

Measuring diversity of university enrollments: The generalized variance approach

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ABSTRACT

Colleges and universities increasingly voice a concern for, and dedicate institutional attention to ethnic ‘diversity’ within their student population, a trend that aligns with broader concerns about social (in-)equity in US Elementary and Secondary schools. Current operational definition of diversity focuses on demographic variety of student population in particular, race/ethnicity as the major indicator of student diversity. This study used a measure of ethnic diversity, the Generalized Variance (GV) approach to investigate the diversity of students enrolled in twenty California State University (CSU) campuses. CSU system-wide diversity index was calculated and used as a target to determine the proximity of the campuses to the system-wide target. The results of analysis of fall 2011 student enrollments of CSU system show that the 1st year enrollees on the campuses were not significantly diverse than the "Other" students (sophomores to graduates) on the campuses. However the degree of diversity of 1st year and "Other" students on the same campuses showed some discrepancies or mismatches. i.e., there were some campuses with ethnically diverse 1st year students and less diverse “Other” students or vice versa. Most of the CSU campuses fell below the system-wide diversity index. Only 30% or six campuses were more ethnically diverse than the system-wide student population. . The data seem to indicate that for CSU campuses, locale is one of the important factors that determine the ethnic diversity on the campuses.

Keywords: Diversity index, generalized variance, Demographic variety, college enrollments, proximity score

INTRODUCTION

Measuring Diversity of University Enrollments: The Generalized Variance Approach

The current concern for social equity in public schools, colleges and universities has increased the awareness of and the need for student diversity in our educational institutions. A briefing Report of the Commission on Civil Rights in 2006 focused on the benefits of racial and ethnic diversity in elementary and secondary school education. Many scholars (e.g., Gurin, Lehman, Lewis, & Dey, 2004; Gurin, Dey, Hurtado, & Gurin, 2002; Halstead, 2010; Hurtado, Milem, Clayton-Pedersen, & Allen, 1998; Nieto, 2000), have developed varied arguments in support of ethnic diversity or the educational benefits associated with diverse student body in our educational institutions. Colleges and universities increasingly voice a concern for, and dedicate institutional attention to ethnic diversity within their student population. For example, in support of diversity in colleges and universities, the Association of American Colleges and Universities (AAC&U) developed an initiative to help its campuses to integrate diversity and quality initiatives and to realize the positive results of well planned and sustained integration efforts. To this end, AAC&U commissioned three papers on diversity (see Bauman, Bustillos, Bensimon, Brown II, & Barteel, 2005), to provide intellectual foundation for its initiatives.

Diversity is usually defined in terms of individual attributes or characteristics such as gender, race, ethnicity, socio-economic status, age, or sexual orientation. However many colleges and universities have moved beyond the demographic dimensions of diversity to include acceptance, respect, recognition and appreciation of individuals. However, the current operational definition of diversity focuses on demographic variety of student population on campuses as an indicator of diversity.

The purpose of this study was to use a measure of ethnic diversity, the Generalized Variance (GV) approach to investigate:

1. the diversity of 1st year students who enrolled in the California State University (CSU) system in Fall 2011; and
2. to compare the diversity of these 1st year students with the diversity of the "other" students (total enrollment-freshmen).

Specifically, the study sought to:

1. determine the degree of diversity of 1st year enrollees on CSU campuses;
2. determine the diversity of all the "other" students (i.e. sophomores to graduate students) on each campus
3. rank the campuses by their 1st year and all the "other" students on diversity measures; and
4. calculate and use the CSU system-wide diversity index as a target to determine the proximity of each campus total enrollment diversity index to the system-wide target.

