Appendix 1: List of Schools Included in Study

All schools with a kindergarten cohort in any year from school year 2010-2011 through 2015-2016 are listed below: these schools were all used in the calculation of the entropy indices. Inclusion in the longitudinal or snapshot analyses are noted. Bold font indicates schools that are identified as DLI and included in this study.

School Name	In Longitudinal	Years included in Longitudinal	In Snapshot	Ward	Lowest Grade	Highest Grade	LEA Type	DLI Status
ACHIEVEMENT PREPARATORY PCS ELEMENTARY	TRUE	3	TRUE	8	PK3	3	Charter	
AITON ES	TRUE	6	TRUE	7	PK3	5	DCPS	
AMIDON BOWEN ES	TRUE	6	TRUE	6	PK3	5	DCPS	
ARTS AND TECHNOLOGY PCS	TRUE	4	FALSE	7	PK3	K	Charter	
BANCROFT ES AT SHARPE	**TRUE**	**6**	**TRUE**	**1**	**PK3**	**5**	**DCPS**	**Whole-School English/Spanish Dual Immersion**
BARNARD ES	TRUE	6	TRUE	4	PK3	5	DCPS	
BEERS ES	TRUE	6	TRUE	7	PK3	5	DCPS	
BREAKTHROUGH MONTESSORI PCS	FALSE	0	FALSE	4	PK3	K	Charter	
BRENT ES	TRUE	6	TRUE	6	PK3	5	DCPS	
BRIDGES PCS	TRUE	4	TRUE	5	PK3	4	Charter	
BRIGHTWOOD EC	TRUE	6	TRUE	4	PK3	8	DCPS	
BROWNE EC	TRUE	6	TRUE	5	PK3	8	DCPS	
BRUCE MONROE ES AT PARK VIEW	**TRUE**	**6**	**TRUE**	**1**	**PK3**	**5**	**DCPS**	**Whole-School English/Spanish Dual Immersion**
BUNKER HILL ES	TRUE	6	TRUE	5	PK3	5	DCPS	
BURROUGHS ES	TRUE	6	TRUE	5	PK3	5	DCPS	
BURRVILLE ES	TRUE	6	TRUE	7	PK3	5	DCPS	
C W HARRIS ES	TRUE	6	TRUE	7	PK3	5	DCPS	
CAPITAL CITY PCS LOWER	TRUE	6	TRUE	4	PK3	4	Charter	
CAPITOL HILL MONTESSORI SCHOOL AT LOGAN	TRUE	5	TRUE	6	PK3	8	DCPS	
CEDAR TREE ACADEMY PCS	TRUE	6	TRUE	8	PK3	KG	Charter	
CENTER CITY BRENTWOOD CAMPUS PCS	FALSE	0	FALSE	5	PK4	8	Charter	
CENTER CITY PCS BRIGHTWOOD	TRUE	6	TRUE	4	PK4	8	Charter	
CENTER CITY PCS CAPITOL HILL	TRUE	6	TRUE	6	PK4	8	Charter	
CENTER CITY PCS CONGRESS HEIGHTS	TRUE	6	TRUE	8	PK4	8	Charter	
CENTER CITY PCS PETWORTH	TRUE	6	TRUE	4	PK4	8	Charter	
CENTER CITY PCS SHAW	TRUE	6	TRUE	6	PK4	8	Charter	
CENTER CITY PCS TRINIDAD	TRUE	6	TRUE	5	PK4	8	Charter	
CITY ARTS AND PREP PCS	TRUE	5	TRUE	5	PK3	8	Charter	
CLEVELAND ES	FALSE	0	FALSE	1	PK3	5	DCPS	English/Spanish Dual Immersion; Traditional English classroom
COMMUNITY ACADEMY AMOS 5	TRUE	5	FALSE	5	PK3	5	Charter	
COMMUNITY ACADEMY AMOS I	TRUE	5	FALSE	4	PK3	5	DCPS	
COMMUNITY ACADEMY AMOS II	TRUE	5	FALSE	5	PK3	1	Charter	

COMMUNITY ACADEMY AMOS III	TRUE	4	FALSE	5	PK3	8	Charter	
COMMUNITY ACADEMY RAND TECH	TRUE	2	FALSE	4	PS**	5	Charter	
CREATIVE MINDS INTERNATIONAL PCS	TRUE	4	TRUE	5	PK3	6	Charter	
DAVIS ES	TRUE	3	FALSE	7	PS**	5	DCPS	
DC BILINGUAL PCS	**TRUE**	**6**	**TRUE**	**5**	**PK3**	**5**	**Charter**	**Whole-School English/Spanish Dual Immersion**
DC PREPARATORY ACADEMY PCS ANACOSTIA ELEMENTARY	FALSE	0	FALSE	8	PK3	KG	Charter	
DC PREPARATORY ACADEMY PCS BENNING ELEMENTARY	TRUE	6	TRUE	7	PK3	3	Charter	
DC PREPARATORY ACADEMY PCS EDGEWOOD ELEMENTARY	TRUE	6	TRUE	5	PK3	3	Charter	
DC SCHOLARS PCS	TRUE	4	TRUE	7	PK3	7	Charter	
DEMOCRACY PREP CONGRESS HEIGHTS PCS	TRUE	2	TRUE	8	PK3	7	Charter	
DOROTHY I HEIGHT ES	TRUE	1	TRUE	4	PK3	5	DCPS	
DREW ES	TRUE	6	TRUE	7	PK3	5	DCPS	
EAGLE ACADEMY PCS CAPITOL RIVERFRONT	TRUE	5	TRUE	6	PK3	3	Charter	
EAGLE ACADEMY PCS CONGRESS HEIGHTS	TRUE	6	TRUE	8	PK3	3	Charter	
EARLY CHILDHOOD ACADEMY PCS	TRUE	6	TRUE	8	PK3	3	Charter	
EARLY CHILDHOOD ACADEMY PCS	TRUE	1	FALSE	8	PK3	3	Charter	
EATON ES	TRUE	6	TRUE	3	PK4	5	DCPS	
EL HAYNES PCS ELEMENTARY	TRUE	3	TRUE	4	PK3	4	Charter	
ELSIE WHITLOW STOKES COMMUNITY FREEDOM PCS	**TRUE**	**6**	**TRUE**	**5**	**PK3**	**5**	**Charter**	**Whole-School English/Spanish Dual Immersion** **Whole-School English/French Dual Immersion**
EMERY ES	TRUE	1	FALSE	5	PK*	8		
EXCEL ACADEMY PCS	TRUE	6	TRUE	8	PK3	8	DCPS	
EXCEL ACADEMY PCS LEAD	FALSE	0	FALSE	8	PK3	8	Charter	
FEREBEE HOPE ES	TRUE	3	FALSE	8	PS**	5	Charter	
FRIENDSHIP PCS ARMSTRONG	TRUE	1	TRUE	5	PK3	5	DCPS	
FRIENDSHIP PCS BLOW PIERCE	TRUE	3	FALSE	7	PK3	3	Charter	
FRIENDSHIP PCS BLOW PIERCE ELEMENTARY	TRUE	3	TRUE	7	PK3	3	Charter	
FRIENDSHIP PCS CHAMBERLAIN	TRUE	3	FALSE	6	PK4	8	Charter	
FRIENDSHIP PCS CHAMBERLAIN ELEMENTARY	TRUE	3	TRUE	6	PK3	3	Charter	
FRIENDSHIP PCS ONLINE	FALSE	0	FALSE	N/A	KG	8	Charter	
FRIENDSHIP PCS SOUTHEAST ACADEMY	FALSE	0	FALSE	4	PK3	5	Charter	
FRIENDSHIP PCS WOODRIDGE CAMPUS	TRUE	3	FALSE	5	PK3	8	Charter	
FRIENDSHIP PCS WOODRIDGE ELEMENTARY	TRUE	3	TRUE	5	PK3	3	Charter	
GARFIELD ES	TRUE	6	TRUE	8	PK3	5	Charter	
GARRISON ES	TRUE	6	TRUE	2	PK3	5	DCPS	
H D COOKE ES	TRUE	6	TRUE	1	PK3	5	DCPS	
HARMONY DC PCS SCHOOL OF EXCELLENCE	TRUE	2	TRUE	5	KG	5	DCPS	
HEARST ES	TRUE	6	TRUE	3	PK4	5	Charter	
HENDLEY ES	TRUE	6	TRUE	8	PK3	5	DCPS	
HOPE COMMUNITY PCS LAMOND	TRUE	6	TRUE	4	PK3	5	DCPS	
HOPE COMMUNITY PCS TOLSON	TRUE	6	TRUE	5	PK3	8	Charter	
HOUSTON ES	TRUE	6	TRUE	7	PK3	5	Charter	
HYDE ADDISON ES	TRUE	6	TRUE	2	PK3	5	DCPS	
IDEAL ACADEMY PCS	TRUE	6	TRUE	4	PK3	8	DCPS	
IMAGINE SOUTHEAST PC	TRUE	4	FALSE	8	PK4	1	Charter	
INGENUITY PREP PCS	TRUE	3	TRUE	8	PK3	3	Charter	
INSPIRED TEACHING DEMONSTRATION PCS	TRUE	5	TRUE	5	PK3	8	Charter	

