as early as 1963 (Sokal & Sneath, 1963). This method can apply to any kind of entity, and past applications have clustered entities as diverse as colleges, states, cities, students, sports teams and players, patients, hospitals, and businesses, to mention a few. In past years, researchers have used it for developing taxonomies, especially with respect to the biological studies (i.e., horticulture, zoology, and entomology).

Depending upon the objective of the researcher, the cluster analysis chooses one or more measurements (aka "variables") of each entity in a population to produce a numerical indicator of "distance" between each entity in a given population. The researcher's objective is imperative in that this will drive the choice of measurements that more or less "determine" the eventual groupings or clusters. If the researcher chooses measurements that poorly reflect the researcher's objective, then the cluster analysis will probably produce a grouping that has marginal validity, if any.

Based upon the aforementioned inter-entity distances, cluster analysis then proceeds to identify sets of entities within a defined population by comparing sets of distances. In the vernacular of cluster analysis, these distances are also called "proximities." If the population under study contains a very unique entity in it, then the cluster analysis may produce, among its groupings, a cluster of one (i.e., a group containing only one case) to preserve the uniqueness of this one entity with respect to the population under study and the researcher's objective.

A procedure known as hierarchical clustering moves through a large number of iterations to progressively "join" one college to another college that the computer finds is its "closest neighbor." The program will then join this resulting pair to the next most similar college (the next closest neighbor), and so on until no other colleges of sufficient similarity can be joined to this initial set. The procedure then repeats this "joining" process for each of the remaining colleges that the program has not already joined with some other college. The peer grouping used this well-established procedure.

Standard options for conducting a cluster analysis method were reviewed and the following steps for peer grouping were used:

- Define a practical number of clusters to be identified
- Select a proximity measure that effectively captures the difference or "distance" between colleges on the basis of their levels of analyst-specified variables.
- Select and use a cluster identification algorithm that applies a specific decision rule (i.e., a type of logic) to cluster the colleges into mutually exclusive groups.
- Prevent bias in the clustering that may result from using variables that use different scales of measurement (i.e., driving miles vs. student headcounts or percentage of students, and so forth).

The following section reports on how the four steps listed above were implemented.

- The peer grouping identifies seven distinct peer groups for all the community colleges in the system. This "target" of seven groups addressed administrative concerns over the identification of too many peer groups and a plethora of single-college peer groups (that is, the finding of some colleges that lacked any statistical peers for comparison).
- The chosen measure of distance between each community college in the system is the so-called squared Euclidean distance. This is the most common measure of proximity in cluster analysis.
- For the peer grouping Ward's method for clustering was used because this method was found to work well with the data. According to Bailey (1994), Ward's method "begins with each object treated as a cluster of one. Then objects are successively combined. The criterion for combination is that the within-cluster variation as measured by the sum of within-cluster deviation from cluster means (error sum of squares) is minimized. Thus, average distances among all members of the cluster are minimized." Ward's method has a tendency to produce clusters of approximately similar size, such as the number of members in each cluster (Everitt, Landau, & Leese, 2011).
- Each measure was converted so that different units of measurement would have no effect upon the clustering solutions. These measures were converted by standardizing the variables to unit variance (also known as converting measurements to z-scores). This can be performed using the following formula (Snedecor & Cochran, 1980):

  z = (raw score for a case – mean of the sample) / (standard deviation of the sample)

Peer Groups for Comparing Performance on the Completion Rate in the 2018 Scorecard

Group 1:	Group 2:	Group 3:	Group 4:	Group 5:	Group 6:	Group7:
Canyons	Antelope Valley	Alameda	Allan Hancock	Barstow	Berkeley City	American River
Cuesta	Bakersfield	Cabrillo	Butte	Coalinga	Canada	Cerro Coso
De Anza	Cerritos	Chabot	Columbia	Compton	Foothill	Coastline
Diablo Valley	Chaffey	Evergreen Valley	Cosumnes River	Contra Costa	Irvine Valley	Gavilan
Folsom Lake	Citrus	Glendale	Cuyamaca	Copper Mountain	Marin	Lake Tahoe
Fullerton	Crafton Hills	L.A. City	Feather River	East L.A.	Mission	Lassen
Golden West	Cypress	L.A. Valley	Mendocino	Hartnell	Saddleback	Monterey
L.A. Pierce	Desert	Laney	Mt. San Antonio	L.A. Harbor	San Diego Miramar	Palo Verde
Las Positas	El Camino	Merritt	Mt. San Jacinto	L.A. Mission	San Francisco City	Santa Ana
MiraCosta	Fresno City	Napa Valley	Redwoods	L.A. Trade-Tech	San Mateo	
Moorpark	Grossmont	Sacramento City	Shasta	Long Beach City	West Valley	
Ohlone	Imperial Valley	San Diego City	Siskiyous	Moreno Valley		
Orange Coast	Lemoore	San Jose City	Southwestern	San Bernardino		
Palomar	Los Medanos	Santa Monica City	Taft	Southwest L.A.		
Pasadena City	Merced	Santa Rosa				
San Diego Mesa	Modesto	Santiago Canyon				
Santa Barbara City	Norco	Solano				
Sierra	Oxnard	West L.A.				
Skyline	Porterville	Woodland				
	Reedley					
	Rio Hondo					
	Riverside					
	San Joaquin Delta					
	Sequoias					
	Ventura					
	Victor Valley					
	Yuba					

