

Mathematics of, for, and as Social Justice

Priscilla Bremser

May 17, 2008

First Workshop on the Mathematics of Social Justice

Rob Root, Lafayette College

May 2006

Second Workshop

P. Bremser, Chawne Kimber

Support from PA/NYCC; Middlebury, Lafayette, W.Chester, Moravian, E. Stroudsburg

Activities

Module development website

Google Group discussion

Sheila Weaver and Andy Miller: Mini Course, MAA Sectional mtg.

Book Chapter

Calculus I: Area between curves

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- ▶ Each person represents $\frac{1}{5}$ of a population (the Purples and the Greens)

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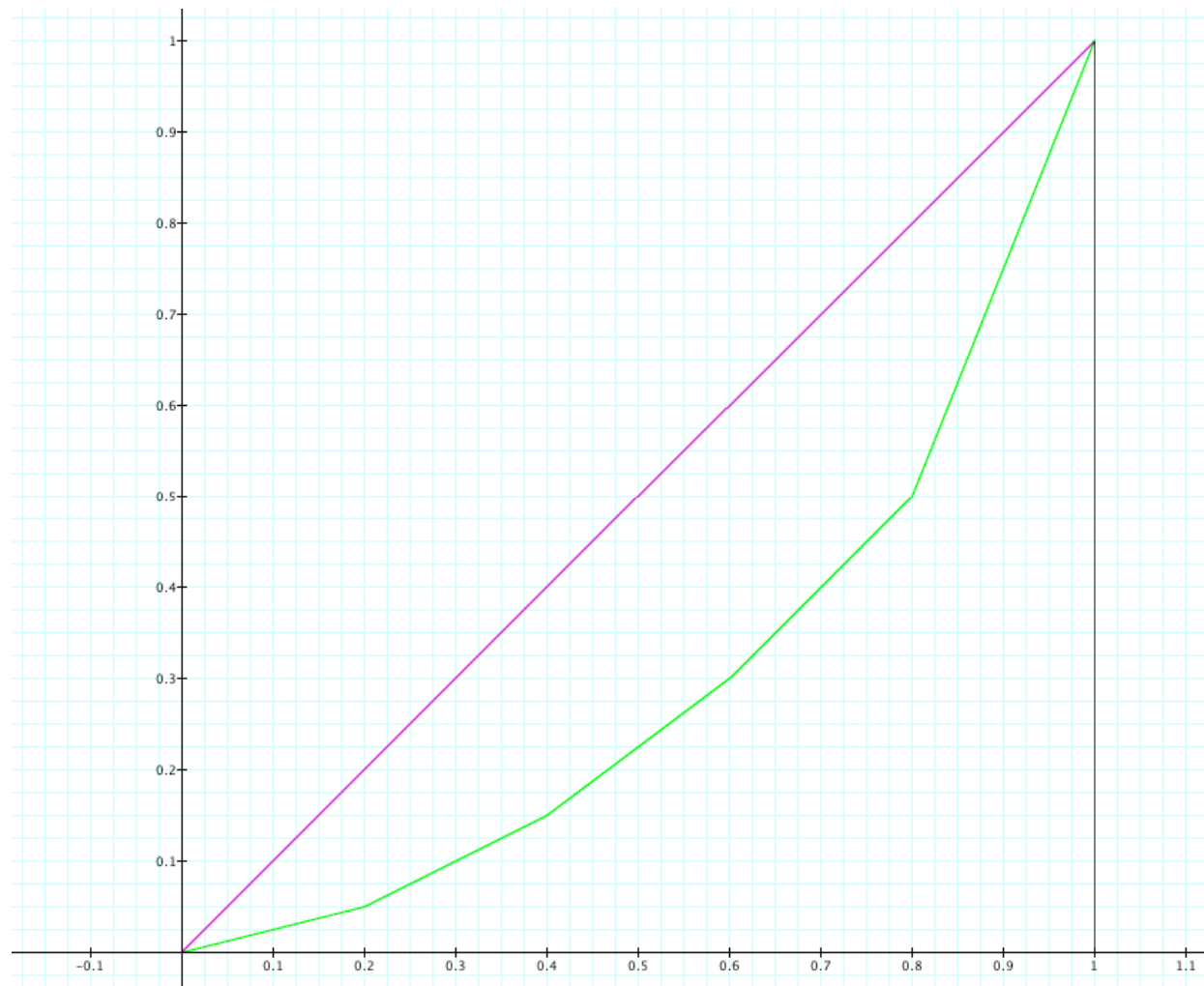
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- ▶ Green as fraction of \$100: $\frac{1}{20}, \frac{3}{20}, \frac{6}{20}, \frac{1}{2}, 1$

Mathematics Of Social Justice

Lorenz curves: Cumulative wealth (vertical) as a function of cumulative population.