J O WILSON ES	TRUE	6	TRUE	6	PK3	5	Charter	
JANNEY ES	TRUE	6	TRUE	3	PK4	5	DCPS	
KENILWORTH ES	TRUE	3	FALSE	7	PS**	5	DCPS	
KETCHAM ES	TRUE	6	TRUE	8	PK3	5	DCPS	
KEY ES	TRUE	6	TRUE	3	PK4	5	DCPS	
KIMBALL ES	TRUE	6	TRUE	7	PK3	5	DCPS	
KING M L ES	TRUE	6	TRUE	8	PK3	5	DCPS	
KIPP DC ARTS AND TECHNOLOGY ACADEMY PCS	TRUE	2	TRUE	7	PK3	KG	DCPS	
KIPP DC CONNECT ACADEMY PCS	TRUE	2	TRUE	5	PK3	KG	Charter	
KIPP DC DISCOVER ACADEMY PCS	TRUE	6	TRUE	8	PK3	KG	Charter	
KIPP DC GROW ACADEMY PCS	TRUE	5	TRUE	6	PK3	KG	Charter	
KIPP DC PCS PROMISE ACADEMY	TRUE	1	TRUE	7	KG	4	Charter	
LAFAYETTE ES	TRUE	6	TRUE	4	PK4	5	Charter	
LANGDON ES	TRUE	6	TRUE	5	PK3	5	DCPS	
LANGLEY ES	TRUE	5	TRUE	5	PK3	5	DCPS	
LASALLE BACKUS EC	TRUE	6	TRUE	4	PK3	8	DCPS	
LATIN AMERICAN MONTESSORI BILINGUAL PCS	**TRUE**	**6**	**TRUE**	**4**	**PK3**	**5**	**DCPS**	**Whole-School English/Spanish Dual Immersion**
LECKIE ES	TRUE	6	TRUE	8	PK3	7	Charter	
LEE MONTESSORI PCS	TRUE	2	TRUE	5	PK3	3	DCPS	
LUDLOW TAYLOR ES	TRUE	6	TRUE	6	PK3	5	Charter	
M C TERRELL ES	FALSE	0	FALSE	8	PS**	5	DCPS	
MALCOLM X ES AT GREEN	TRUE	6	TRUE	8	PK3	5	DCPS	
MAMIE D LEE SCHOOL	FALSE	0	FALSE	5	PK3	Adult	DCPS	
MANN ES	TRUE	6	TRUE	3	PK4	5	DCPS	
MARIE REED ES AT MACFARLAND	FALSE	0	FALSE	1	PK3	5	DCPS	English/Spanish Dual Immersion; Traditional English classroom
MARSHALL EC	TRUE	3	FALSE	5	PS**	5	DCPS	
MARY MCLEOD BETHUNE DAY ACADEMY PCS	TRUE	6	TRUE	5	PK3	8	DCPS	
MAURY ES	TRUE	6	TRUE	6	PK3	5	Charter	
MERIDIAN PCS	TRUE	6	TRUE	1	PK3	8	DCPS	
MINER ES	TRUE	6	TRUE	6	PK3	5	Charter	
MONTGOMERY ES	FALSE	0	FALSE	6	PS**	4	DCPS	
MOTEN ES	TRUE	6	TRUE	8	PK3	5	DCPS	
MUNDO VERDE BILINGUAL PCS	**TRUE**	**5**	**TRUE**	**5**	**PK3**	**5**	**DCPS**	**Whole-School English/Spanish Dual Immersion**
MURCH ES	TRUE	6	TRUE	3	PK4	5	Charter	
NALLE ES	TRUE	6	TRUE	7	PK3	5	DCPS	
NIA COMMUNITY PCS	TRUE	1	FALSE	7	PK*	6	DCPS	
NOYES ES	TRUE	6	TRUE	5	PK3	5	Charter	
ORR ES	TRUE	6	TRUE	8	PK3	5	DCPS	
OYSTER ADAMS BILINGUAL SCHOOL	**TRUE**	**6**	**TRUE**	**3**	**PK4**	**8**	**DCPS**	**Whole-School English/Spanish Dual Immersion**
PATTERSON ES	TRUE	6	TRUE	8	PK3	5	DCPS	
PAYNE ES	TRUE	6	TRUE	6	PK3	5	DCPS	
PEABODY ES CAPITOL HILL CLUSTER	TRUE	6	TRUE	6	PK3	KG	DCPS	
PERRY STREET PREPARATORY PCS	TRUE	6	TRUE	5	PK3	8	DCPS	
PLUMMER ES	TRUE	6	TRUE	7	PK3	5	Charter	
POTOMAC PREPARATORY PCS	TRUE	6	TRUE	5	PK3	8	DCPS	

POWELL ES	FALSE	0	FALSE	4	PK3	5	Charter	English/Spanish Dual Immersion; Traditional English classroom
PROSPECT LC	FALSE	0	FALSE	6	PK*	8	DCPS	
RANDLE HIGHLANDS ES	TRUE	6	TRUE	7	PK3	5	DCPS	
RAYMOND EC	TRUE	6	TRUE	4	PK3	8	DCPS	
ROCKETSHIP DC PCS	FALSE	0	FALSE	8	PK3	4	DCPS	
ROOTS PCS	TRUE	5	TRUE	4	PK3	5	Charter	
ROOTS PCS NORTH CAPITOL STREET CAMPUS	TRUE	1	FALSE	4	PK3	5	Charter	
ROSS ES	TRUE	6	TRUE	2	PK3	5	Charter	
SAVOY ES	TRUE	6	TRUE	8	PK3	5	DCPS	
SCHOOL FOR ARTS IN LEARNING PCS SAIL	TRUE	1	FALSE	2	K	8	DCPS	
SCHOOL WITHIN SCHOOL AT GODING	TRUE	4	TRUE	6	PK3	4	Charter	
SCHOOL WITHOUT WALLS AT FRANCIS STEVENS	TRUE	6	TRUE	2	PK3	8	DCPS	
SEATON ES	TRUE	6	TRUE	6	PK3	5	DCPS	
SELA PCS	**TRUE**	**3**	**TRUE**	**4**	**PK3**	**2**	**DCPS**	**Whole-School English/Hebrew Dual Immersion**
SEPTIMA CLARK PCS	TRUE	3	FALSE	8	PS**	5	Charter	
SHAED ES	TRUE	1	FALSE	5	PS**	8	Charter	
SHEPHERD ES	TRUE	6	TRUE	4	PK3	5	DCPS	
SHINING STARS MONTESSORI ACADEMY PCS	TRUE	5	TRUE	5	PK3	5	DCPS	
SIMON ES	TRUE	6	TRUE	8	PK3	5	Charter	
SMOTHERS ES	TRUE	6	TRUE	7	PK3	5	DCPS	
ST. COLETTA SPECIAL EDUCATION PCS	FALSE	0	FALSE	7	N/A	N/A	DCPS	
STANTON ES	TRUE	6	TRUE	8	PK3	5	Charter	
STODDERT ES	TRUE	6	TRUE	3	PK4	5	DCPS	
TAKOMA EC	TRUE	6	TRUE	4	PK3	8	DCPS	
THE CHILDRENS GUILD PCS	TRUE	1	TRUE	5	KG	8	DCPS	
THOMAS ES	TRUE	6	TRUE	7	PK3	5	Charter	
THOMSON ES	TRUE	6	TRUE	2	PK3	5	DCPS	
TREE OF LIFE COMMUNITY PCS	TRUE	5	FALSE	5	PK3	8	DCPS	
TRUESDELL EC	TRUE	6	TRUE	4	PK3	8	Charter	
TUBMAN ES	TRUE	6	TRUE	1	PK3	5	DCPS	
TURNER ES	TRUE	6	TRUE	8	PK3	5	DCPS	
TWO RIVERS PCS 4TH ST	TRUE	6	TRUE	6	PK3	8	DCPS	
TWO RIVERS PCS MIDDLE SCHOOL	FALSE	0	FALSE	6	PK3	8	Charter	
TWO RIVERS PCS YOUNG	TRUE	1	TRUE	5	PK3	2	Charter	
TYLER ES	FALSE	0	FALSE	6	PK3	5	Charter	English/Spanish Dual Immersion; Traditional English classroom
VAN NESS ES	TRUE	1	TRUE	6	PK3	1	DCPS	
WALKER JONES EC	TRUE	6	TRUE	6	PK3	8	DCPS	
WASHINGTON YU YING PCS	**TRUE**	**6**	**TRUE**	**5**	**PK3**	**5**	**DCPS**	**Whole-School English/Chinese Dual Immersion**
WEST EC	TRUE	6	TRUE	4	PK3	8	Charter	
WHEATLEY EC	TRUE	6	TRUE	5	PK3	8	DCPS	
WHITTIER EC	TRUE	6	TRUE	4	PK3	8	DCPS	
WILLIAM E DOAR JR WEDJ EDGEWOOD ELEMENTARY PCS	TRUE	1	FALSE	5	PK3	8	DCPS	
WINSTON EC	TRUE	3	FALSE	7	PS**	8	Charter	

* Listed as PK on equity report: assumed to be PK4.