Results of Revised Peering Grouping

The development of college-level services area indices that represent the economic and education characteristics or environments of the student served have been useful as predictor variables in the initial accountability framework (van Ommeren, Liddicoat & Hom, 2008). The Chancellor's Office has updated these indices with current Census data, as well as explored additional indices such as the Academic Performance Index.

 The predictors for the Completion Rate (2011-12 to 2016-17) are:

- API: The Academic Performance Index is an index calculated by the California Department of Education for each high school in the state based on standardized test scores in a number of subjects. A variable of this index was developed by the CCCCO that assigns a weighted API (based on 2010 API) to each college based on the proportion of enrolled students from a given high school (Fall 2011).

- BA Index: The Bachelor of Arts/Sciences Index represents the bachelor degree attainment of the population, 25 years or older in a college's service area. This index, created by CCCCO, combines the enrollment patterns (Fall 2011) of students by ZIP code of residence with educational data for ZCTA (ZIP Code Tabulation Area) codes obtained from the American Community Survey.

- Pct Age 25+: The percentage of students at a community college in the Fall of 2011 that are age 25 years or older, obtained from the CCCCO MIS.

To assist users evaluate the data completeness of each predictor, the percent of students with missing information by college is shown in Appendix.

The table below shows the regression coefficients of predictors at each step of the hierarchical model predicting the Completion Rate. The complete model has an adjusted R^2 = .71 with the regression coefficients for all predictors significant at the .05 level. Based on the standardized beta coefficients, the BA+ provides the largest relative contribution to the model. Multicollinearity is negligible in the final regression and the residuals appeared to be normally distributed.

Hierarchical Regression Analysis Summary for the Completion Rate (2011-12 to 2016-17)

Step	Variables	B	Std. Error	Standardized Coefficients	Model R^2
1	(Constant)	-54.3	8.9		
	API	.14	.01	.73	.53
2	(Constant)	-29.3	9.2		
	API	.09	.01	.49	
	BA+	.27	.05	.39	.63
3	(Constant)	- 4.0	9.3		
	API	.07	.01	.37	
	BA+	.35	.05	.51	
	25+	-.24	.04	-.30	.71

Discussion

The first variable entered was a composite Academic Performance Index (API) score for each college. This weighted API was calculated by the Chancellor's Office based on the proportion of students from a given high school at each college. This weighted API acts as a proxy of K-12 academic preparation which literature has shown to be a significant predictor of college success.

Entered next was a community based predictor variable, the Bachelor Plus Index. This college level variable, also developed by the Chancellor's Office, reflects the educational attainment of the population 25 years old and over for the service area of the college. Research indicates that a major predictor of college success is the level of parent education. In addition, studies indicate that the socioeconomic background of an area has a link to educational outcomes of those who grow up in a neighborhood (the so-called "neighborhood effect"). The BA Index might be considered a proxy for these other variables or a combination of such variables in the broader context of a community's socioeconomics.

The last variable entered was percent of students 25 years old and over is negatively associated with the student progress and achievement rate. Possibly, colleges with greater percentages of "older" students focus on education that does not include a certificate, degree or outcomes related to transfer. For example, older students might already be in the workforce but continue to take courses to enhance their job skills or other interests without degree or transfer as their goal.