Mathematics Of Social Justice

To measure how far Green strays from equal distribution, consider the green area.



The *Gini Index* (or *Gini Coefficient*) is the ratio of the green area to the area of the triangle. Actually the area of the triangle is $\frac{1}{2}$, so we have

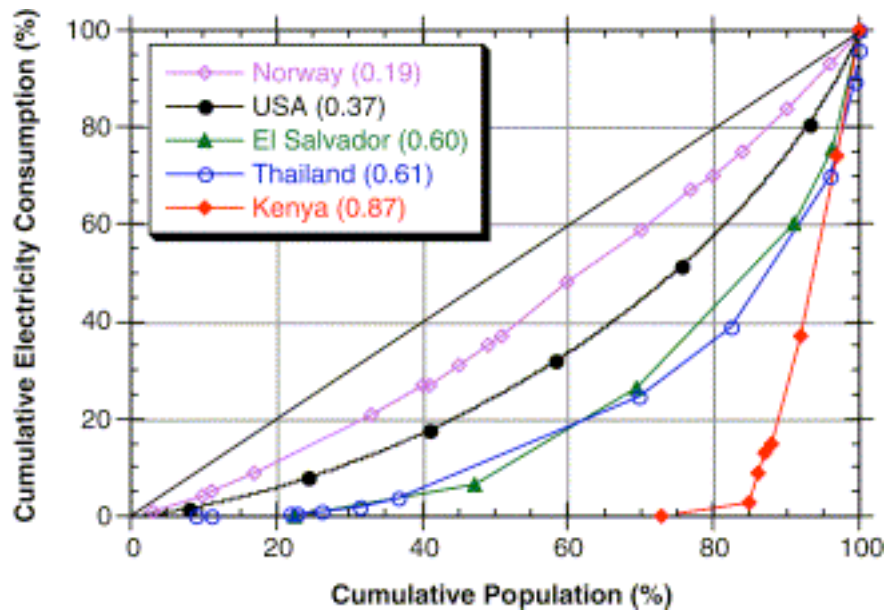
$$2 \int_0^1 (x - L(x)) dx,$$

where the Lorenz curve is represented by the function $L(x)$.

A low Gini Index means a distribution close to uniform.

See Wikipedia (really!), *Gini Coefficient*, for pros and cons.

Lorenz curves measuring energy consumption:



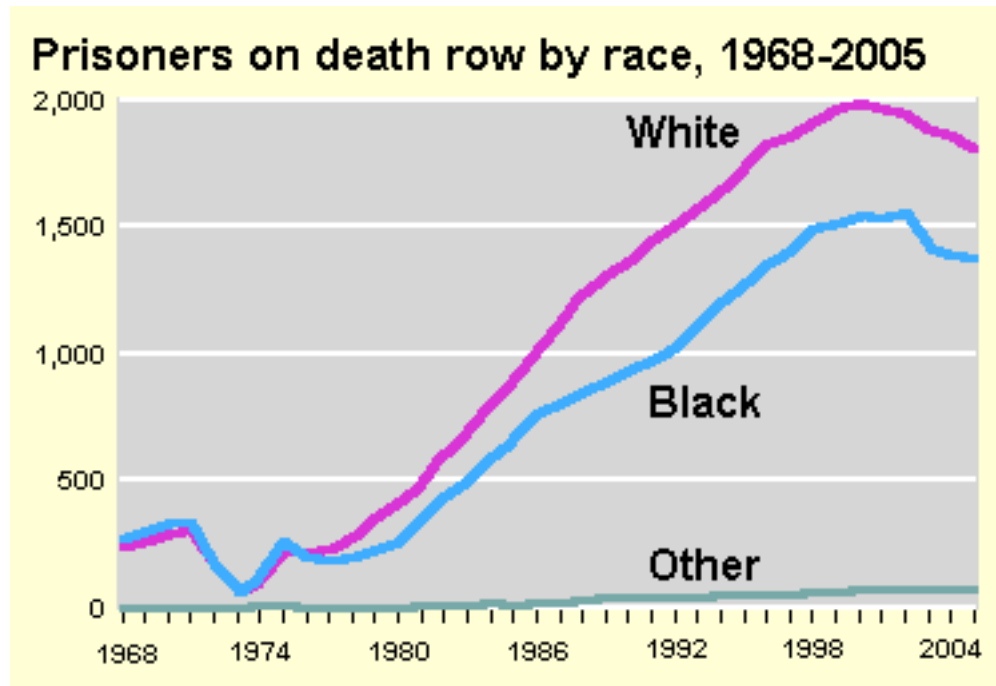
Mathematics for Understanding Criminal Justice Issues