** Listed as PS on equity report: assumed to be PK3.

Appendix 2: Entropy Index Calculation and Notes

Diversity indices measure the number of groups or types that are present in a population, and how evenly those groups or types are represented in that population. Diversity indices are used not only in human demographic studies, but also in ecology, economics, information science, and other fields.

Typically, a diversity index has a set range, with extremes representing either an entirely homogenous population or a population with equal numbers of individuals from each category, and the index represents the entire population. However, in a case such as the representation of racial groups schools, we want to be able to compare the distribution of the population at these individual schools to a common standard: the balance of racial groups at the district level.[1] For this purpose we have chosen to use **Theil's information theory index** or **entropy index** (Theil and Finezza 1971), which builds on the work of econometrician Henri Theil (1967, 1972), who introduced the index to study racial segregation in Chicago Public Schools. Others have used the index to study residential segregation (e.g., Reardon and Firebaugh 2002; Reardon and O'Sullivan 2004; White 1986). However, Roberto argues that the index is better understood as a measure of relative homogeneity than segregation, as it "compares the diversity of local areas to the overall diversity of a region" (Roberto 2015: 6).

In our case, for a single school (i), the **individual school's entropy index** (H_i) indicates the standardized difference between the school's entropy (E_i) and the region's entropy (E), by dividing the difference ($E - E_i$) by the region's entropy (E) (Theil and Finezza 1971; Roberto 2015):

$$H_i = \frac{E - E_i}{E}$$

And the **overall District of Columbia's entropy index** (H) is the weighted average of H_i across all schools:

$$H = 1 - \frac{E_i}{E}$$

While H typically ranges from [0,1] (Roberto 2015), H_i may have both positive and negative values

a. H

   i. H=1: every individual school's E_i should be 0, which means every individual school in the region contains only one race of students. All individual schools contain one group only (maximum segregation, least balanced). (Iceland 2004)

[1] While we recognize that each ward, zip code, and neighborhood cluster has its own distinct "entropy," or balance of racial/ethnic groups, for this study we calculate entropy indices based on the overall entropy of the district, since each school in the study is available to students beyond the limits of ward, zip code, and neighborhood cluster.

ii. H=0: $\underline{E_i} = E$, the average entropy across all individuals schools equal to the region's entropy. All individual schools have the same composition as the entire metropolitan area (i.e., maximum integration, most balanced). (Iceland 2004)

iii. H typically ranges from [0,1]

b. H_i

i. $H_i = 1: E_i = 0$; there is only one racial group in individual school i.

ii. $H_i = 0: E = E_i$; region's entropy = the individual school i's entropy; the relative sizes of groups within an individual school exactly mirror the distribution of groups in the region.

iii. $H_i > 0: E > E_i$; racial groups are less evenly distributed (represented) in the individual school i than in the region. The region is more balanced than the individual school i.

iv. $H_i < 0: E < E_i$; "hyper-integration" (Reardon and O'Sullivan 2004); racial groups are more evenly distributed (represented) in the individual school i than in the region; individual school i is more balanced than the region.

Calculation of entropy (E_i, E)

a. (Roberto 2015) Outcome (m), probability of occurrence (π_m). Weighting each outcome by the probability of its occurrence, the **overall entropy (E)** is

$$E = \sum_{m=1}^{M} \pi_m \ln\left(\frac{1}{\pi_m}\right)$$

b. (Iceland 2004)

i. Individual school's entropy (entropy score, or diversity)

$$E_i = \sum_{r=1}^{r} (\pi_{ri}) \ln\left(\frac{1}{\pi_{ri}}\right)$$

1. π_{ri} refers to a particular racial/ethnic group's proportion of the population in individual school i

ii. Metropolitan area's entropy (entropy score, or diversity), overall diversity

$$E = \sum_{r=1}^{r} (\pi_r) \ln\left(\frac{1}{\pi_r}\right)$$

1. π_r refers to a particular racial/ethnic group's proportion of the whole metropolitan area population

Calculation of entropy indices (H_i, H)

c. Individual school's entropy index H_i

i. Measures the extent to which the individual school's entropy (E_i) is reduced below the region's entropy (E), standardized by dividing by the region's entropy (E).

ii. $H_i = \frac{E-E_i}{E}$ or $H_i = 1 - \frac{E_i}{E}$

d. Region's entropy index H

i. The region's index score is the weighted average of H_i across all individual schools.

ii. $H = \sum_{i=1}^{n} \frac{t_i(E-E_i)}{ET} = 1 - \frac{\sum_{i=1}^{n} t_i E_i}{ET} = 1 - \frac{1}{E}\frac{\sum_{i=1}^{n} t_i}{T} E_i = 1 - \frac{\bar{E}_i}{E}$

- T: overall population count
- t_i: the population count for individual school i
- n: the number of individual schools in the region
- E_i: individual school i's entropy
- E: metropolitan area's entropy

Appendix 3: Descriptive Statistics (Longitudinal)

Kindergarten Population Racial/Ethnic Composition

Number and percentage of students in seven groups each year from 2010 to 2015

	District-wide kindergarten							
	Total	American Indian	Asian	Hispanic	Black	White	Pacific Islander	Two or more races
2010	5315	6 (0.11%)	83 (1.56%)	746 (14.04%)	3742 (70.41%)	661 (12.44%)	4 (0.08%)	73 (1.37%)
2011	5768	6 (0.10%)	101 (1.75%)	850 (14.74%)	4023 (69.75%)	704 (12.21%)	6 (0.10%)	78 (1.35%)
2012	6404	7 (0.11%)	93 (1.45%)	973 (15.19%)	4375 (68.32%)	817 (12.76%)	14 (0.22%)	125 (1.95%)
2013	6607	10 (0.15%)	102 (1.54%)	1040 (15.74%)	4478 (67.78%)	841 (12.73%)	6 (0.09%)	130 (1.97%)
2014	6840	10 (0.15%)	106 (1.55%)	1033 (15.10%)	4617 (67.50%)	927 (13.55%)	3 (0.04%)	144 (2.11%)
2015	6989	20 (0.29%)	105 (1.50%)	979 (14.00%)	4704 (67.31%)	991 (14.18%)	8 (0.11%)	182 (2.60%)

Number of students in seven groups in DLI kindergartens each year from 2010 to 2015

	Kindergarten (DLI schools)							
	Total	American Indian	Asian	Hispanic	Black	White	Pacific Islander	Two or more races
2010	373	0	13	204	82	64	1	9
2011	449	1	13	238	103	79	0	15
2012	554	0	20	276	108	117	0	33
2013	547	0	20	274	133	98	1	21
2014	558	0	19	264	117	127	0	31
2015	589	2	18	234	138	159	0	38

Number of students in seven groups in non-DLI kindergartens each year from 2010 to 2015

	Kindergarten (non-DLI schools)							
	Total	American Indian	Asian	Hispanic	Black	White	Pacific Islander	Two or more races
2010	4942	6	70	542	3660	597	3	64
2011	5319	5	88	612	3920	625	6	63
2012	5850	7	73	697	4267	700	14	92
2013	6060	10	82	766	4345	743	5	109
2014	6282	10	87	769	4500	800	3	113
2015	6400	18	87	745	4566	832	8	144

Kindergarten Populations Longitudinal Differences: Proportion Asian

Descriptive statistics

Year	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.01	118	0.03	0.00	0.25
2011	0.02	120	0.03	0.00	0.20
2012	0.01	123	0.03	0.00	0.20
2013	0.01	121	0.03	0.00	0.18
2014	0.02	123	0.04	0.00	0.26
2015	0.01	125	0.03	0.00	0.15

Descriptive statistics by DLI and non-DLI schools

Year	non-DLI					DLI				
	Mean	Count	Standard Deviation	Minimum	Maximum	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.01	111	0.03	0.00	0.25	0.03	7	0.05	0.00	0.14
2011	0.02	112	0.03	0.00	0.20	0.02	8	0.04	0.00	0.11
2012	0.01	115	0.03	0.00	0.20	0.03	8	0.04	0.00	0.11
2013	0.01	112	0.03	0.00	0.16	0.03	9	0.06	0.00	0.18
2014	0.02	114	0.04	0.00	0.26	0.03	9	0.04	0.00	0.12
2015	0.01	116	0.03	0.00	0.15	0.03	9	0.04	0.00	0.12

Comparison of Proportions of Asian Students across Schools

Year	Differences Among Schools				Differences Between DLI and non-DLI schools			
	Proportion	χ^2	df	p	DLI Proportion	Non-DLI Proportion	χ^2	p
2010	0.02	424.81	118	<.001	0.03	0.01	0.18	0.67
2011	0.02	334.17	119	<.001	0.03	0.02	0.07	0.80
2012	0.01	401.14	122	<.001	0.04	0.01	0.29	0.59
2013	0.02	447.18	120	<.001	0.04	0.01	0.29	0.59
2014	0.02	482.20	123	<.001	0.03	0.01	0.22	0.64
2015	0.02	467.35	124	<.001	0.03	0.01	0.16	0.69

* indicates significance at $\alpha = .05$.
df for tests of differences between DLI and non-DLI schools was 1.
Proportions given in this table are out of whole populations, not unweighted averages of school proportions.