References

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Peer Group	Means of Predictors			Completion Rate for the 2011-12 cohort (Overall)			Peer Group Colleges	
	API	Bachelor Plus Index	Pct Students Age 25+	Lowest Peer	Highest Peer	Average	# Peers	Colleges in the Peer Group
1	787	38.1	34.6	49.0	64.0	56.1	19	Canyons, Cuesta, De Anza, Diablo Valley, Folsom Lake, Fullerton, Golden West, L.A. Pierce, Las Positas, MiraCosta, Moorpark, Ohlone, Orange Coast, Palomar, Pasadena City, San Diego Mesa, Santa Barbara City, Sierra, Skyline
2	733	20.1	34.6	32.8	51.3	44.2	27	Antelope Valley, Bakersfield, Cerritos, Chaffey, Citrus, Crafton Hills, Cypress, Desert, El Camino, Fresno City, Grossmont, Imperial Valley, Lemoore, Los Medanos, Merced, Modesto, Norco, Oxnard, Porterville, Reedley, Rio Hondo, Riverside, San Joaquin Delta, Sequoias, Ventura, Victor Valley, Yuba
3	731	33.9	45.5	33.3	59.6	46.5	19	Alameda, Cabrillo, Chabot, Evergreen Valley, Glendale, L.A. City, L.A. Valley, Laney, Merritt, Napa Valley, Sacramento City, San Diego City, San Jose City, Santa Monica City, Santa Rosa, Santiago Canyon, Solano, West L.A., Woodland
4	752	23.1	43.9	35.4	48.8	43.7	14	Allan Hancock, Butte, Columbia, Cosumnes River, Cuyamaca, Feather River, Mendocino, Mt. San Antonio, Mt. San Jacinto, Redwoods, Shasta, Siskiyous, Southwestern, Taft
5	679	19.1	43.3	30.0	49.0	40.0	14	Barstow, Coalinga, Compton, Contra Costa, Copper Mountain, East L.A., Hartnell, L.A. Harbor, L.A. Mission, L.A. Trade-Tech, Long Beach City, Moreno Valley, San Bernardino, Southwest L.A.
6	790	49.5	50.2	45.0	62.8	55.2	11	Berkeley City, Canada, Foothill, Irvine Valley, Marin, Mission, Saddleback, San Diego Miramar, San Francisco City, San Mateo, West Valley
7	739	26.6	61.6	30.3	48.5	41.7	9	American River, Cerro Coso, Coastline, Gavilan, Lake Tahoe, Lassen, Monterey, Palo Verde, Santa Ana
State-wide*	**743**	**29.1**	**42.3**			**46.9**		

*: These are the averages of all community colleges (n=113).

Appendix

Percent of students with missing age, zip code, or High School are shown below. The peer groups are created using only non-missing data on students.

*   For High School information, students who; 1) were 22 or older or special admit, 2) did not go to a high school, or 3) went to one out-of-state, are excluded from the calculation.
**   One college did not report zip code information for Fall 2011, therefore, information from Fall 2009 was used.
*** Seven colleges did not report High School information on students enrolled in Fall 2011, therefore, most recent information available from Fall 2007 through 2010 was used.

College	Percent of missing age (Fall 2011)	Percent of missing zip code (Fall 2011)	Percent of missing High School* (Fall 2011)
ALAMEDA	0.0	1.3	3.7***
ALLAN HANCOCK	0.0	15.6	5.8
AMERICAN RIVER	0.0	0.2	11.7
ANTELOPE VALLEY	0.0	0.0	28.4
BAKERSFIELD	0.0	0.1	6.5
BARSTOW	0.1	1.6	3.7
BERKELEY CITY	0.0	1.2	4.7***
BUTTE	0.0	0.7	2.5
CABRILLO	0.0	0.0	15.7
CANADA	0.0	1.8	6.9
CANYONS	0.0	0.1	30.1
CERRITOS	0.1	0.3**	19.5
CERRO COSO	0.0	0.0	29.0
CHABOT	0.0	0.0	1.1
CHAFFEY	0.0	0.0	12.3
CITRUS	0.0	3.9	4.6
COASTLINE	0.0	5.0	18.3
COLUMBIA	0.0	0.1	5.3
COMPTON	0.0	0.0	5.2
CONTRA COSTA	0.1	0.5	25.0
COPPER MOUNTAIN	0.1	0.3	20.8
COSUMNES RIVER	0.0	0.2	7.7
CRAFTON HILLS	0.0	0.1	82.0
CUESTA	0.0	20.8	3.3
CUYAMACA	0.0	1.6	5.8
CYPRESS	0.0	2.0	0.0
DE ANZA	0.0	1.0	7.4
DESERT	0.0	0.0	3.7
DIABLO VALLEY	0.0	0.4	22.6
EAST LA	0.0	0.0	2.0
EL CAMINO	0.0	0.0	1.9
EVERGREEN VALLEY	0.0	0.0	61.9
FEATHER RIVER	0.1	0.5	16.0
FOLSOM LAKE	0.0	0.1	6.9
FOOTHILL	0.2	0.9	3.0
FRESNO CITY	0.0	0.7	31.2