A course intended to give an overview of topics in discrete mathematics together with their applications to criminal justice issues. Developed by Mike Olinick and others at MSJ2.

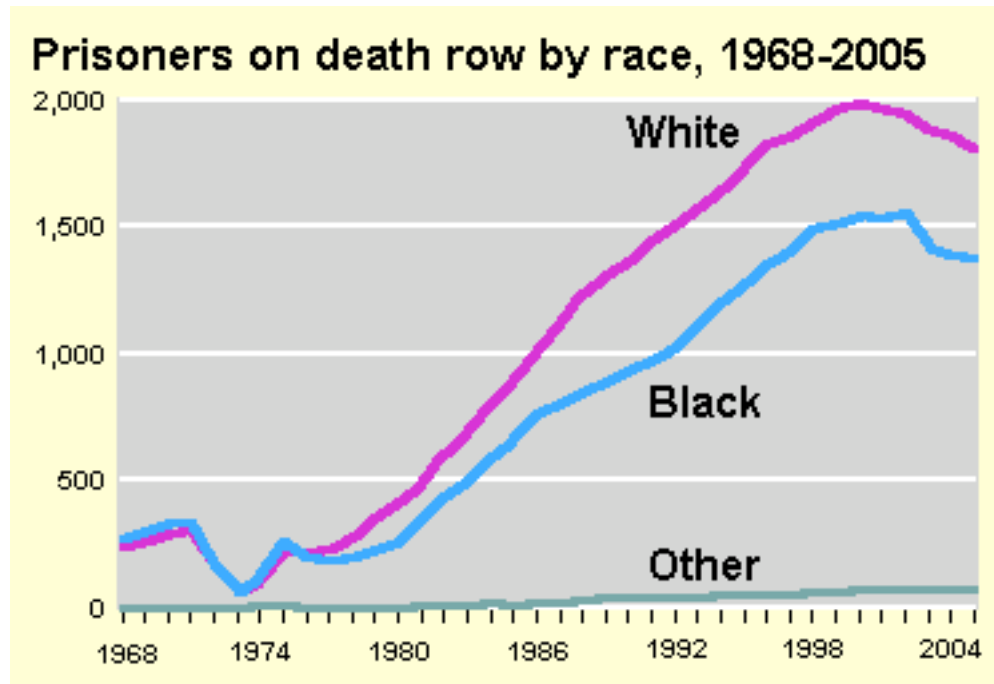
Mathematical topics include set theory, probability, counting principles, Markov chains, decision theory, and difference equations.

Applications include reliability of eyewitness testimony and lie-detector tests, measuring recidivism, Should you accept a plea-bargain offer?, and forecasting future prison populations.

Mathematics Of Social Justice



Mathematics Of Social Justice



UNITED STATES POPULATION BY RACE 2005

	Estimate
Total:	288,378,137
White alone	215,333,394
Black or African American alone	34,962,569
American Indian or Alaska Native alone	2,357,544
Asian alone	12,471,815
Native Hawaiian/Pacific Islander alone	397,030
Some other race alone	17,298,601
Two or more races	5,557,184

Source: U.S. Census Bureau, 2005 American Community Survey
Available at <http://www.census.gov/>