Kindergarten Populations Longitudinal Differences: Proportion Black

Descriptive statistics

Year	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.74	118	0.32	0.00	1
2011	0.73	120	0.32	0.02	1
2012	0.71	123	0.33	0.04	1
2013	0.70	121	0.33	0.05	1
2014	0.69	123	0.33	0.03	1
2015	0.69	125	0.33	0.02	1

Descriptive statistics by DLI and non-DLI schools

Year	non-DLI					DLI				
	Mean	Count	Standard Deviation	Minimum	Maximum	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.78	111	0.30	0.00	1.00	0.23	7	0.15	0.08	0.49
2011	0.77	112	0.30	0.02	1.00	0.25	8	0.17	0.07	0.62
2012	0.75	115	0.30	0.04	1.00	0.18	8	0.12	0.07	0.37
2013	0.73	112	0.31	0.05	1.00	0.29	9	0.23	0.08	0.76
2014	0.72	114	0.31	0.03	1.00	0.24	9	0.20	0.03	0.71
2015	0.72	116	0.32	0.02	1.00	0.27	9	0.21	0.05	0.69

Comparison of Proportions of Black Students across Schools

Year	Differences Among Schools				Differences Between DLI and non-DLI schools			
	Proportion	χ^2	df	p	DLI Proportion	Non-DLI Proportion	χ^2	p
2010	0.70	2900.12	117	<.001	0.22	0.74	8.570*	<.001
2011	0.70	3207.56	119	<.001	0.23	0.74	9.117*	<.001
2012	0.68	3450.69	122	<.001	0.20	0.73	9.871*	<.001
2013	0.68	3523.84	120	<.001	0.24	0.72	8.565*	<.001
2014	0.68	3698.41	122	<.001	0.21	0.72	9.761*	<.001
2015	0.67	3931.09	124	<.001	0.23	0.71	8.714*	<.001

* indicates significance at $\alpha = .05$.
df for tests of differences between DLI and non-DLI schools was 1.
Proportions given in this table are out of whole populations, not unweighted averages of school proportions.

Kindergarten Populations Longitudinal Differences: Proportion Hispanic

Descriptive statistics

Year	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.14	118	0.21	0.00	1.00
2011	0.14	120	0.21	0.00	0.79
2012	0.15	123	0.21	0.00	0.85
2013	0.15	121	0.22	0.00	0.89
2014	0.15	123	0.21	0.00	0.89
2015	0.14	125	0.19	0.00	0.77

Descriptive statistics by DLI and non-DLI schools

Year	non-DLI					DLI				
	Mean	Count	Standard Deviation	Minimum	Maximum	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.11	111	0.19	0.00	1.00	0.54	7	0.25	0.02	0.79
2011	0.11	112	0.17	0.00	0.79	0.52	8	0.25	0.08	0.78
2012	0.12	115	0.18	0.00	0.76	0.54	8	0.25	0.06	0.85
2013	0.12	112	0.18	0.00	0.70	0.47	9	0.31	0.00	0.89
2014	0.12	114	0.18	0.00	0.73	0.46	9	0.31	0.05	0.89
2015	0.12	116	0.17	0.00	0.72	0.38	9	0.23	0.07	0.77

Comparison of Proportions of Hispanic Students across Schools

Year	Differences Among Schools				Differences Between DLI and non-DLI schools			
	Proportion	χ^2	df	p	DLI Proportion	Non-DLI Proportion	χ^2	p
2010	0.14	1241.54	117	< .001	0.55	0.11	10.43	< .001
2011	0.15	1425.49	119	< .001	0.53	0.12	10.24	< .001
2012	0.15	1601.94	122	< .001	0.50	0.12	8.34	< .001
2013	0.16	1679.44	120	< .001	0.50	0.13	8.81	< .001
2014	0.15	1737.28	122	< .001	0.47	0.12	9.32	< .001
2015	0.14	1728.56	124	< .001	0.40	0.12	5.47	0.02

* indicates significance at $\alpha = .05$.
df for tests of differences between DLI and non-DLI schools was 1.
Proportions given in this table are out of whole populations, not unweighted averages of school proportions.

Kindergarten Populations Longitudinal Differences: Proportion White

Descriptive statistics

Year	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.09	118	0.20	0.00	0.77
2011	0.10	120	0.20	0.00	0.83
2012	0.11	123	0.21	0.00	0.82
2013	0.11	121	0.21	0.00	0.75
2014	0.12	123	0.22	0.00	0.79
2015	0.13	125	0.21	0.00	0.77

Descriptive statistics by DLI and non-DLI schools

Year	non-DLI					DLI				
	Mean	Count	Standard Deviation	Minimum	Maximum	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.09	111	0.20	0.00	0.77	0.17	7	0.13	0.00	0.32
2011	0.09	112	0.20	0.00	0.83	0.18	8	0.12	0.00	0.35
2012	0.10	115	0.21	0.00	0.82	0.20	8	0.13	0.00	0.38
2013	0.11	112	0.22	0.00	0.75	0.18	9	0.13	0.00	0.37
2014	0.12	114	0.22	0.00	0.79	0.21	9	0.14	0.01	0.42
2015	0.11	116	0.21	0.00	0.77	0.26	9	0.13	0.02	0.44

Comparison of Proportions of White Students across Schools

Year	Differences Among Schools				Differences Between DLI and non-DLI schools			
	Proportion	χ^2	df	p	DLI Proportion	Non-DLI Proportion	χ^2	p
2010	0.12	2551.20	117	<.001	0.17	0.12	0.16	0.69
2011	0.12	2719.46	119	<.001	0.18	0.12	0.24	0.63
2012	0.13	3016.62	122	<.001	0.21	0.12	0.56	0.45
2013	0.13	3009.25	120	<.001	0.18	0.12	0.24	0.62
2014	0.14	3055.61	122	<.001	0.23	0.13	0.72	0.40
2015	0.14	2924.65	124	<.001	0.27	0.13	1.34	0.25

* indicates significance at $\alpha = .05$.
df for tests of differences between DLI and non-DLI schools was 1.
Proportions given in this table are out of whole populations, not unweighted averages of school proportions.

Kindergarten Populations Longitudinal Differences: Entropy index

Descriptive statistics

Year	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.54	118	0.45	-0.40	1
2011	0.51	120	0.46	-0.58	1
2012	0.49	123	0.41	-0.45	1
2013	0.48	121	0.46	-0.52	1
2014	0.46	123	0.45	-0.40	1
2015	0.45	125	0.46	-0.40	1

Descriptive statistics by DLI and non-DLI schools

Year	non-DLI					DLI				
	Mean	Count	Standard Deviation	Minimum	Maximum	Mean	Count	Standard Deviation	Minimum	Maximum
2010	0.58	111	0.44	-0.40	1.00	-0.03	7	0.24	-0.33	0.33
2011	0.55	112	0.45	-0.53	1.00	-0.01	8	0.30	-0.58	0.44
2012	0.53	115	0.39	-0.38	1.00	-0.03	8	0.33	-0.45	0.47
2013	0.51	112	0.45	-0.50	1.00	0.05	9	0.39	-0.52	0.59
2014	0.50	114	0.43	-0.37	1.00	-0.02	9	0.36	-0.40	0.60
2015	0.50	116	0.45	-0.37	1.00	-0.13	9	0.22	-0.40	0.29

Independent T-test for equality of means of entropy index in each year[2]

Year	t	*df*	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
2010*	6.15	8.70	<.001	0.61	.39	.84
2011*	4.87	9.35	<.001	0. 56	.30	.82
2012*	3.93	121	<.001	0.56	.28	.84
2013*	3.01	119	<.001	0.46	.16	.77
2014*	3.51	121	<.001	0.52	.23	.82
2015*	7.36	13.63	<.001	0.63	.44	.81

* indicates significance at $\alpha = .05$.

[2] In each year's independent t-test, a random sampling is assumed, and the homogeneity of variance issues are assessed. Violation of the assumption of normality was found, however, empirically speaking, as long as the sample is based on 30 or more observations, the sampling distribution of the mean can be safely assumed to be normal (Kwak & Kim, 2017).