In their recent article on measuring diversity, Budescu and Budescu (2012) demonstrated the appropriateness and versatility of using Generalized Variance (GV) as a measure of diversity. Unlike the Majority-Minority approach to measuring diversity, GV is a multi-category measure of diversity. It renders, for instance, the distribution of all the (K) categories of ethnic groups on

a campus into a single measure of diversity for the campus. Generalized variance (GV) takes the form:

$$GV = \sum p_i (1-p_i) = 1 - \sum p_i^2$$

Where $\sum p_i^2$ is the sum of the variances of the K ethnic categories, a measure of diversity. GV is also interpreted as "the probability that two randomly selected individuals from a particular population belong to different subgroups . . . A higher value (probability) reflects a higher degree of diversity" (Budescu and Budescu, p. 217)

METHOD

The sample of this study consisted of two groups of CSU students: (1) 1st year students who enrolled in the CSU system during fall, 2011; and (2) all the "other" (total enrollment - freshmen) CSU students in fall 2011. To meet the objectives of this study, student enrollment data, broken down by ethnicity, were downloaded from a publically accessible California State University web site (http://www.calstate.edu/as/stat_reports/2011-2012/rfeth01.htm). The enrollment data were carefully screened and the following groups or categories were eliminated from the study: 1. CSU students who identified themselves as belonging to two or more races; 2. Ethnicity Unknowns; 3. Non-Resident Aliens; 4. American Indians and 5. Pacific Islanders. These eliminations produced a study sample comprised of twenty out of twenty two CSU campuses. The study sample consisted of six distinct ethnic categories (African American, Asian, Filipino, Mexican American, Other Latino and White). Moreover, the study assessed a final sample of 349,780 students consisting of 70,194 1st year and 279,586 "Other" students. The names of the campuses plus Id numbers assigned by the researcher for ease of data presentation are presented in Table 1 (Appendix A).

DATA ANALYSIS AND RESULTS

This study calculated a diversity measure GV for 1st year, "other" and the total campus enrollments to 1) measure the degree of ethnic diversity in the campuses and 2) to identify and rank all institutions with respect to the diversity of 1st year enrollees, the "other" enrollees, or the total campus enrollments. Table 2 in Appendix B shows the data for computing the diversity measures, i.e., the proportion of freshmen by ethnicity on each CSU campus. The proportion of each ethnic group on a campus was squared and summed together to compute diversity index (GV) for that campus. Generalized variance (GV) procedure was selected to measure and compare the amount of diversity in CSU enrollments. The descriptive statistics of the GV measures are presented in Table 3 Appendix C. As shown in Table 3, the diversity measures of the 1st year students on the twenty campuses were normally distributed with a mean GV of .686, Skewness of -.557 and a relatively wide Inter Quartile Range (IQR) of .144. In contrast, the distributions of GV's of the "other" students and the total campus students were skewed to the left with four outliers, San Luis Obispo (Id 17), Sonoma (Id 19), Humboldt (Id 7) and Chico (Id 2), i.e., these four campuses registered very low diversity index values.

The data for addressing the main purposes of the study are presented in Table 4 (Appendix D). Columns 1, 2 and 3 of the Table 4 show the Ids of the campuses, diversity indices (GVs) of the freshmen and the rankings of their GV's respectively. (Note the smallest GV value

was assigned rank 1). The GVs of "Other" students and their rankings are presented in columns 4 and 5. Columns 6 and 7 display the GVs of the total campus enrollment and the proximity scores of each campus. As shown in column 3 of Table 4, more diverse groups of 1st year students about 31% or 22,069 enrolled on the following five campuses, East Bay (Id 6), Northridge (Id 10), Sacramento (Id 12), San Francisco (Id 15) and San Jose (Id 16). These groups of 1st year students were the most ethnically diverse groups ($GVs \geq .763$, or above Q3) than the remaining 69% of the 1st year students that enrolled on the remaining campuses. The five campuses with the most diverse "Other" students were, Dominguez Hills (Id3), Pomona (Id11), Northridge (Id10), Long Beach (Id 8), and East Bay (Id6). Approximately 19% or 13411 1st year students identified as the least ethnically diverse group ($GVs < .619$, or below the bottom quartile) enrolled at Bakersfield (Id 1), Chico (Id 2), Los Angeles (Id E9), San Luis Obispo (Id 17) and Sonoma (Id 19).