Service-Learning in Mathematics Courses

- ▶ Sheila Weaver, UVM
Course: Math and Social Justice, a liberal arts mathematics course
Content: financial math, game theory, fair division, probability and statistics
Community Partner: Vermont Campaign to End Childhood Hunger
Project Round 1: Students generated a data snapshot for each VT county, including # eligible for food stamps and # who actually apply.
Project Round 2: Students are finding, e.g., the correlation between percentage of those eligible who actually use food stamps in each town, and distance to nearest state DCF office.
- ▶ Ron Buckmire and Angela Gallegos, Occidental College
Course: Mathematics, Education, and Access to Power
Community Partner: NE Education Strategy Group, esp. Franklin High School, Los Angeles
Project: Tutoring or assisting in Algebra 1

Mathematics for All: A First-Year Seminar

- ▶ Fifteen (well, 16) students
- ▶ Writing-Intensive
- ▶ Advising component

Interviews with students, teachers, parents, administrators

Class session with M.Hock, VT Assessment Director

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NECAP: A Parent's Guide

Along with children throughout Vermont, New Hampshire, and Rhode Island, your child takes the NECAP (New England Common Assessment). As graduates of the standardized testing process, we understand the anxiety and confusion associated with testing. We hope that through our guide you gain an understanding of the goals of the NECAP, the design and makeup of the test, and the reasoning behind your child's participation.

Two books:

- ▶ *Radical Equations: Civil Rights from Mississippi to the Algebra Project* by Robert P. Moses and Charles E. Cobb, Jr.

“Math illiteracy is not unique to Blacks the way the denial of the right to vote in Mississippi was. But it affects Blacks and other minorities much, much more intensely, making them the designated serfs of the information age just as the people that we worked with in the 1960s on the plantations were Mississippi’s serfs then.”

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- ▶ *What the Numbers Say*
by Derrick Niederman and David Boyum
“What distinguishes good quantitative thinkers is not their skill with pure mathematics, but rather their approach to quantitative information... we are confident that you already know all the math you need...arithmetic, percentages, fractions, decimals, square roots, and exponents.”