Appendix 4: Hierarchical Linear Modeling[3]

Model Estimation

Calculation

Year is used as a continuous level-one variable, centered around the first year of the study, SY 2010–11. An uncentered dichotomous variable indicating the DLI status of the school is used as a level-2 predictor. DLI status is utilized as a dichotomous predictor of slopes. Significance of this DLI predictor indicates differences in demographic patterns between DLI and non-DLI schools. Differences between individual schools, and varied patterns of demographic changes in the District, are accounted for through random effects: intercept variance (level-1) will be considered to represent variance in initial school demographic measures, while slope variance (level-2) will be considered to represent variance in rates of change in demographic measures between schools over the range of years of the study; significance of both will be noted in results. The following formulae express the model estimating *D*, or the respective demographic measures:

Level-1 Model

$$D_t = \pi_0 + \pi_1*(YEAR_t) + e_t$$

Level-2 Model

$$\pi_0 = \beta_{00} + \beta_{01}*(DLI) + r_0$$

$$\pi_1 = \beta_{10} + \beta_{11}*(DLI) + r_1$$

Combined Multilevel Model

$$D_t = \beta_{00} + \beta_{01}*DLI + \beta_{10}*YEAR_t + \beta_{11}*DLI*YEAR_t + r_0 + r_1*YEAR_t + e_t$$

The multilevel model building process and detailed results are shown below. The following assumptions of multilevel models were reviewed for each model fit: at level 1, normality and homogeneity of variance of residuals, and independence of residuals and level-1 predictor *year*; at level 2, multivariate normality of residuals, independence of residuals and the level-2 predictor (*DLI status*); finally, independence of level-1 and level-2 residuals was verified. Violations of the assumption of multivariate normality were found in the four models describing individual races and violations of the assumption of level-2 homogeneity of variance were detected in all five models fit, but the findings and interpretations of the models were upheld.[4] The assumption of independence of observations was

[3] Multilevel models fit using HLM 7.03 (Raudenbush & Bryk, 2017), estimated with full maximum likelihood estimation. Linear models were selected following visual observation of the data and due to the short time frame of the study.

[4] Multilevel models are robust to violations of normality when there are over 100 level-2 units (Maas et al. 2004; Cheong, Fotiu, & Raudenbush, 2001; Hox & Maas, 2001; Krauermann & Carroll, 2001), and this assumption was accepted. Violation of the assumption of homogeneity of variance is understood to affect standard errors, but not coefficient estimates (Raudenbush & Bryk, 2002). This violation was considered an artifact of the sample size and is an acknowledged limitation of this study. As the findings from interpretation of the coefficients are in line with known demographic changes in the District, we consider them valid within the scope of this study.

violated to a slight degree due to the fact that approximately 6% of students nationwide repeat kindergarten annually; this data was not available on a school or district level for the District of Columbia. However, no patterns are typically found in the demographics of students who repeat kindergarten (U.S. Department of Education, 2013), and the violation was determined to not impact the models' validity.

All model explanations below are based on these results. The findings described below are considered to be interpreted as valid with all other variables held constant: that is to say, these models consider the relationships between time, DLI, and the demographic variables in isolation, and the findings should be interpreted as such. To investigate the relationships between each outcome variable and DLI and year factors, we use Model 5 as our final model.

Alternate, exploratory analyses of the four proportion models were performed in order to further verify findings: the outcome variables were transformed into count data and multilevel models were fit assuming a Poisson distribution. Significance and direction of slope parameters in the population-average model fits were compared to the presented findings. In the cases of Asian, Black, and Hispanic, direction of change and significance matched, but in the White model, directions of change matched but the slopes significances did not. In all cases, examination of the residuals revealed no violations of the assumptions of multilevel models. Examination of the data indicated that the difference in the White models between the original models and the Poisson models was likely due to rounding differences in the transformation to count data that existed in the White proportions but not the others. These procedures, while exploratory, provide further support of the validity of the presented models.

Reporting Tables from HLM Building Process

Kindergarten proportion Asian reporting table

	Model 1		Model 2		Model 3		Model 4		Model 5	
Fixed Part	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept π_0										
Intercept β_{00}	0.013*	0.002	0.013*	0.002	0.012*	0.002	0.012*	0.002	0.012*	0.002
Bilingual Status β_{01}					0.015	0.013	0.015	0.013	0.015	0.014
Slope on Year π_1										
Intercept β_{10}			0.000	0.000	0.000	0.000	-0.000	0.000	-0.000	0.000
Bilingual Status β_{11}									0.000	0.001
Random Effects	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*
τ_{00}	0.000*	<0.001	0.000*	<0.001	0.000*	<0.001	0.000*	<0.001	0.000*	<0.001
Variance in Years Slope							0.000	>0.500	0.000	>0.500
σ^2	0.000		0.000		0.000		0.000		0.000	
Model Fit	Deviance	*df*	Deviance	*df*	Deviance	df	Deviance	*df*	Deviance	*df*
$-2LL$	-3463.490	3	-3463.490	4	-3466.002	5	-3467.378	7	-3467.379	8

* = Significant at $\alpha = .05$

Random Effect	**Standard Deviation**	**Variance Component**	***df***	χ^2	***p*-value**
Intercept r_0	0.025	0.001*	134	647.782	<0.001
Year slope r_1	0.001	0.000	134	131.595	>0.500
Level-1,	0.018	0.000			

Kindergarten proportion Black reporting table

	Model 1		Model 2		Model 3		Model 4		Model 5	
Fixed Part	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept π_0										
Intercept β_{00}	0.739*	0.025	0.756*	0.025	0.786*	0.024	0.786*	0.024	0.786*	0.024
Bilingual Status β_{01}					-0.499*	0.070	-0.498*	0.071	-0.499*	0.072
Slope on Year π_1										
Intercept β_{10}			-0.007*	0.002	-0.007*	0.002	-0.007*	0.002	-0.007*	0.003
Bilingual Status β_{11}									0.000	0.004
Random Effects	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*
τ_{00}	0.093*	<0.001	0.093*	<0.001	0.080*	<0.001	0.077*	<0.001	0.077*	<0.001
Variance in Years Slope							0.000*	<0.001	0.000*	<0.001
σ^2	0.005		0.005		0.005		0.004		0.004	
Model Fit	Deviance	*df*	Deviance	*df*	Deviance	df	Deviance	*df*	Deviance	*df*
$-2LL$	-1109.973	3	-1125.589*	4	-1149.917*	5	-1200.734*	7	-1200.734*	8

* = Significant at $\alpha = .05$

Random Effect	**Standard Deviation**	**Variance Component**	***df***	χ^2	***p*-value**
Intercept r_0	0.278	0.077*	134	4776.583	<0.001
Year slope r_1	0.020	0.000*	134	318.042	<0.001
Level-1,	0.062	0.004			

Kindergarten proportion Hispanic reporting table

	Model 1		Model 2		Model 3		Model 4		Model 5	
Fixed Part	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept π_0										
Intercept β_{00}	0.129*	0.015	0.128*	0.017	0.107*	0.015	0.108*	0.015	0.105*	0.015
Bilingual Status β_{01}					0.350*	0.087	0.346*	0.087	0.401*	0.090
Slope on Year π_1										
Intercept β_{10}			0.001	0.002	0.001	0.002	0.000	0.002	0.002	0.002
Bilingual Status β_{11}									-0.019*	0.007
Random Effects	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*
τ_{00}	0.035*	<0.001	0.035*	<0.001	0.028*	<0.001	0.030*	<0.001	0.030*	<0.001
Variance in Years Slope							0.000	<0.001	0.000*	<0.001
σ^2	0.005		0.005		0.005		0.004		0.004	
Model Fit	Deviance	*df*	Deviance	*df*	Deviance	df	Deviance	*df*	Deviance	*df*
$-2LL$	-1337.170	3	-1337.278	4	-1369.688*	5	-1404.709*	7	-1410.328*	8

* = Significant at $\alpha = .05$

Random Effect	**Standard Deviation**	**Variance Component**	***df***	χ^2	***p*-value**
Intercept r_0	0.173	0.030*	134	2067.625	<0.001
Year slope r_1	0.016	0.000*	134	269.472	<0.001
Level-1,	0.060	0.004			

Kindergarten proportion White reporting table

	Model 1		Model 2		Model 3		Model 4		Model 5[5]	
Fixed Part	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept π_0										
Intercept β_{00}	0.100*	0.016	0.092*	0.016	0.086*	0.017	0.085*	0.017	0.087*	0.017
Bilingual Status β_{01}					0.107*	0.040	0.102*	0.040	0.078	0.040
Slope on Year π_1										
Intercept β_{10}			0.003*	0.001	0.003*	0.001	0.003*	0.001	0.003	0.002
Bilingual Status β_{11}									0.011*	0.004
Random Effects	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*
τ_{00}	0.037*	<0.001	0.036*	<0.001	0.036*	<0.001	0.036*	<0.001	0.036*	<0.001
Variance in Years Slope							0.000*	<0.001	0.000*	<0.001
σ^2	0.002		0.002		0.002		0.002		0.002	
Model Fit	Deviance	*df*	Deviance	*df*	Deviance	df	Deviance	*df*	Deviance	*df*
$-2LL$	-1761.135	3	-1769.127	4	-1771.755*	5	-1806.103*	7	-1809.974*	8

* = Significant at $\alpha = .05$

Random Effect	**Standard Deviation**	**Variance Component**	***df***	χ^2	***p*-value**
Intercept r_0	0.190	0.036*	134	5337.597	<0.001
Year slope r_1	0.012	0.000*	134	301.671	<0.001
Level-1,	0.041	0.002			

[5] Since 10 was non-significant and 11 was significant, the DLI slope $(10+11)$ was confirmed by reverse-coding the dichotomous DLI predictor in order to confirm significance. When reverse-coded, both 10 and 10 were significant.

