Analysis of SPF and Demographic Characteristics

Contents

Introduction

This document presents a descriptive analysis of the relationship between various measures used in Colorado School Performance Framework (SPF) accountability ratings and school demographic characteristics, as well as the relationships of these measures to each other. State accountability ratings for traditional schools (i.e., schools not designated as Alternative Education Campuses, or AECs) rely upon two principal indicators at the elementary and middle levels and three indicators at the high school level. For all schools, student achievement and growth are included in framework rating calculations; for high schools, various postsecondary and workforce readiness (PWR) measures are additionally included. At the school level, achievement is measured using Mean Scale Score (MSS), while growth is measured by calculating the median value of student growth percentiles (SGPs), resulting in what is referred to as a school's median growth percentile, or MGP. PWR measures include SAT mean scale scores, graduation rates, matriculation rates, and dropout rates.

This document is for references purposes only and is not meant as a full evaluation of the use of these metrics in determining school accountability ratings, nor is it meant to support arguments pertaining to their validity.

The following criteria apply for all analyses below:

- Analysis is at the school level using 2023 data only.
- Schools are disaggregated by EHM level. Thus, a school containing two different EMH levels (i.e., middle and high) would be treated as two separate data points.
- Data does not include schools designated as Alternative Education Campuses (AECs).
- DLM assessments are included.

Analytic Sample

To ensure consistent interpretation, the same sample of schools is used across all analyses. This sample is constructed by limiting observations to school EMH levels that have at least 20 students with valid student growth percentiles in a given subject. We use growth rather than achievement to establish this minimum N count since it is more restrictive, meaning that there are cases where valid achievement measures do not have corresponding available growth scores. The same requirement is also applied to the PWR analyses since a school must have reportable growth data to receive an overall SPF point total and rating. The resulting analytic sample comprises 1972 total observations (1036 elementary schools, 562 middle schools, and 374 high schools).

Plot Interpretation

For the majority of analyses below, relationships between different metrics are displayed in the form of scatterplots where each point on the plot represents a single school (separated by EMH level). School enrollment size is represented by the size of the point, and colors reflect the school's 2023 preliminary SPF plan type. Each scatterplot includes a line of best fit and a correlation coefficient (r), described below:

- **Lines of Best Fit:** Solid black lines in each plot show a "line of best fit", or the general trend in the relationship between school-level mean scale score or median growth percentile and the school's proportion of students from a particular subgroup. For example, the downward sloping line in the first plot below suggests that, as the percentage of multilingual learners in a school increases, the percent of total SPF points earned decreases. This is a negative correlation. However, it's important to note that this is only a general trend and doesn't apply to every individual data point. There are always exceptions, and other factors could be influencing these scores as well. The line of best fit gives us a way to visualize and understand the overall pattern in the data, but it is important not to attribute a "causal" relationship to patterns we observe.
- **Correlation (r):** The "r" value in each plot, known as the correlation coefficient, quantifies the strength of the relationship between the two measures shown in the plot. In other words, these correlation coefficients provide a sense of how well the line of best fit captures variation in the data. A higher r value means that the line of best fit explains more variation in the data. High absolute values of the correlation coefficient suggest a "strong relationship", wherein individual data points will more closely follow the overall trend described by the line of best fit. Lower correlations indicate a weaker relationship, wherein a larger number of data points will fall farther away from the overall trend line.

Correlations can range from -1 to 1. Interpreting correlation coefficients is context-dependent and should thus be undertaken with caution, but *absolute magnitudes* of correlations can generally be interpreted as follows:

Absolute Value of r	Strength of Relationship
r < 0.3	very weak or no relationship
0.3 <= r < 0.5	weak relationship
0.5 <= r < 0.7	moderate relationship
r >= 0.7	strong relationship

- **Plan Types:** For parsimony on all figures, SPF plan types are abbreviated as follows:
  - P = Performance Plan
  - I = Improvement Plan
  - PI = Priority Improvement Plan
  - T = Turnaround Plan
  - ISD = Insufficient State Data

Overview of Analyses

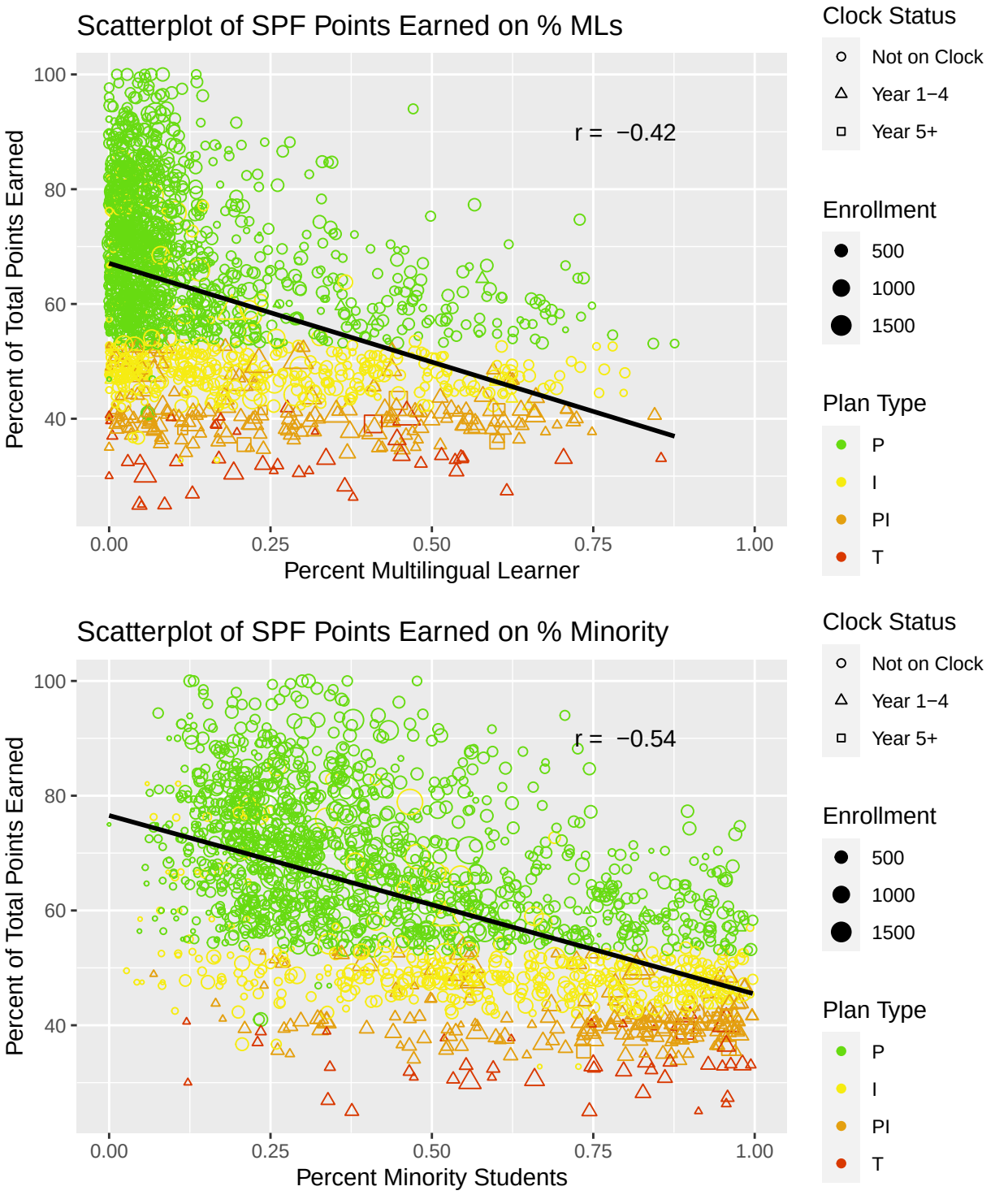
This document contains eight main sections, each presenting figures and/or tables designed to address the following questions:

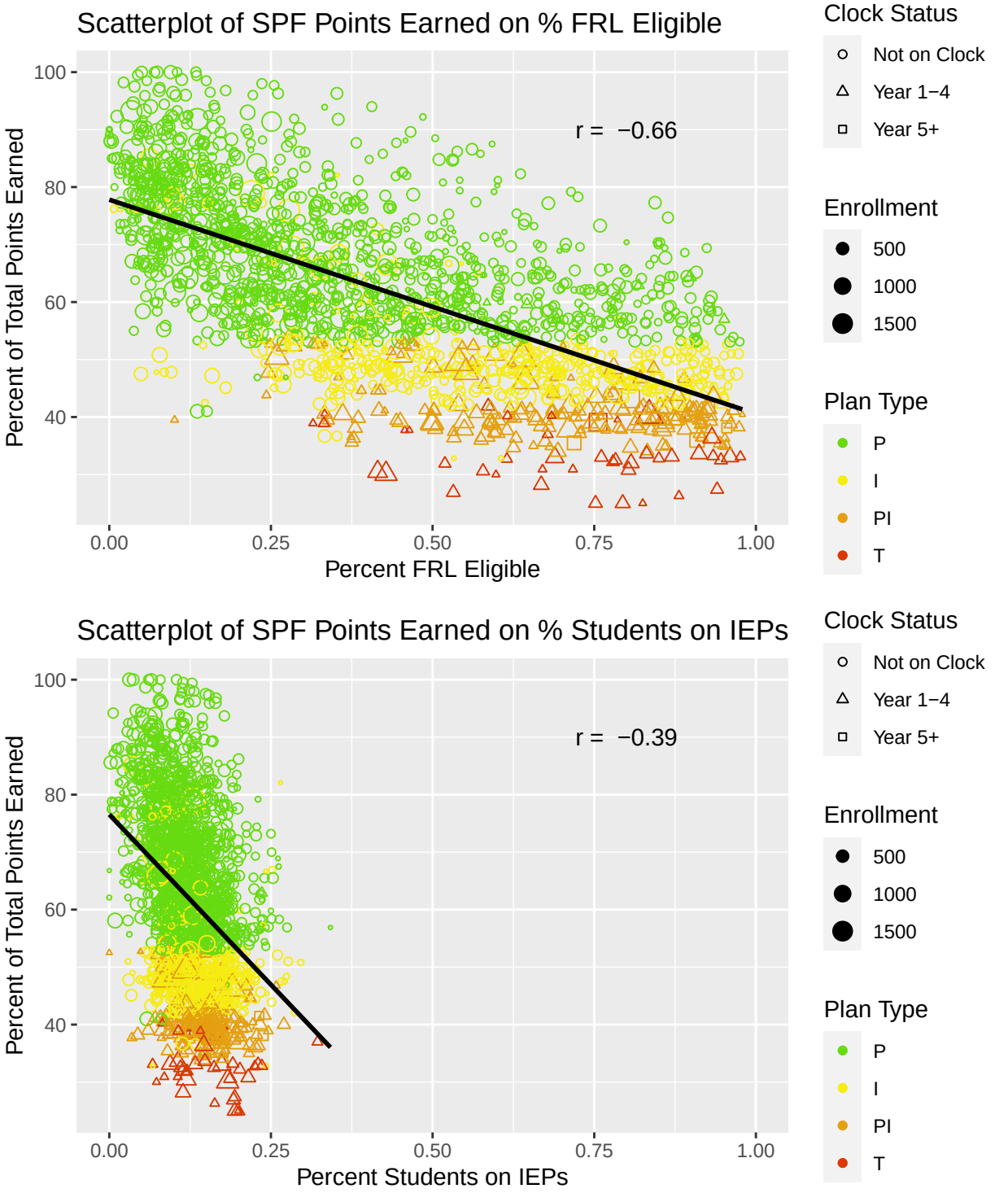
1. What is the relationship between total percent of points earned on SPF frameworks and school demographics?
2. What is the relationship between student achievement and school demographics and how does it compare to the relationship between student growth and school demographics?
3. What is the relationship between school-level measures of achievement and growth (i.e., how well does achievement predict growth)?
4. What is the relationship between total percent of points earned on the PWR subindicator and school demographics?
5. What is the relationship between PWR measures and school demographics?
6. What is the relationship between PWR measures and achievement or growth?
7. How closely are PWR measures related to each other?
8. How much of the variability in achievement and growth measures is explained by school demographics?

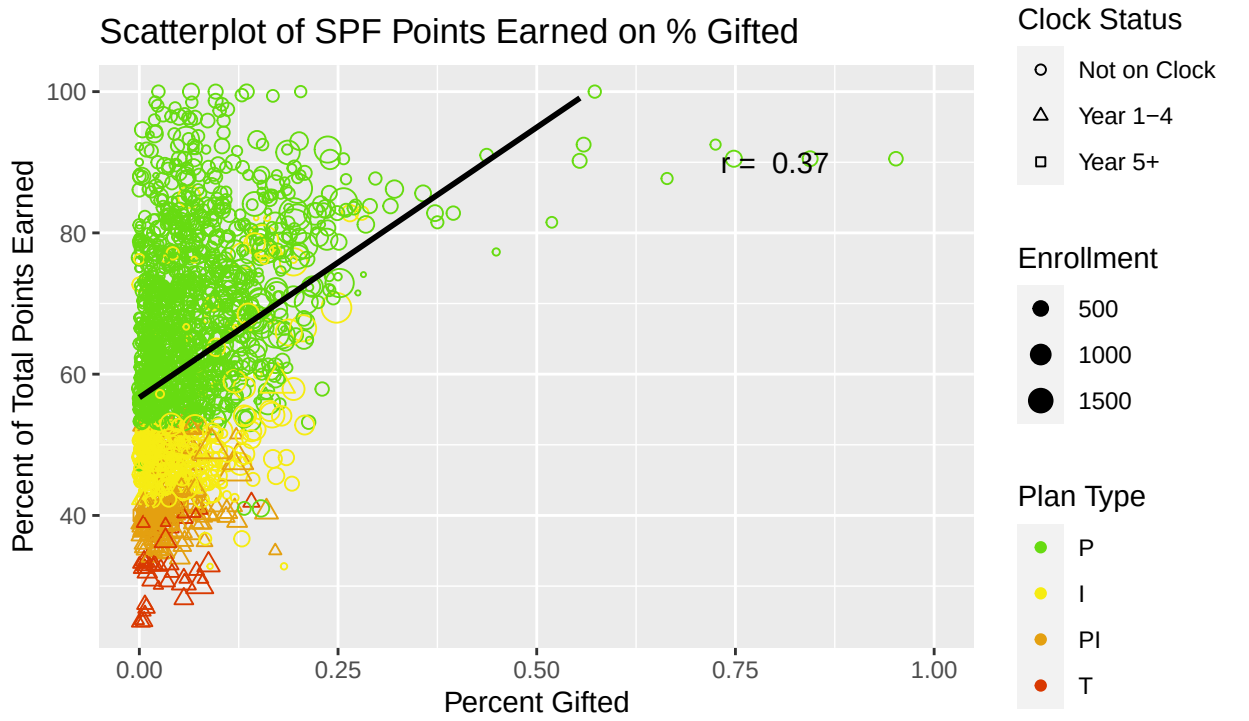
Total SPF Framework Points Earned and School Demographics

The scatterplots below show the percent of total SPF framework points earned by each school on the y-axis and the percent of that school's enrollment represented by a given subgroup on the x-axis. Refer to the introduction for guidance on interpreting fit lines and correlations. These plots include schools from all EMH levels.