Mathematics and Social Justice - Examples

ScienceDirect - Full Size Image

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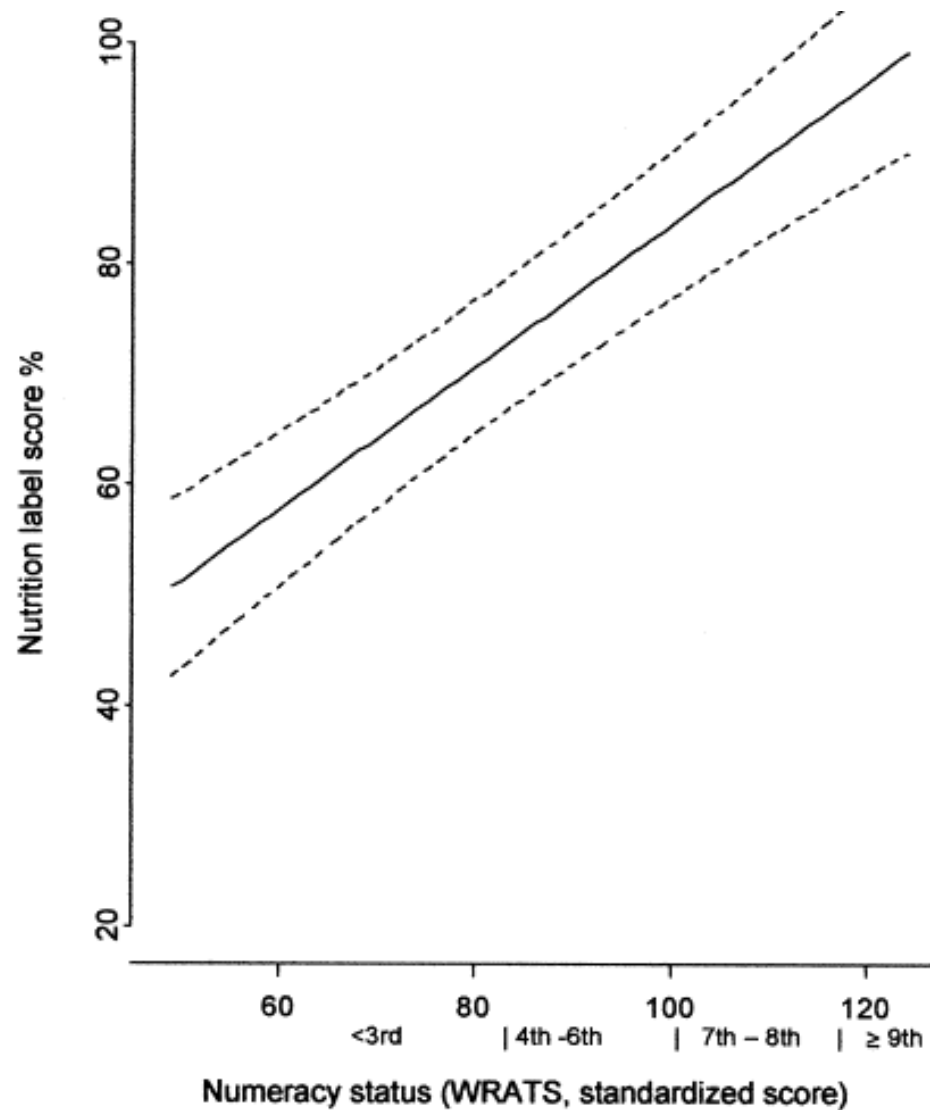
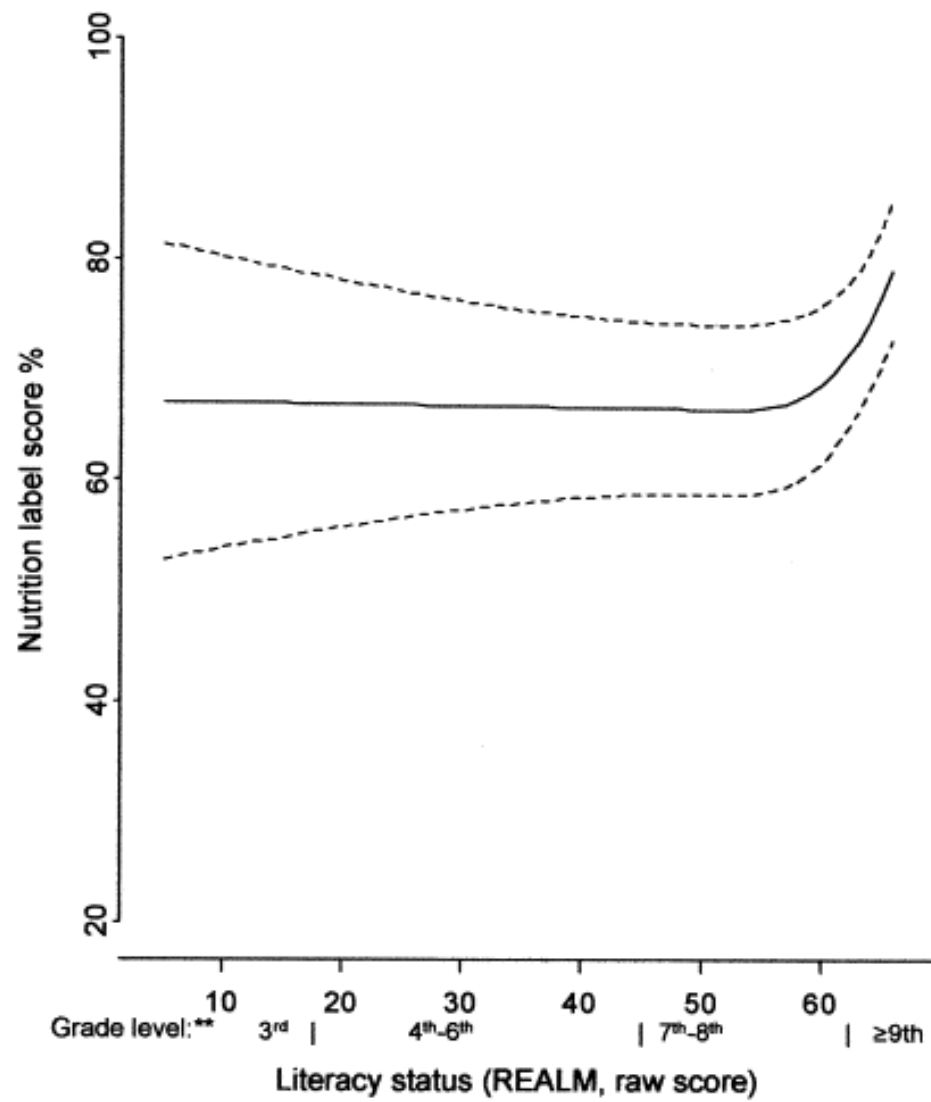
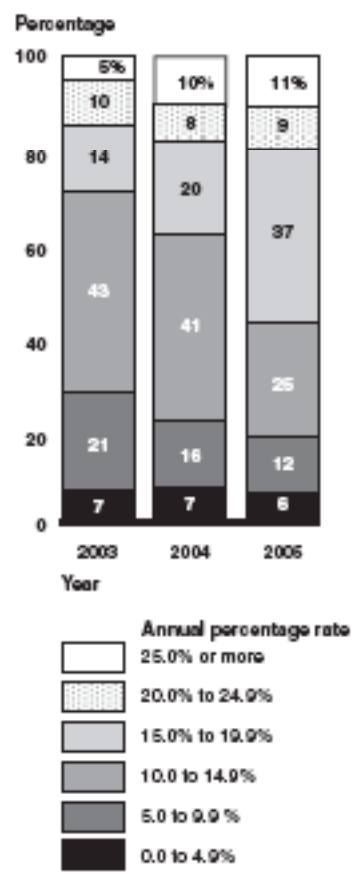