Did ethnically diverse groups of 1st year students find themselves on campuses with "Other" less diverse student body? To answer this question, the Spearman rank-order correlation was used to compare the relationship between the diversity indices of the first year enrollees and the "Other" students on the campuses. The results of the analysis showed significant Spearman rank-order correlation coefficient ($r(18) = .579$, $p < .01$). The significant positive correlation coefficient indicates that ethnically diverse first year students tend to enroll on campuses with diverse "Other" students. Conversely, less diverse freshmen groups enrolled on campuses with less diverse "Other" student bodies. The diversity rankings presented in Table 4 columns 3 and 5 further illustrate the differences and similarities between the diversity of 1st year students and the "Other" campus enrollments. They indicate matches or mismatches between the two groups. For example, the 1st year students on Los Angeles campus (Id 9) with $GV = .608$ and a rank of 4 were less ethnically diverse while the "Other" Los Angeles campus students were more diverse with a GV above Q3 and ranked 16th out of the twenty campuses. This is an instance where 1st year less diverse students found themselves on ethnically more diverse campus. From the overall campus enrollments, the most ethnically diverse campuses were Dominguez Hills (Id 3), East Bay (Id 6), Long Beach (Id 8), Northridge (Id 10) and San Jose (Id 16). Their GVs were above Q3 or .755. The least diverse campuses with GVs below Q1 or .660 were Chico (Id 2), Humboldt (Id 7), San Luis Obispo (Id 17), San Marcos (Id 18) and Sonoma (Id 19).

A major objective of the study was to compute the CSU system-wide diversity index, to use this index as a target for comparing the campuses and thereby determine the proximity of each campus to the target. The ethnic distributions across the CSU system were $P_{(Afric.Ame.)} = .060$, $P_{(Asian)} = .174$, $P_{(Filipino)} = .024$, $P_{(Mexican.Ame.)} = .264$, $P_{(Other.Latino)} = .092$, and $P_{(White)} = .385$. The system wide diversity index computed from the proportions of ethnic groups in the system presented above was .739. Measures of proximity of each campus to the target were computed from equation: $r_i = \log(Diversity_i / Diversity_{target})$. (See Budescu and Budescu, 2012). The proximity measures or log ratios of campus GVs are presented in column 7 of Table 4. Campuses which were less diverse than the system wide diversity target show negative values. Positive values were assigned to campuses more diverse than the target. Campuses that were equally diverse as the total CSU system were assigned a value of 0. A large majority (65%) of the campuses were less ethnically diverse than the system-wide student population. Thirty percent of the campuses were more diverse and 5% were equally diverse as the system wide student body.

SUMMARY

The results of analysis of fall 2011 student enrollments of CSU system show that the 1st year enrollees on the campuses were not significantly diverse than the "Other" student body on the campuses. However the degree of diversity of 1st year and "Other" students on the same campuses showed some discrepancies or mismatches. i.e., there were some campuses with ethnically diverse 1st year students and less diverse "Other" students or vice versa. Mismatches in degree of diversity between freshmen and "Other" campus students may have implications for the campus environments or "racial climate". Most of the CSU campuses fell below the system-wide diversity index. Only 30% or six campuses were more ethnically diverse than the system-wide population. The ethnic composition of a few cities in which some campuses are located suggest that campus diversity reflects the ethnic composition of the city or areas in which the campus is located. For example, campuses located in predominantly White cities like San Luis Obispo, $P_{(white)} = .758$, Sonoma, $P_{(white)} = .792$ or Chico, $P_{(white)} = .737$ have less diverse student populations. The reverse is true for campuses located in ethnically diverse cities like San Jose, $P_{(white)} = .287$, Alameda County, $P_{(white)} = .371$, or San Francisco, $P_{(white)} = .419$. The data seem to indicate that for CSU campuses, locale is one of the important factors that determine the ethnic diversity on the campuses.