Kindergarten entropy index (H_i index) reporting table and variance components

	Model 1		Model 2		Model 3		Model 4		Model 5	
Fixed Part	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE	Estimate	SE
Intercept π_0										
Intercept β_{00}	0.526*	0.035	0.549*	0.036	0.585*	0.036	0.585*	0.036	0.584*	0.036
Bilingual Status β_{01}					-0.581*	0.094	-0.580*	0.094	-0.554*	0.102
Slope on Year π_1										
Intercept β_{10}			-0.009*	0.004	-0.009*	0.004	-0.010*	0.004	-0.009*	0.004
Bilingual Status β_{11}									-0.009	0.010
Random Effects	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*	Estimate	*p*
τ_{00}	0.178*	<0.001	0.177*	<0.001	0.158*	<0.001	0.162*	<0.001	0.162*	<0.001
Variance in Years Slope							0.001*	0.002	0.001*	0.002
σ^2	0.019		0.018		0.018		0.017		0.017	
Model Fit	Deviance	*df*	Deviance	*df*	Deviance	df	Deviance	*df*	Deviance	*df*
$-2LL$	-274.514	3	-283.148	4	-299.895*	5	-306.349*	7	-306.793*	8

* = Significant at $\alpha = .05$

Random Effect	**Standard Deviation**	**Variance Component**	***df***	χ^2	***p*-value**
Intercept r_0	0.402	0.162*	134	2230.391	<0.001
Year sloper_1	0.021	0.000*	134	187.278	0.002
Level-1,	0.130	0.017			

Appendix 5: Descriptive Statistics Tables (Single-Year Snapshot Study)

Post-Analysis Variables

Proportion Asian in each school's kindergarten cohort

- Kindergarten only
- Number of Asian students in a school's kindergarten cohort divided by the total number of students in the school's kindergarten cohort
- SY 2015–16
- Data source: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx

Descriptive Statistics

N	125
Mean	.01
Median	.00
Std. Deviation	.03
Range	0
Minimum	0
Maximum	0

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	.01	.01	2	.02	.03	5	.02	.02
2	5	.07	.05	0	.	.	5	.07	.05
3	7	.07	.04	1	.01	.	8	.06	.05
4	18	.00	.01	2	.00	.00	20	.00	.01
5	25	.01	.03	4	.04	.05	29	.02	.04
6	19	.01	.02	0	.	.	19	.01	.02
7	17	.00	.01	0	.	.	17	.00	.01
8	22	.00	.00	0	.	.	22	.00	.00
All Schools	116	.01	.03	9	.02	.04	125	.01	.03

Proportion Black in each school's kindergarten cohort

- Kindergarten only
- Number of Black students in a school's kindergarten cohort divided by the total number of students in the school's kindergarten cohort
- SY 2015–16
- Data source: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx

Descriptive Statistics

N	125
Mean	.69
Median	.88
Std. Deviation	.33
Range	1
Minimum	0
Maximum	1

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	0.44	0.16	2	0.14	0.08	5	0.32	0.2
2	5	0.31	0.16	0	.	.	5	0.31	0.16
3	7	0.08	0.05	1	0.07	.	8	0.08	0.05
4	18	0.53	0.26	2	0.37	0.45	20	0.52	0.27
5	25	0.81	0.23	4	0.34	0.11	29	0.74	0.27
6	19	0.67	0.29	0	.	.	19	0.67	0.29
7	17	0.97	0.03	0	.	.	17	0.97	0.03
8	22	0.97	0.06	0	.	.	22	0.97	0.06
All Schools	116	0.72	0.32	9	0.27	0.21	125	0.69	0.33

Proportion Hispanic in each school's kindergarten cohort

- Kindergarten only
- Number of Hispanic students in a school's kindergarten cohort divided by the total number of students in the school's kindergarten cohort
- SY 2015–16
- Data source: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx

Descriptive Statistics

N	125
Mean	.14
Median	.06
Std. Deviation	.19
Range	1
Minimum	0
Maximum	1

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	0.53	0.15	2	0.71	0.08	5	0.6	0.15
2	5	0.26	0.22	0	.	.	5	0.26	0.22
3	7	0.12	0.05	1	0.45	.	8	0.16	0.12
4	18	0.34	0.24	2	0.22	0.19	20	0.32	0.23
5	25	0.07	0.07	4	0.27	0.15	29	0.1	0.11
6	19	0.08	0.10	0	.	.	19	0.08	0.1
7	17	0.02	0.03	0	.	.	17	0.02	0.03
8	22	0.01	0.02	0	.	.	22	0.01	0.02
All Schools	116	0.12	0.17	9	0.38	0.23	125	0.14	0.19

Proportion White in each school's kindergarten cohort

- Kindergarten only
- Number of White students in a school's kindergarten cohort divided by the total number of students in the school's kindergarten cohort
- SY 2015–16
- Data source: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx

Descriptive Statistics

N	125
Mean	.12
Median	.01
Std. Deviation	.21
Range	1
Minimum	0
Maximum	1

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	0.01	0.02	2	0.11	0.13	5	0.05	0.09
2	5	0.27	0.20	0	.	.	5	0.27	0.2
3	7	0.66	0.10	1	0.44	.	8	0.63	0.12
4	18	0.08	0.18	2	0.3	0.19	20	0.1	0.19
5	25	0.08	0.16	4	0.26	0.05	29	0.11	0.16
6	19	0.19	0.24	0	.	.	19	0.19	0.24
7	17	0.00	0.00	0	.	.	17	0	0
8	22	0.01	0.04	0	.	.	22	0.01	0.04
All Schools	116	0.11	0.21	9	0.26	0.13	125	0.12	0.21

Proportion EL in each school

- Whole school
- Operationalization: Defined under No Child Left Behind, as cited by OSSE: https://osse.dc.gov/sites/default/files/dc/sites/osse/publication/attachments/SY%202015-16%20Enrollment%20Audit%20Handbook%208%2011%2015.pdf
- SY 2015–16
- Source: https://osse.dc.gov/enrollment

Descriptive Statistics

N	125
Mean	.09
Median	.03
Std. Deviation	.14
Range	1
Minimum	0
Maximum	1

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	0.33	0.09	2	0.54	0	5	0.41	0.13
2	5	0.18	0.18	0	.	.	5	0.18	0.18
3	7	0.10	0.04	1	0.16	.	8	0.1	0.04
4	18	0.24	0.17	2	0.27	0.15	20	0.24	0.17
5	25	0.05	0.07	4	0.22	0.2	29	0.08	0.11
6	19	0.04	0.09	0	.	.	19	0.04	0.09
7	17	0.01	0.02	0	.	.	17	0.01	0.02
8	22	0.00	0.01	0	.	.	22	0	0.01
All Schools	116	0.08	0.13	9	0.29	0.2	125	0.09	0.14

Proportion free/reduced lunch eligible

- Whole school
- Operationalization: *Calculated:* Proportion Free and Reduced Lunch Available: The count of students eligible for free or reduced-price lunch divided by the total number of students.
- The sum of the free lunch eligible and reduced-price lunch eligible students is available only if both figures were reported by a given school (U.S. Department of Education, n.d.).
- SY 2015–16
- Source: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx

Descriptive Statistics

N	125
Mean	0.74
Median	0.99
Std. Deviation	0.36
Range	1.00
Minimum	0.00
Maximum	1.00

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	1.00	0.00	2	1.00	0.00	5	1.00	0.00
2	5	0.53	0.43	0	.	.	5	0.53	0.43
3	7	0.08	0.05	1	0.22	.	8	0.10	0.07
4	18	0.81	0.28	2	0.41	0.23	20	0.77	0.30
5	25	0.71	0.34	4	0.23	0.23	29	0.64	0.37
6	19	0.70	0.38	0	.	.	19	0.70	0.38
7	17	1.00	0.00	0	.	.	17	1.00	0.00
8	22	0.91	0.24	0	.	.	22	0.91	0.24
All Schools	116	0.77	0.35	9	0.44	0.37	125	0.74	0.36