We find weak to moderate correlations of between -0.38 and -0.65 when examining the relationship between total percent of SPF points earned and school demographics. Because achievement scores account for 40% of SPF ratings at the elementary and middle levels and 30% at the high school level, and because known associations exist between achievement and demographics, these correlations are not unexpected. However, we note that none of the relationships are strong (defined here as $|r| >= 0.7$), and there are a large number of schools that perform far better than the general trend described in the scatterplots. In the next section, we examine associations with school demographics separately for achievement and growth measures.


Scatterplot of SPF Points Earned on % MLs
r = −0.42
Percent of Total Points Earned
Percent Multilingual Learner
100
80
60
40
0.00
0.25
0.50
0.75
1.00
Clock Status
Not on Clock
Year 1−4
Year 5+
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
Scatterplot of SPF Points Earned on % Minority
r = −0.54
Percent of Total Points Earned
Percent Minority Students
Clock Status
Not on Clock
Year 1−4
Year 5+
Enrollment
500
1000
1500
Plan Type
P
I
PI
T


Scatterplot of SPF Points Earned on % FRL Eligible
Percent of Total Points Earned
Percent FRL Eligible
r = −0.66
100
80
60
40
0.00
0.25
0.50
0.75
1.00
Clock Status
Not on Clock
Year 1−4
Year 5+
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
Scatterplot of SPF Points Earned on % Students on IEPs
Percent of Total Points Earned
Percent Students on IEPs
r = −0.39
100
80
60
40
0.00
0.25
0.50
0.75
1.00
Clock Status
Not on Clock
Year 1−4
Year 5+
Enrollment
500
1000
1500
Plan Type
P
I
PI
T



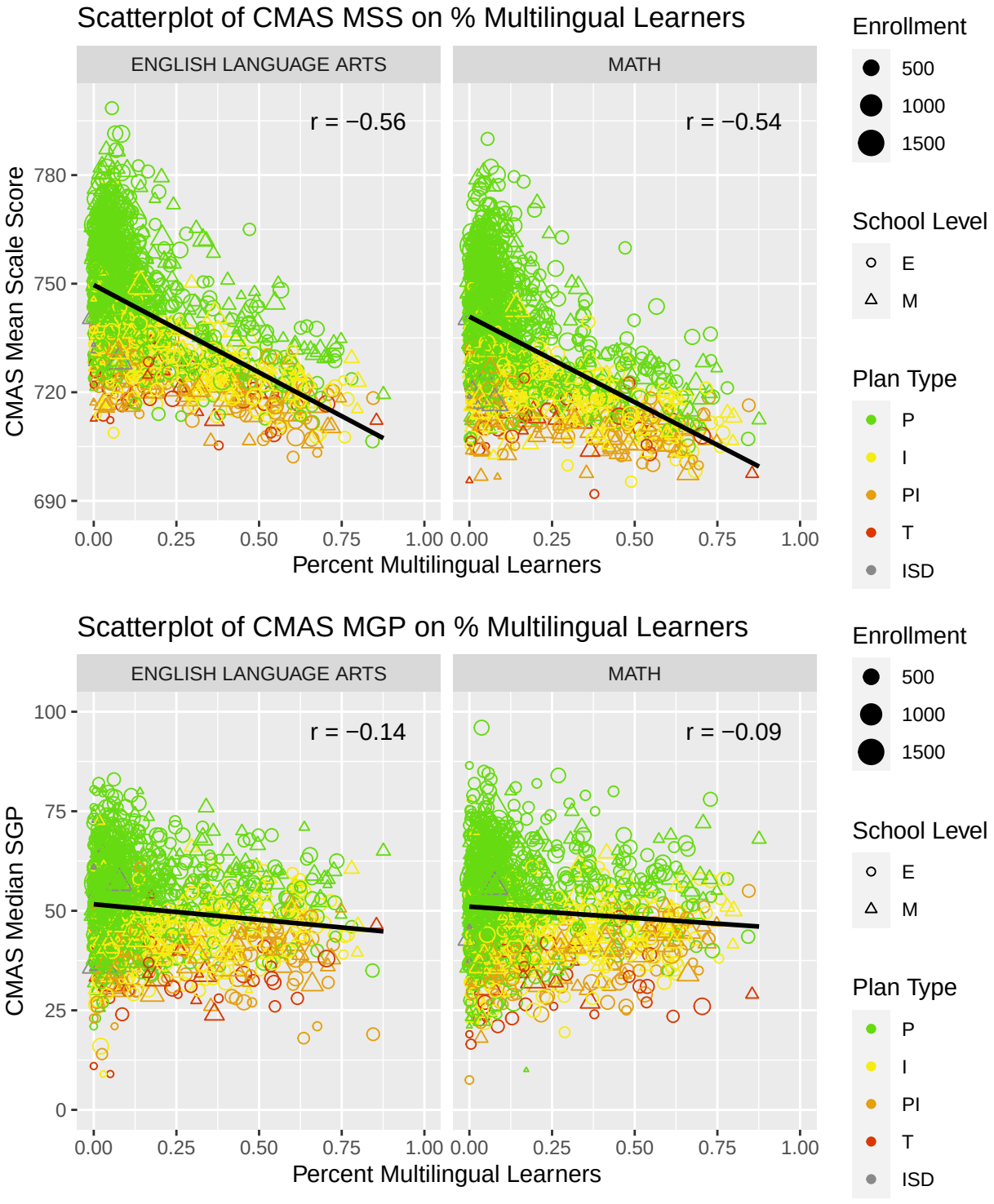
Achievement/Growth and School Demographics