College	Percent of missing age (Fall 2011)	Percent of missing zip code (Fall 2011)	Percent of missing High School* (Fall 2011)
FULLERTON	0.0	2.1	0.0
GAVILAN	0.0	0.2	3.0
GLENDALE	0.0	0.0	0.9***
GOLDEN WEST	0.0	9.9	6.5
GROSSMONT	0.0	2.3	5.0
HARTNELL	0.1	0.0	9.1
IMPERIAL VALLEY	0.0	0.2	3.3
IRVINE VALLEY	0.0	0.1	1.3
LA CITY	0.0	0.0	2.1
LA HARBOR	0.0	0.0	0.4
LA MISSION	0.0	0.0	0.6
LA PIERCE	0.0	0.0	0.1
LA SWEST	0.0	0.0	0.9
LA TRADE	0.0	0.0	1.6
LA VALLEY	0.0	0.0	0.5
LAKE TAHOE	0.1	0.0	9.4
LANEY	0.0	1.6	9.7***
LAS POSITAS	0.0	0.0	0.5
LASSEN	0.0	0.2	37.8
LONG BEACH	0.1	0.0	22.2
LOS MEDANOS	0.0	0.4	14.8
MARIN	0.1	1.1	23.0
MENDOCINO	0.0	0.2	5.7
MERCED	0.6	0.6	4.4
MERRITT	0.0	1.6	3.6***
MIRACOSTA	0.0	0.2	18.1
MISSION	0.1	1.7	55.1
MODESTO	0.0	0.0	5.1
MONTEREY PENINSULA	0.0	0.1	0.1
MOORPARK	0.0	4.5	0.4
MORENO VALLEY	0.0	0.1	7.4
MT SAN ANTONIO	0.1	7.8	3.3
MT SAN JACINTO	0.1	0.0	4.4
NAPA	0.0	0.0	6.1
NORCO	0.0	0.1	3.1
OHLONE	0.0	0.0	6.8
ORANGE COAST	0.0	8.8	8.4
OXNARD	0.0	2.2	0.1
PALO VERDE	0.7	0.0	45.4***
PALOMAR	0.0	0.0	6.5
PASADENA CITY	0.0	0.1	7.0
PORTERVILLE	0.0	0.0	9.0
REDWOODS	0.1	0.2	1.7
REEDLEY	0.0	1.2	25.0
RIO HONDO	0.0	0.4	17.4
RIVERSIDE CITY	0.0	0.1	4.4

College	Percent of missing age (Fall 2011)	Percent of missing zip code (Fall 2011)	Percent of missing High School* (Fall 2011)
SACRAMENTO CITY	0.0	1.0	24.6
SADDLEBACK	0.0	0.1	1.0
SAN BERNARDINO	0.0	0.0	83.0
SAN DIEGO CITY	0.0	0.0	5.9
SAN DIEGO MESA	0.0	0.0	6.9
SAN DIEGO MIRAMAR	0.0	0.0	5.0
SAN FRANCISCO	0.0	2.5	2.0
SAN JOAQUIN DELTA	0.0	0.0	1.5
SAN JOSE CITY	0.0	0.1	72.2
SAN MATEO	0.0	1.8	4.2
SANTA ANA	0.0	0.0	13.5
SANTA BARBARA	0.0	0.4	2.6
SANTA MONICA	0.0	0.1	0.5
SANTA ROSA	0.0	0.0	0.6
SANTIAGO CANYON	0.0	0.1	13.5
SEQUOIAS	0.1	1.0	0.8
SHASTA	0.1	0.1	6.7
SIERRA	0.0	47.2	1.7
SISKIYOUS	0.0	4.4	32.9
SKYLINE	0.0	0.8	4.0
SOLANO	0.0	0.1	5.3
SOUTHWESTERN	0.0	0.1	52.6***
TAFT	0.0	0.3	10.2
VENTURA	0.0	2.7	0.2
VICTOR VALLEY	0.1	0.0	87.3
WEST HILLS COALINGA	0.0	1.2	24.2
WEST HILLS LEMOORE	0.1	1.2	37.5
WEST LA	0.0	0.0	0.4
WEST VALLEY	0.2	1.5	44.4
WOODLAND	0.2	0.1	3.3
YUBA	0.0	0.1	1.7