Figure 2. Predicted nutrition label score by literacy or numeracy status. Models were adjusted for age, gender, race/ethnicity, income, insurance status, presence of chronic disease, education level, literacy or numeracy, status of being on a specific diet, and label reading frequency. Dashed lines represent 95% confidence intervals. **Grade levels are approximations based on the REALM and WRAT-3 scores. REALM, Rapid Estimate of Adult Literacy in Medicine; WRAT-3, Wide Range Achievement Test, edition 3.

Mathematics and Social Justice - Examples

Figure 18: Proportion of Active Accounts of the Six Largest Card Issuers with Various Interest Rates for Purchases, 2003 to 2005



Source: GAO analysis of data reported by the six largest credit card issuers.

Mathematics and Social Justice - Examples



Fall 2007 Grades 03-08- NECAP Tests

Disaggregated State Results

	Reading					Math					Writing				
	Tested	Level 4	Level 3	Level 2	Level 1	Tested	Level 4	Level 3	Level 2	Level 1	Tested	Level 4	Level 3	Level 2	Level 1
All Students															
All Students	39338	17%	53%	19%	11%	39347	19%	44%	19%	18%	13403	13%	35%	32%	20%
Primary Race/Ethnicity															
American Indian or Alaskan Native	88	2%	39%	26%	31%	87	3%	34%	24%	38%	40	0%	28%	25%	48%
Asian	599	28%	52%	14%	8%	608	32%	44%	13%	11%	211	27%	38%	25%	10%
Black or African American	650	9%	42%	24%	26%	651	6%	31%	23%	41%	198	7%	28%	32%	33%
Native Hawaiian or Pacific Islander	40	10%	72%	18%	0%	40	12%	57%	18%	12%	11	9%	27%	64%	0%
No Primary race/Ethnicity	621	13%	49%	23%	15%	622	12%	38%	23%	28%	199	9%	28%	38%	26%
White (non-Hispanic)	37340	17%	53%	19%	11%	37340	19%	44%	19%	17%	12744	13%	35%	32%	20%
Gender															
Female	19222	22%	53%	17%	8%	19219	18%	45%	19%	17%	6555	18%	40%	29%	12%
Male	20116	12%	53%	22%	14%	20129	20%	43%	19%	18%	6848	8%	29%	35%	28%
LEP Status															
Currently receiving LEP Services	921	12%	46%	21%	21%	929	15%	37%	19%	29%	274	12%	34%	29%	25%
LEP All Other Students	38447	17%	53%	19%	11%	38448	19%	44%	19%	18%	13140	13%	35%	32%	20%
IEP															
IEP All Other Students	34533	19%	57%	17%	8%	34543	21%	48%	19%	12%	11674	15%	39%	33%	13%
Students with an IEP	4805	1%	19%	32%	48%	4805	2%	16%	22%	60%	1740	1%	6%	28%	65%
SES															
Economically Disadvantaged Students	12336	8%	45%	27%	20%	12336	8%	37%	25%	30%	3979	6%	24%	37%	33%
SES All Other Students	27032	21%	56%	16%	7%	27042	24%	47%	17%	12%	9435	16%	39%	30%	15%

Level 4 = Proficient with Distinction; Level 3 = Proficient; Level 2 = Partially Proficient; Level 1 = Substantially Below Proficient