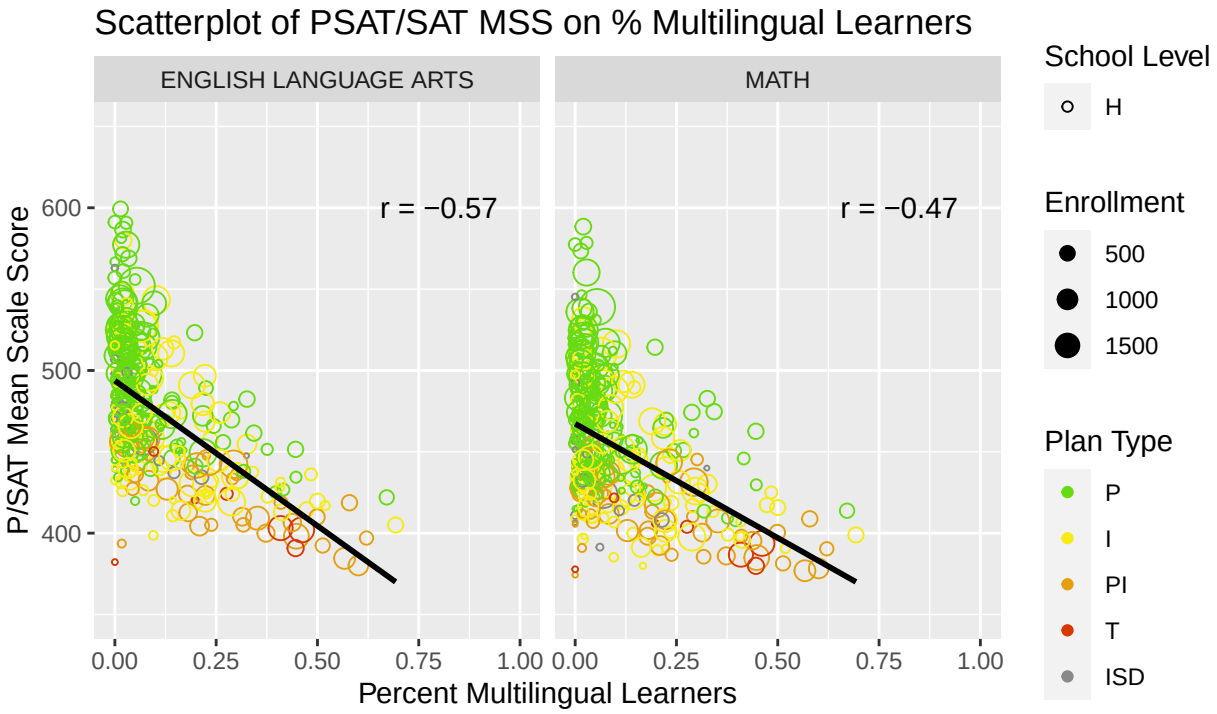
The scatterplots below show school-level achievement (MSS) or growth (MGP) on the y-axis and school demographics on the x-axis. Refer to the introduction for guidance on interpreting fit lines and correlations. The previous section describes weak to moderate correlations between percent of SPF points earned and school demographics, and we note that these associations are likely due at least in part to known associations between student achievement scores and various student demographic factors. Part of the rationale for using growth measures in addition to achievement for SPF calculations is that they are expected to be less highly correlated with these demographic factors. Thus, this section analyzes relationships with school demographics separately for achievement and growth. We also disaggregate results by subject for English Language Arts and Math and further by test (i.e., CMAS and PSAT/SAT). Of particular interest is the extent to which correlations are or are not attenuated (lessened) when examining the relationship between *growth* and demographics as compared to *achievement* and demographics.

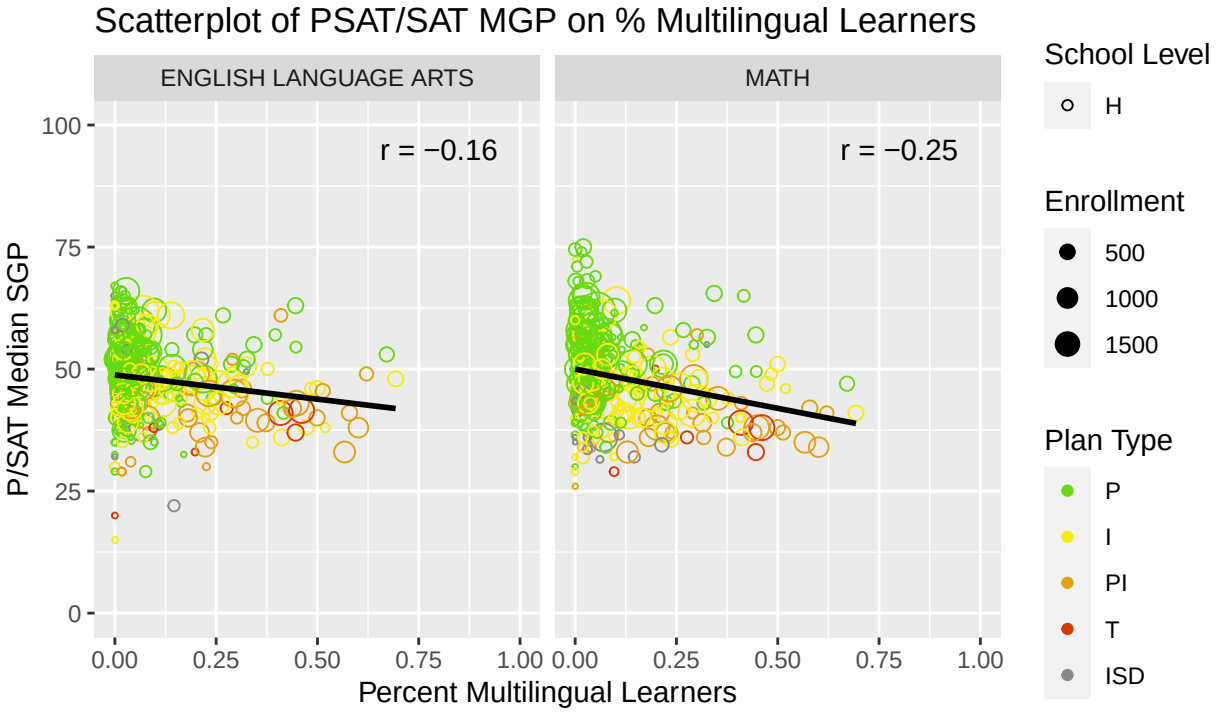
To ease interpretation, correlations from all analyses in this section are reported together in Table 1 (at the end of the section). In most cases, we observe moderate to strong relationships between school demographics and achievement, whereas those between growth and demographics are very weak to weak. We also note that, while still lower than for achievement, correlations between growth and demographics at the high school level are not as attenuated as they are for elementary and middle schools. There are, however, far fewer data points at the high school level, meaning that that a few schools that retain stronger relationships between growth and demographics could have an outsized influence on the overall correlation at that level.

Taken together, this evidence suggests that the inclusion of growth metrics in SPF framework ratings does serve to mitigate existing associations between achievement and demographics. We also note that, while correlations between growth and demographics tend to be weak or very weak, some relationship does exist. There is also some variability in the degree of attenuation observed across different subgroups.