In-seat attendance rate in each school

- Whole school
- Operationalization: "In-seat attendance rates are calculated by dividing the total number of students' days present by the total number of students' days enrolled in the school." (Definition in school equity reports from OSSE)
- Year: SY 2013–14
- Source: https://osse.dc.gov/page/2013-14-school-year-equity-reports

Descriptive Statistics

N	116
Mean	93.22
Median	93.00
Std. Deviation	2.537
Range	13
Minimum	85
Maximum	98

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	93.00	.00	2	95.50	.71	5	94.00	1.41
2	5	95.40	2.07	0	.	.	5	95.40	2.07
3	7	96.57	.98	1	96.00	.	8	96.50	.93
4	17	94.24	1.60	2	94.00	2.83	19	94.21	1.65
5	21	92.57	1.91	4	95.50	1.00	25	93.04	2.09
6	17	93.35	2.45	0	.	.	17	93.35	2.45
7	17	92.00	1.87	0	.	.	17	92.00	1.87
8	20	91.40	3.07	0	.	.	20	91.40	3.07
All Schools	107	93.06	2.54	9	95.22	1.39	116	93.22	2.54

Suspension rate

- Whole school
- Operationalization: Suspension rates are calculated by dividing the total number of students with out-of-school suspensions of 1 or more full days (11 or more days in the case of long-term suspensions) in this school by the total number of students enrolled, as determined by the [date] enrollment audit. (Definition in school equity reports from OSSE)
- Year: SY 2013–14
- Source: https://osse.dc.gov/page/2013-14-school-year-equity-reports

Descriptive Statistics

N	116
Mean	6.44
Median	5.00
Std. Deviation	6.73
Range	34.00
Minimum	.00
Maximum	34.00

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	5.33	2.08	2	2.00	.00	5	4.00	2.35
2	5	3.40	3.78	0	.	.	5	3.40	3.78
3	7	.00	.00	1	3.00	.	8	.38	1.06
4	17	4.29	3.89	2	2.50	3.54	19	4.11	3.80
5	21	8.67	7.53	4	2.50	1.29	25	7.68	7.26
6	17	7.00	7.27	0	.	.	17	7.00	7.27
7	17	8.41	7.00	0	.	.	17	8.41	7.00
8	20	8.75	8.21	0	.	.	20	8.75	8.21
All Schools	107	6.78	6.89	9	2.44	1.51	116	6.44	6.73

Number of Metrobus/Metrorail lines

- Whole school
- Operationalization: Single variable, sum of Metrorail and Metrobus lines by which school is accessible
- Year: SY 2015–16
- Source: http://www.myschooldc.org/resources/data
    - Data for schools not included in lottery retrieved from previous year's performance reports or current year parent handbooks.

Descriptive Statistics

N	125
Mean	8.26
Median	7.00
Std. Deviation	4.86
Range	25
Minimum	1
Maximum	26

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools			
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	t-test sig.
1	3	14.33	6.03	2	13.00	2.83	5	13.80	4.55	.797
2	5	22.00	3.08	0	.	.	5	22.00	3.08	
3	7	7.71	4.50	1	8.00	.	8	7.75	4.17	
4	18	7.39	4.34	2	6.50	4.95	20	7.30	4.27	.788
5	25	5.80	3.55	4	6.25	2.50	29	5.86	3.39	.810
6	19	8.26	3.57	0	.	.	19	8.26	3.57	
7	17	6.71	2.52	0	.	.	17	6.71	2.52	
8	22	9.27	4.03	0	.	.	22	9.27	4.03	
All Schools	116	8.28	4.94	9	8.00	3.84	125	8.26	4.86	.870

Lowest Grade Waitlist Proportion

- Lowest grade offered only
- Operationalization: The waitlist for the lowest grade offered divided by the number of seats (total, not just available seats) in the lowest grade offered in Round 1 of the lottery. This figure represents demand in this model.
- Year: SY 2015–16
- Sources:
    - Seats available: https://public.tableau.com/profile/aaron2446#!/vizhome/MSDCSeatsandWaitlistOfferData/MSDCPublicDisplay
    - Waitlist data: https://districtmeasured.com/2015/04/14/what-school-waitlists-tell-us-about-the-demand-for-public-schools/
        - Note that several schools did not participate in the common lottery, but their waitlists are publicly reported.

Descriptive Statistics

N	117
Mean	2.64
Median	0.22
Std. Deviation	5.18
Range	36.70
Minimum	0.00
Maximum	36.70

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools			
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	t-test sig.
1	3	1.75	1.47	2	2.90	2.22	5	2.21	1.64	.53
2	5	8.90	9.06	0	.	.	5	8.90	9.06	
3	7	7.18	4.00	1	36.70	.	8	10.87	11.07	
4	16	1.80	2.12	1	0.02	.	17	1.70	2.09	.
5	23	1.47	2.80	4	11.14	4.87	27	2.90	4.65	<.001
6	19	2.94	3.99	0	.	.	19	2.94	3.99	
7	16	0.13	0.16	0	.	.	16	0.13	0.16	
8	20	0.04	0.07	0	.	.	20	0.04	0.07	
All Schools	109	2.03	3.77	8	10.88	11.88	117	2.64	5.18	.07

Charter/DCPS Status

- Whole-school
- Operationalization: DCPS indicates the District of Columbia's traditional public schools. A DC public charter school is operated by an independent local education agency (LEA) funded by taxpayer money through a per-pupil formula. The DC Public Charter School Board has chartering authority over DC public charter schools.
- Year: SY 2015–16
- Source: OSSE Classification

Ward	non-DLI		DLI		All Schools	
	Charter Count	DCPS Count	Charter Count	DCPS Count	Charter Count	DCPS Count
1	1	2	0	2	1	4
2	0	5	0	0	0	5
3	0	7	0	1	0	8
4	7	11	2	0	9	11
5	18	7	4	0	22	7
6	6	13	0	0	6	13
7	5	12	0	0	5	12
8	11	13	0	0	11	13
All Schools	48	70	6	3	54	73

Teacher/Pupil Ratio

- Whole-school
- Operationalization: "This is the calculated Pupil Teacher Ratio: The total reported students divided by the FTE classroom teachers." (Definition provided on ELSI tablegenerator platform; link below)
- Year: SY 2015–16
- Source: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx

Descriptive Statistics

N	113
Mean	13.24
Median	12.97
Std. Deviation	2.290
Range	12
Minimum	9
Maximum	21

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools			
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	t-test sig.
1	3	11.99	1.46	2	10.27	.38	5	11.30	1.41	.217
2	4	12.40	2.36	0	.	.	4	12.40	2.36	
3	7	14.20	1.06	1	11.60	.	8	13.88	1.34	
4	16	12.26	1.51	2	10.30	1.24	18	12.04	1.58	.100
5	20	13.15	2.37	3	10.82	1.74	23	12.84	2.40	.119
6	18	13.82	2.21	0	.	.	18	13.82	2.21	
7	16	13.19	1.86	0	.	.	16	13.19	1.86	
8	20	14.32	2.30	0	.	.	20	14.32	2.30	
All Schools	104	13.37	2.12	8	10.65	1.15	112	13.17	2.18	.050

Outcome Variables

At-Risk

- Whole school[6]
- Operationalization: At the elementary school level, at-risk refers to a student who was (1) enrolled in TANF (financial assistance) or SNAP (formerly known as food stamps), (2) "under the care of the Child and Family Services Administration," and/or (3) homeless at any point during the calendar year prior to the enrollment audit (OSSE Enrollment Audit Handbook).
- SY 2015–16
- Source: https://osse.dc.gov/sites/default/files/dc/sites/osse/publication/attachments/SY%202015-16%20Enrollment%20Audit%20Handbook%208%2011%2015.pdf

Descriptive Statistics

N	125
Mean	.49
Median	.53
Std. Deviation	.25
Range	.892
Minimum	.015
Maximum	.907

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	.53	.07	2	.45	.11	5	.50	.09
2	5	.25	.21	0	.	.	5	.25	.21
3	7	.04	.03	1	.09	.	8	.05	.03
4	18	.41	.15	2	.16	.07	20	.39	.16
5	25	.48	.19	4	.19	.17	29	.44	.21
6	19	.40	.24	0	.	.	19	.40	.24
7	17	.70	.10	0	.	.	17	.70	.10
8	22	.75	.13	0	.	.	22	.75	.13
All Schools	116	.51	.25	9	.23	.17	125	.49	.25

[6] *The variables proportion EL, in-seat attendance, and suspension rate for each school were not calculated, but were retrieved from the OSSE database as percentages with one decimal point. For privacy reasons, OSSE does not give precise calculations in cases in which the number of at-risk in a school or the total number of students in a school are small enough that the at-risk students could be identified, instead substituting the exact number with the text "Less than 1%" or "Less than 4%." In cases such as this, we made the assumption that the distribution of likely exact numbers would be normal, and we replaced the value with .5 less than the number given, for example, .5% for "less than 1%" and 3.5% for "less than 4%."