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APPENDIX

Table 1- Names and IDs of California State University Campuses

Campus Name	Assigned ID
Bakersfield	1
Chico	2
Dominguez Hill	3
Fresno	4
Fullerton	5
East Bay	6
Humboldt	7
Long Beach	8
Los Angeles	9
Northridge	10
Pomona	11
Sacramento	12
San Bernardino	13
San Diego	14
San Francisco	15
San Jose	16
San Luis Obispo	17
San Marcos	18
Sonoma	19
Stanislaus	20

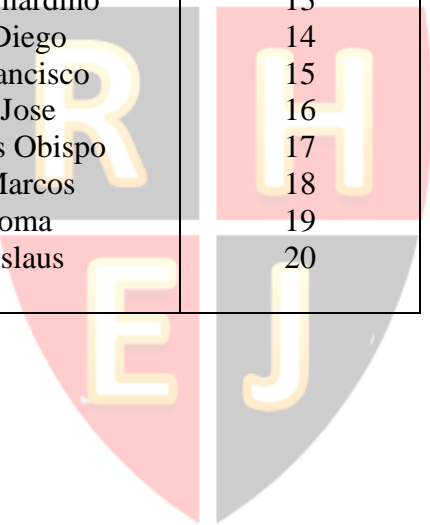


Table 2 - Distribution of CSU Freshmen Enrollment by Campus and Ethnicity Fall 2011
Proportions

Campus ID	African American	Asian	Filipino	Mexican American	Other Latino	White	Total
E1	.099	.054	.026	.582	.092	.147	1566
E2	.028	.076	.004	.232	.065	.594	2734
E3	.199	.057	.021	.474	.179	.071	2044
E4	.056	.205	.009	.441	.047	.243	3992
E5	.029	.208	.039	.361	.093	.271	5418
E6	.213	.186	.068	.294	.093	.147	1590
E7	.074	.039	.008	.265	.082	.533	1575
E8	.053	.209	.056	.373	.106	.203	5223
E9	.056	.127	.023	.584	.173	.037	3832
E10	.109	.092	.035	.371	.192	.200	6601
E11	.043	.252	.044	.348	.091	.222	3620
E12	.094	.229	.039	.281	.055	.302	4090
E13	.087	.063	.020	.576	.111	.143	3181
E14	.052	.096	.070	.294	.071	.417	4046
E15	.058	.252	.069	.212	.118	.291	4675
E16	.058	.335	.070	.239	.072	.226	5113
E17	.009	.119	.016	.132	.053	.671	3175
E18	.036	.069	.048	.373	.076	.398	1759
E19	.028	.035	.006	.201	.088	.642	2104
E20	.045	.112	.016	.484	.056	.286	1767

Table 3 - Descriptive Statistics of Generalized Variance Index (GV) of Diversity of CSU Students

	GV of Freshmen	GV of "Other" Students	GV of Total Students
N	20	20	20
Mean	.686	.664	.677
Median	.698	.716	.712
Std.Deviation	.084	.123	.110
Skewness	-.557	-1.377	-1.323
Range	.284	.370	.329
IQR	.144	.101	.096
Q1	.619	.646	.660
Q2	.698	.716	.712
Q3	.763	.747	.755

Table 4 - Diversity Indices and Rankings of 1st Year and “Other” Enrollees in CSU by Campus

Campos ID	GV Index Freshmen	Rank of GV Index Freshmen	GV Index “Other”	Rank of GV Index “Other”	GV Index Total Students	Proximity Score
17	.515	1	.456	4	.469	-.20
19	.537	2	.409	1	.451	-.21
2	.583	3	.423	2	.469	-.20
9	.608	4	.749	16	.728	-.01
1	.617	5	.707	10	.700	-.02
13	.624	6	.722	12	.712	-.02
7	.632	7	.450	3	.506	-.16
20	.666	8	.671	6	.676	-.04
18	.688	9	.638	5	.654	-.05
3	.696	10	.779	20	.771	.02
4	.699	11	.707	9	.711	-.02
14	.718	12	.692	8	.696	-.03
5	.742	13	.734	14	.739	.00
11	.754	14	.750	17	.753	.01
8	.759	15	.758	18	.763	.01
12	.764	17	.689	7	.709	-.02
10	.764	17	.740	15	.756	.01
16	.766	18	.727	13	.766	.02
15	.785	19	.722	12	.738	.00
6	.799	20	.764	19	.780	.02