Special Education

- Proportion Special Education
  - Whole school
  - Operationalization: Percent of students enrolled by Special Education (SPED) status at any point during the calendar year prior to the enrollment audit from: https://osse.dc.gov/sites/default/files/dc/sites/osse/publication/attachments/SY%202015-16%20Enrollment%20Audit%20Handbook%208%2011%2015.pdf
- SY 2015–16
- Source: https://osse.dc.gov/enrollment

Descriptive Statistics

N	125
Mean	.11
Median	.11
Std. Deviation	.06
Range	.30
Minimum	.01
Maximum	.30

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	.12	.03	2	.10	.00	5	.11	.02
2	5	.12	.10	0	.	.	5	.12	.10
3	7	.07	.03	1	.10	.	8	.07	.03
4	18	.11	.05	2	.08	.05	20	.10	.05
5	25	.14	.08	4	.08	.03	29	.13	.07
6	19	.12	.06	0	.	.	19	.12	.06
7	17	.13	.06	0	.	.	17	.13	.06
8	22	.10	.04	0	.	.	22	.10	.04
All Schools	116	.12	.06	9	.09	.03	125	.11	.06

Entropy (i.e. Diversity)

- Entropy index
  - Kindergarten only
  - Operationalization: Divergence from overall district distribution of population (See appendix 2 for full calculation)
  - SY 2015–16
  - Source: Calculated from data from: https://nces.ed.gov/ccd/elsi/tableGenerator.aspx

Descriptive Statistics

N	125
Mean	0.45
Median	0.53
Std. Deviation	0.47
Range	1.40
Minimum	-0.40
Maximum	1.00

Descriptive Statistics by Ward and Type

Ward	non-DLI			DLI			All Schools		
	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation	Count	Mean	Standard Deviation
1	3	0.21	0.10	2	0.14	0.21	5	0.18	0.13
2	5	-0.23	0.18	0	.	.	5	-0.23	0.18
3	7	-0.06	0.24	1	-0.08	.	8	-0.06	0.22
4	18	0.24	0.31	2	-0.06	0.16	20	0.21	0.31
5	25	0.52	0.41	4	-0.33	0.05	29	0.40	0.49
6	19	0.32	0.39	0	.	.	19	0.32	0.39
7	17	0.89	0.11	0	.	.	17	0.89	0.11
8	22	0.89	0.20	0	.	.	22	0.89	0.20
All Schools	116	0.49	0.45	9	-0.14	0.22	125	0.45	0.47

Appendix 6: Omnibus Tests and Coefficient Tables from Snapshot Study

At-Risk

Predictors: DLI (dichotomous); weighted effect code for wards 1, 3, 4, 5, 6, 7, 8

Dependent Variable: At Risk

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.779	.606	.579	.165	1.859

ANOVA Table

	Sum of Squares	df	Mean Square	F	Sig.
Regression	4.871	8	.609	22.325	<.001
Residual	3.163	116	.027		
Total	8.034	124			

Coefficients

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	.500	.015		32.463	<.001	.470	.531					
Immersion	-.208	.061	-.212	-3.401	.001	-.328	-.087	-.282	-.301	-.198	.877	1.140
Ward1_WEC	.079	.075	.088	1.054	.294	-.070	.228	.140	.097	.061	.484	2.067
Ward3_WEC	-.427	.057	-.688	-7.552	<.001	-.539	-.315	-.123	-.574	-.440	.410	2.442
Ward4_WEC	-.091	.034	-.320	-2.675	.009	-.158	-.024	.101	-.241	-.156	.237	4.211
Ward5_WEC	-.032	.027	-.160	-1.187	.238	-.086	.022	.141	-.110	-.069	.187	5.339
Ward6_WEC	-.099	.035	-.334	-2.823	.006	-.169	-.030	.109	-.254	-.164	.242	4.135
Ward7_WEC	.199	.037	.608	5.317	<.001	.125	.274	.315	.443	.310	.259	3.855
Ward8_WEC	.252	.032	.969	7.809	<.001	.188	.316	.361	.587	.455	.221	4.534

Special Education

Predictors: DLI (dichotomous); weighted effect code for wards 1, 3, 4, 5, 6, 7, 8

Dependent Variable: Special Education

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.297	.088	.025	.057469	1.965

ANOVA Table

	Sum of Squares	df	Mean Square	F	Sig.
Regression	.037	8	.005	1.399	.204
Residual	.383	116	.003		
Total	.420	124			

Coefficients

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	.116	.005		21.715	<.001	.106	.127					
Immersion	-.034	.021	-.153	-1.615	.109	-.076	.008	-.138	-.148	-.143	.877	1.140
Ward1_WEC	.006	.026	.032	.247	.805	-.045	.058	-.031	.023	.022	.484	2.067
Ward3_WEC	-.038	.020	-.270	-1.951	.053	-.077	.001	-.131	-.178	-.173	.410	2.442
Ward4_WEC	-.008	.012	-.131	-.719	.474	-.032	.015	-.054	-.067	-.064	.237	4.211
Ward5_WEC	.018	.009	.385	1.878	.063	-.001	.036	.024	.172	.167	.187	5.339
Ward6_WEC	.000	.012	.005	.027	.978	-.024	.025	-.016	.003	.002	.242	4.135
Ward7_WEC	.011	.013	.153	.881	.380	-.014	.037	.018	.081	.078	.259	3.855
Ward8_WEC	-.014	.011	-.229	-1.215	.227	-.036	.009	-.060	-.112	-.108	.221	4.534

Entropy (i.e. Diversity)

Predictors: DLI (dichotomous); weighted effect code for wards 1, 3, 4, 5, 6, 7, 8

Dependent Variable: Entropy

Model Summary

R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
.768	.589	.561	.308	1.559

ANOVA Table

	Sum of Squares	df	Mean Square	F	Sig.
Regression	15.814	8	1.977	20.804	<.001
Residual	11.022	116	.095		
Total	26.836	124			

Coefficients

	Unstandardized Coefficients		Standardized Coefficients			95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	B	Std. Error	Beta	t	Sig.	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	.482	.029		16.743	<.001	.425	.539					
Immersion	-.485	.114	-.270	-4.256	<.001	-.710	-.259	-.351	-.368	-.253	.877	1.140
Ward1_WEC	-.109	.140	-.067	-.778	.438	-.387	.169	.125	-.072	-.046	.484	2.067
Ward3_WEC	-.485	.106	-.427	-4.596	<.001	-.695	-.276	.057	-.392	-.273	.410	2.442
Ward4_WEC	-.226	.063	-.436	-3.573	.001	-.351	-.101	.169	-.315	-.213	.237	4.211
Ward5_WEC	-.014	.051	-.039	-.284	.777	-.115	.086	.252	-.026	-.017	.187	5.339
Ward6_WEC	-.166	.066	-.306	-2.530	.013	-.296	-.036	.210	-.229	-.151	.242	4.135
Ward7_WEC	.413	.070	.689	5.900	<.001	.274	.551	.427	.480	.351	.259	3.855
Ward8_WEC	.412	.060	.867	6.845	<.001	.293	.531	.439	.536	.407	.221	4.534

Appendix 7: Methods of Comparison of Proportions

Several of the measures in this study consist of proportions when more fine-grained, student-level data was not available. These measures describe the proportions of students with certain characteristics in kindergarten cohorts or whole-school populations; for example, the proportions of students in a class who were Asian or the proportion of the whole school who are ELs. These were analyzed in two ways, depending on the nature of the data available.

Straightforward **proportions** (the population of students in the cohort or school with the characteristic divided by the total population of the cohort or school, respectively) were compared using two-sample *z*-tests.

When proportions were available in **counts** of students possessing and not possessing characteristics (i.e. the number of Asian versus non-Asian students in a cohort) or could be converted to counts, two chi-squared tests were performed sequentially to examine measures of proportion many samples as recommended by Fleiss (1973).

First, a chi-square test was performed to examine determine whether **significant differences existed among the proportions of students in independently sampled schools**. The following formula was used to test for significant differences among all m schools with n_i students. $\underline{p}$ represents the proportion of students in all schools measured who possess the characteristic studied, while p_i represents the proportion in school i who possess the characteristic. $\underline{q}$ is calculated by $\underline{p} - 1$, and $m - 1$ degrees of freedom determine the critical test value.

$$\chi^2 = \frac{1}{\bar{p}\bar{q}} \sum_{i=1}^{m} n_{i.}(p_i - \bar{p})^2$$

Second, if significant differences were found, a second chi-squared test was performed to compare proportions between groups to **determine whether these differences were attributable to group (DLI) differences between schools** of $n_{(DLI)}$ and $n_{(non-DLI)}$ populations with $\underline{p}_{DLI}$ and $\underline{p}_{non-DLI}$ proportions of students with the characteristic, respectively, and 1 degree of freedom.

$$\chi^2_{diff} = \frac{1}{\bar{p}\bar{q}} \times \frac{n_{(DLI)} n_{(non-DLI)}}{n..} (\bar{p}_{DLI} - \bar{p}_{non-DLI})^2$$