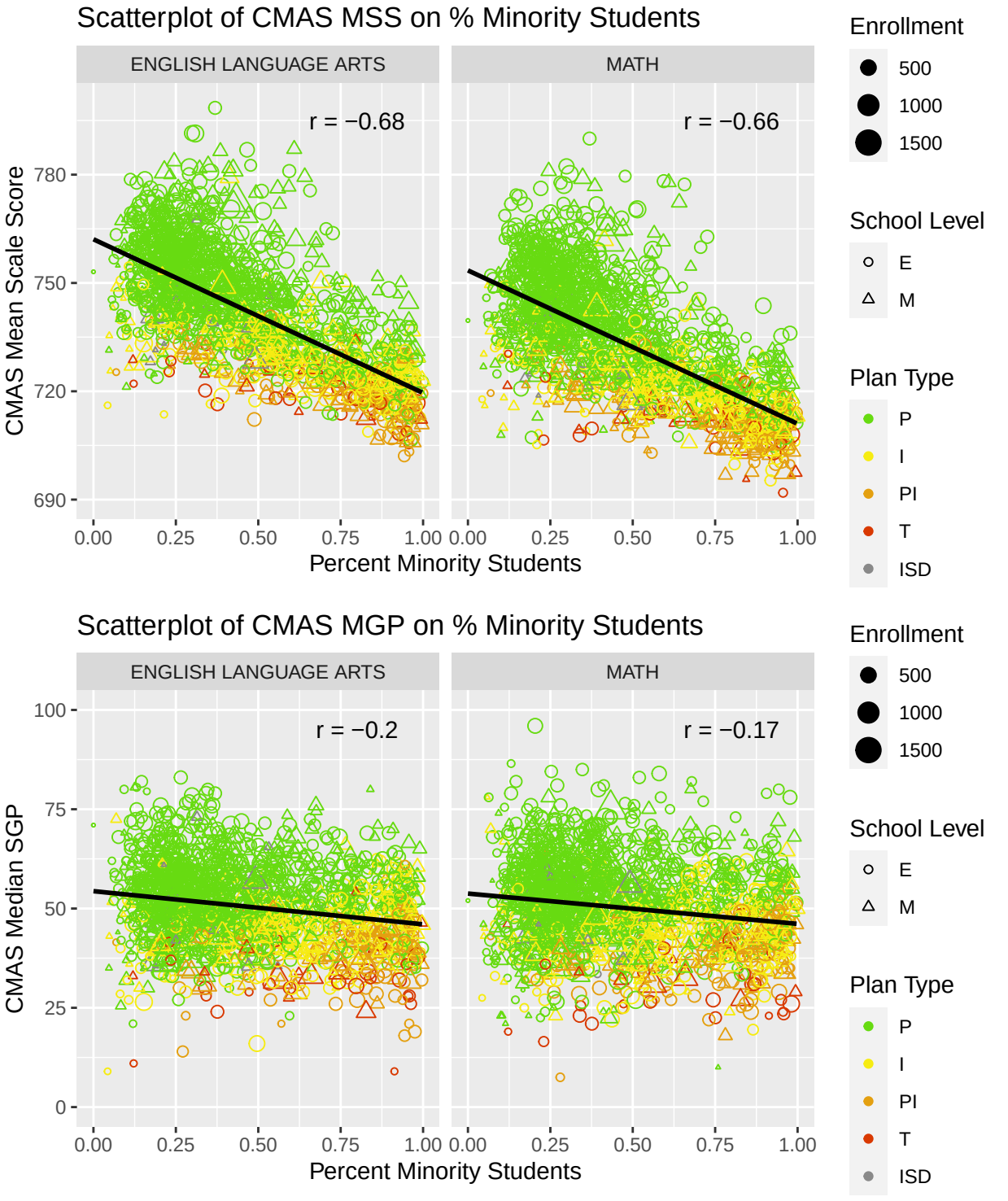
Multilingual Learners

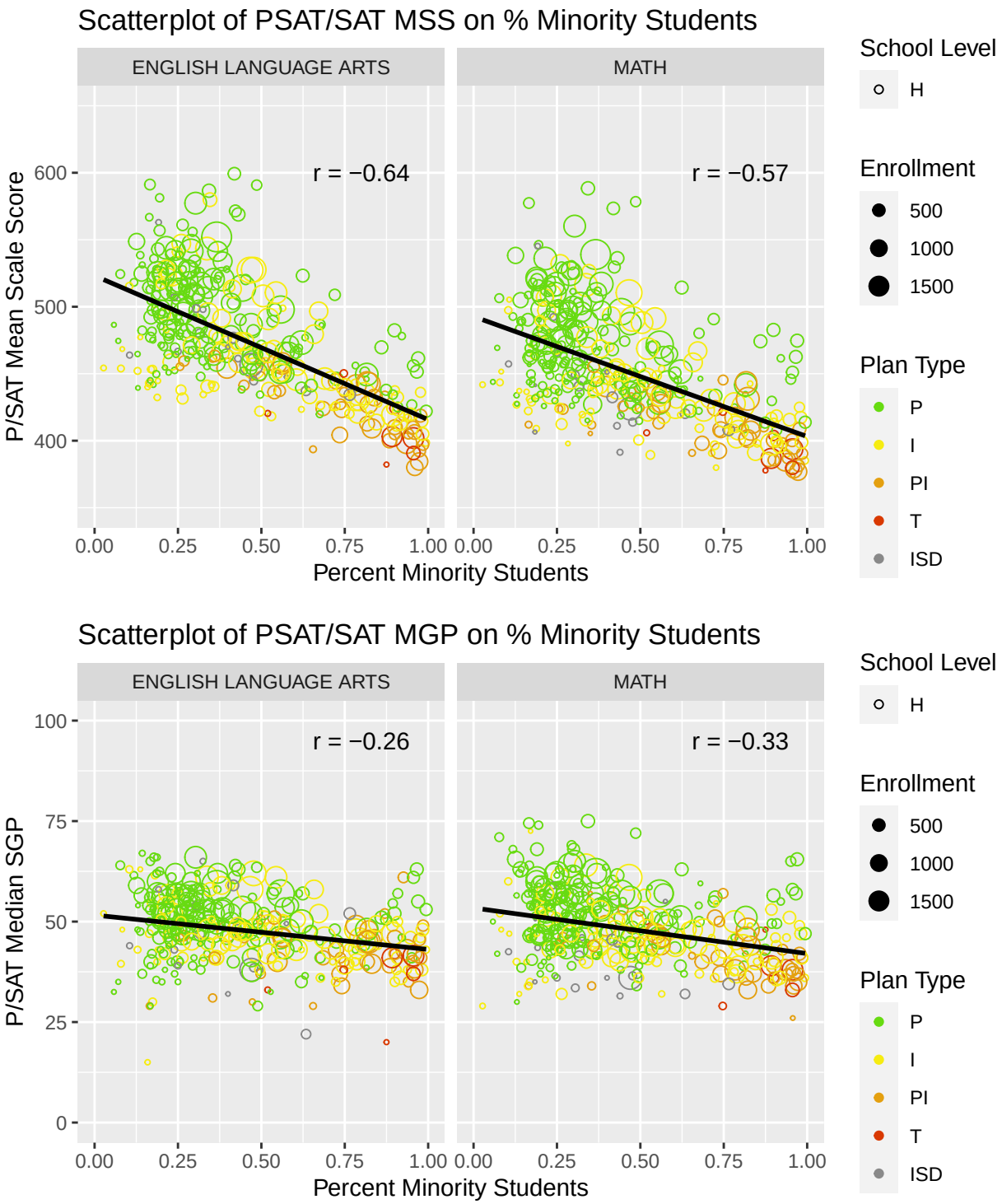



Scatterplot of PSAT/SAT MSS on % Multilingual Learners
ENGLISH LANGUAGE ARTS
MATH
r = −0.57
r = −0.47
P/SAT Mean Scale Score
600
500
400
0.00
0.25
0.50
0.75
1.00
Percent Multilingual Learners
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD

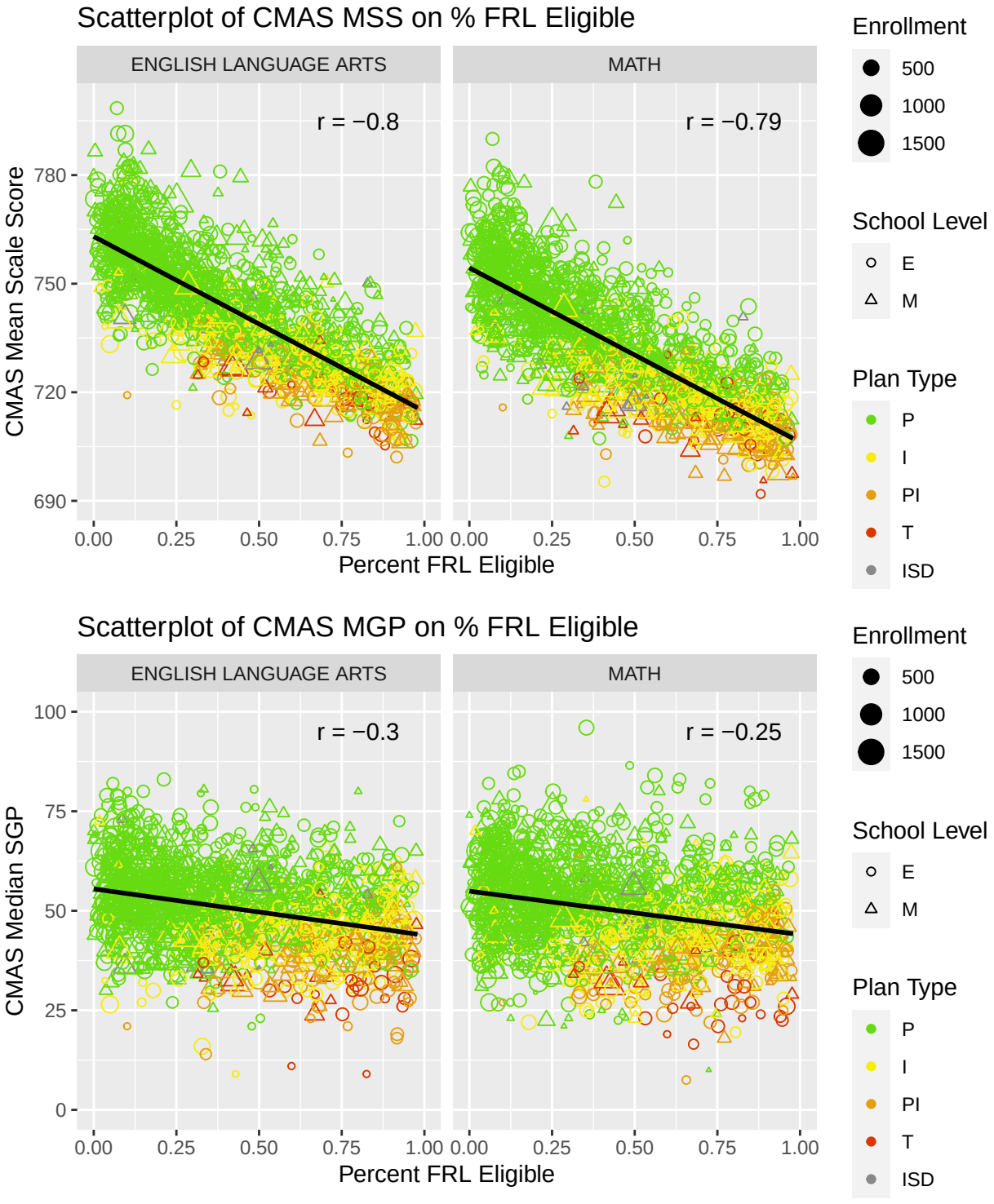

Scatterplot of PSAT/SAT MGP on % Multilingual Learners
ENGLISH LANGUAGE ARTS
MATH
r = −0.16
r = −0.25
P/SAT Median SGP
100
75
50
25
0
0.00
0.25
0.50
0.75
1.00
Percent Multilingual Learners
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD

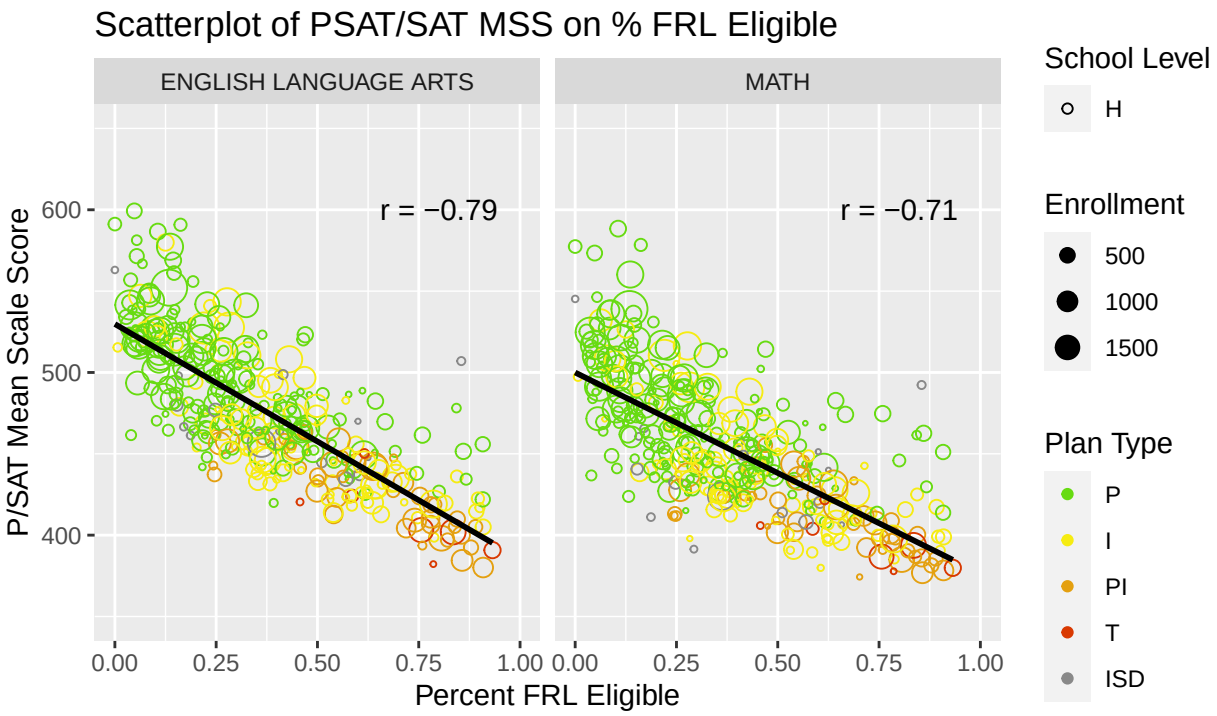
Minority Students

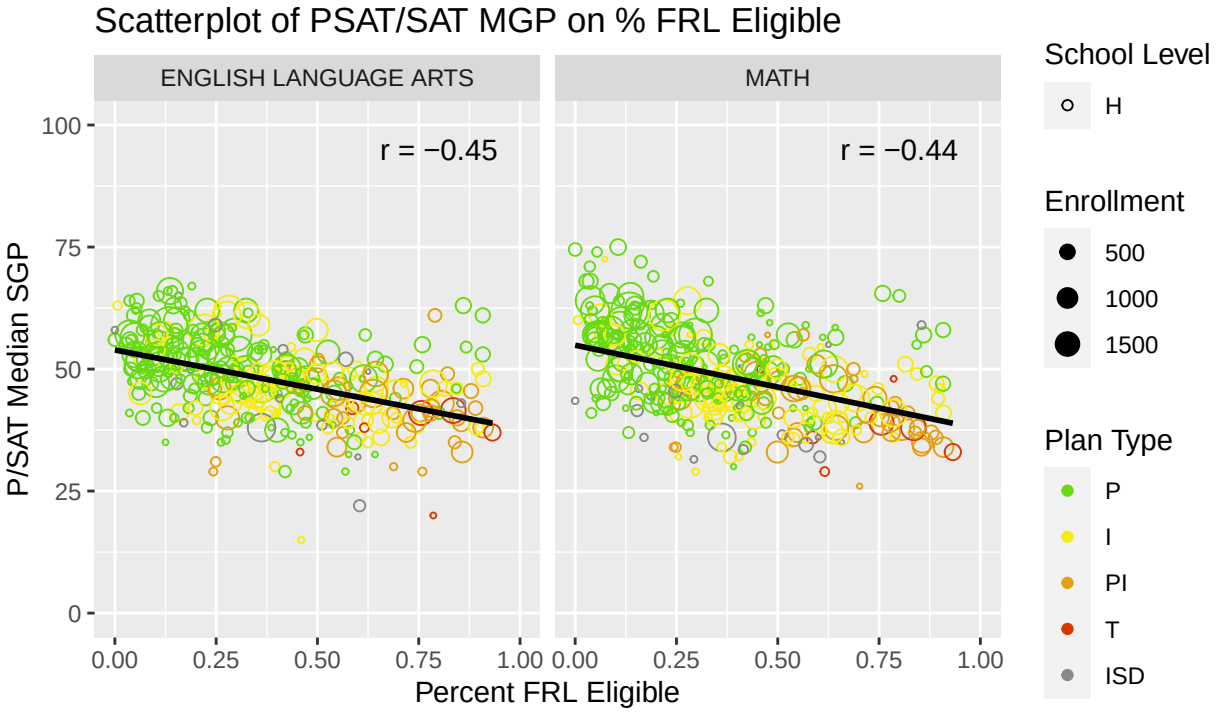



Scatterplot of PSAT/SAT MSS on % Minority Students
ENGLISH LANGUAGE ARTS
MATH
r = −0.64
r = −0.57
P/SAT Mean Scale Score
600
500
400
0.00
0.25
0.50
0.75
1.00
Percent Minority Students
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD
Scatterplot of PSAT/SAT MGP on % Minority Students
ENGLISH LANGUAGE ARTS
MATH
r = −0.26
r = −0.33
P/SAT Median SGP
100
75
50
25
0
0.00
0.25
0.50
0.75
1.00
Percent Minority Students
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD

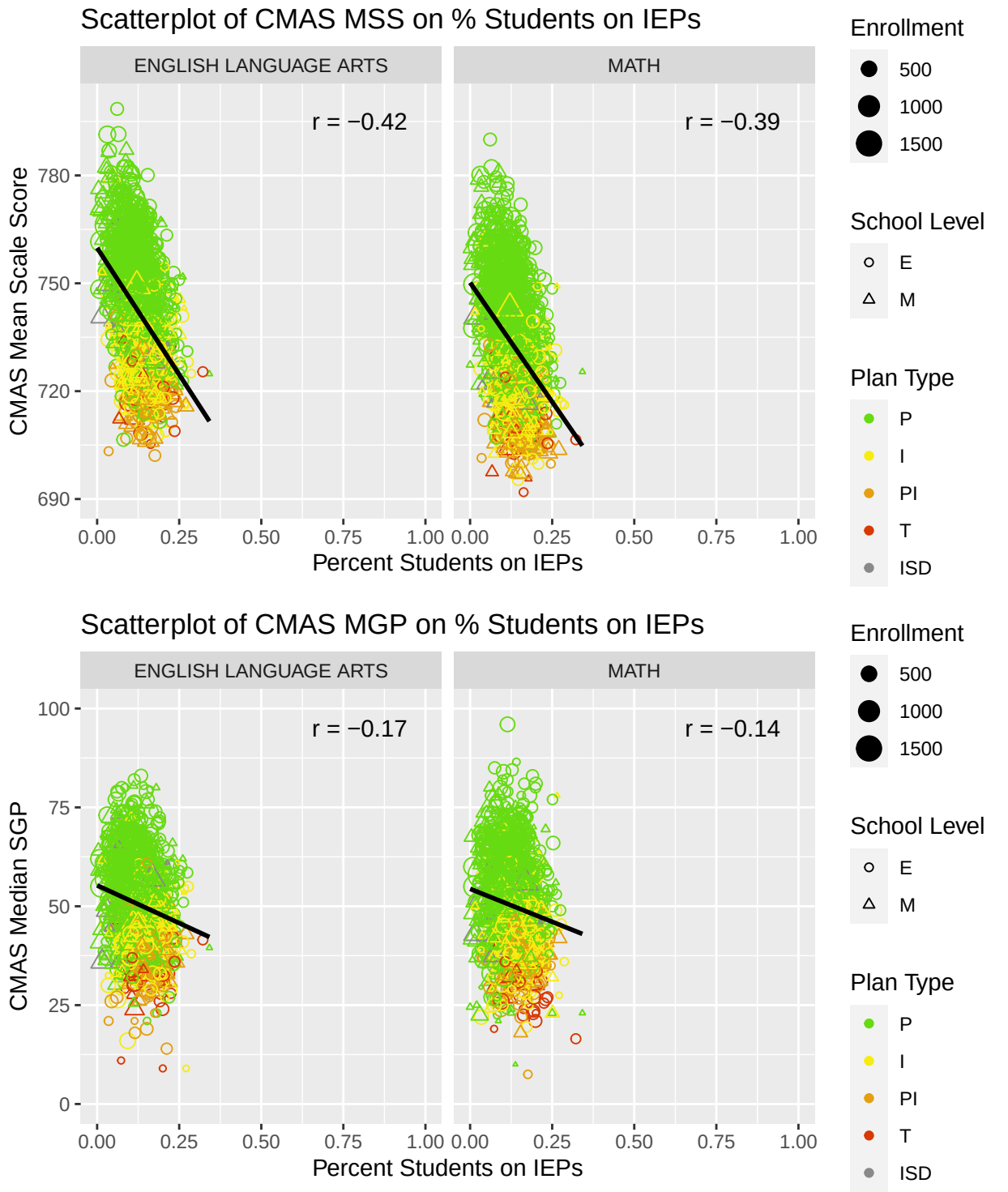
FRL Eligible

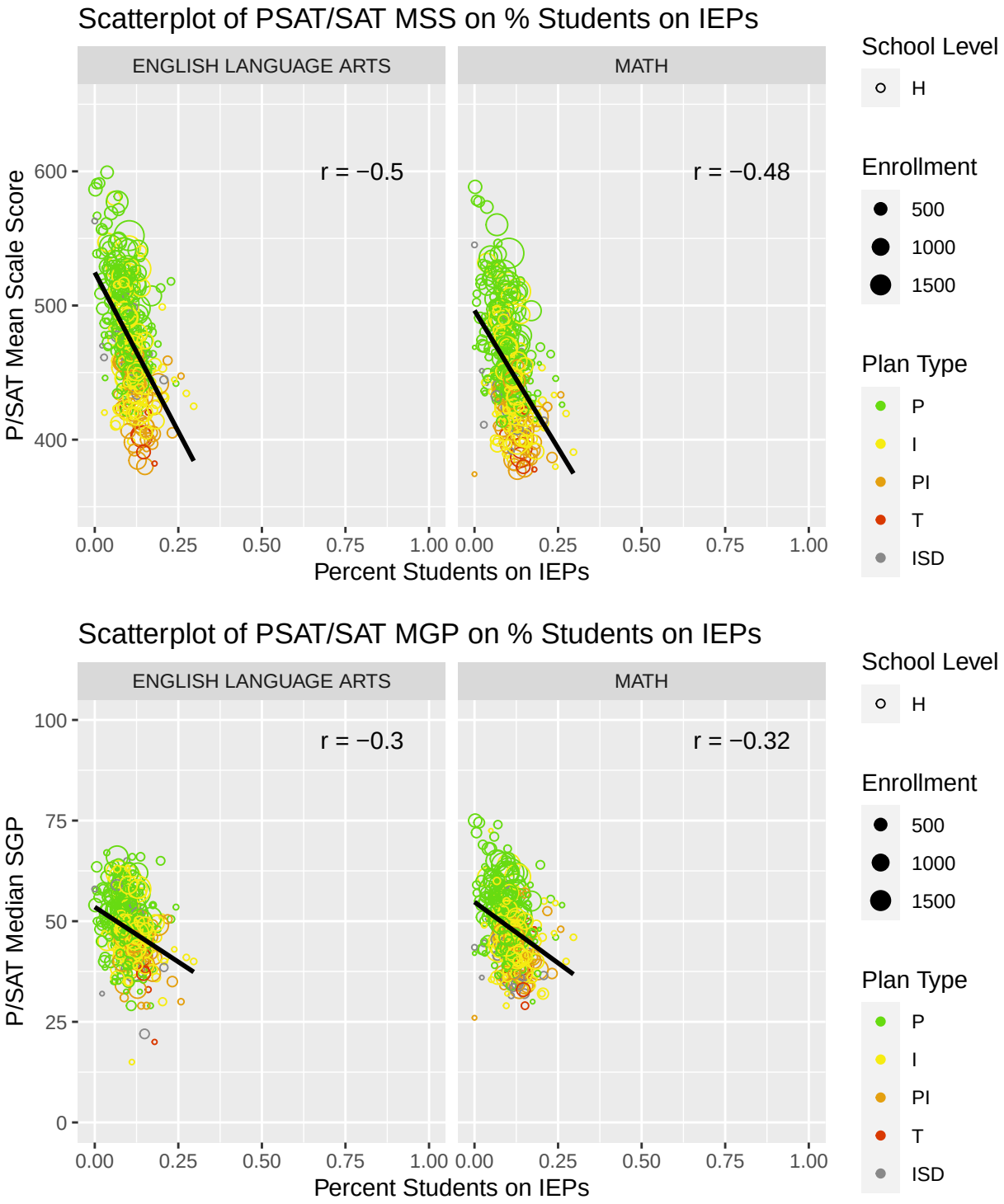



Scatterplot of PSAT/SAT MSS on % FRL Eligible
ENGLISH LANGUAGE ARTS
MATH
r = −0.79
r = −0.71
P/SAT Mean Scale Score
600
500
400
0.00
0.25
0.50
0.75
1.00
Percent FRL Eligible
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD

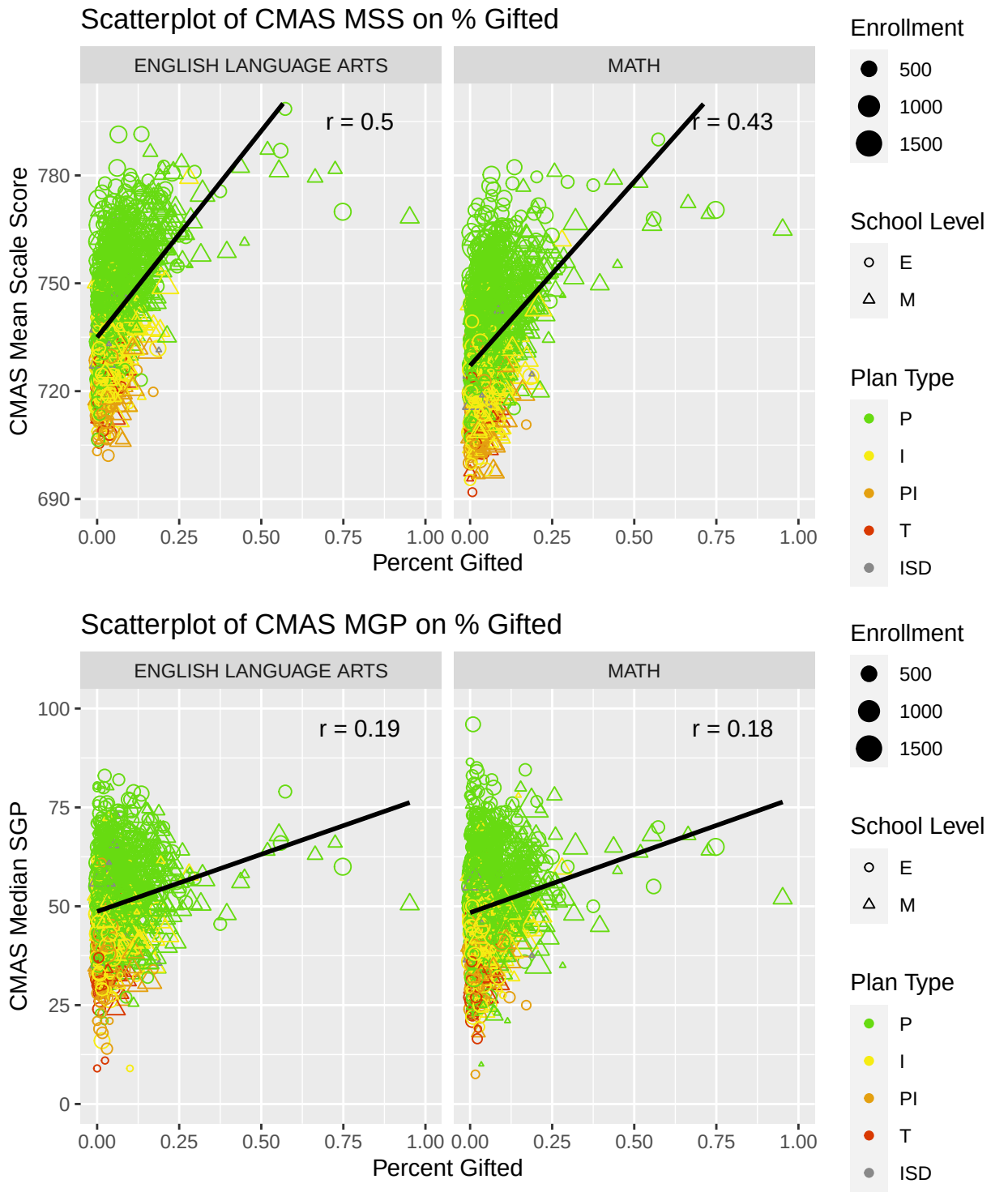

Scatterplot of PSAT/SAT MGP on % FRL Eligible
ENGLISH LANGUAGE ARTS
MATH
r = −0.45
r = −0.44
P/SAT Median SGP
100
75
50
25
0
0.00
0.25
0.50
0.75
1.00
Percent FRL Eligible
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD

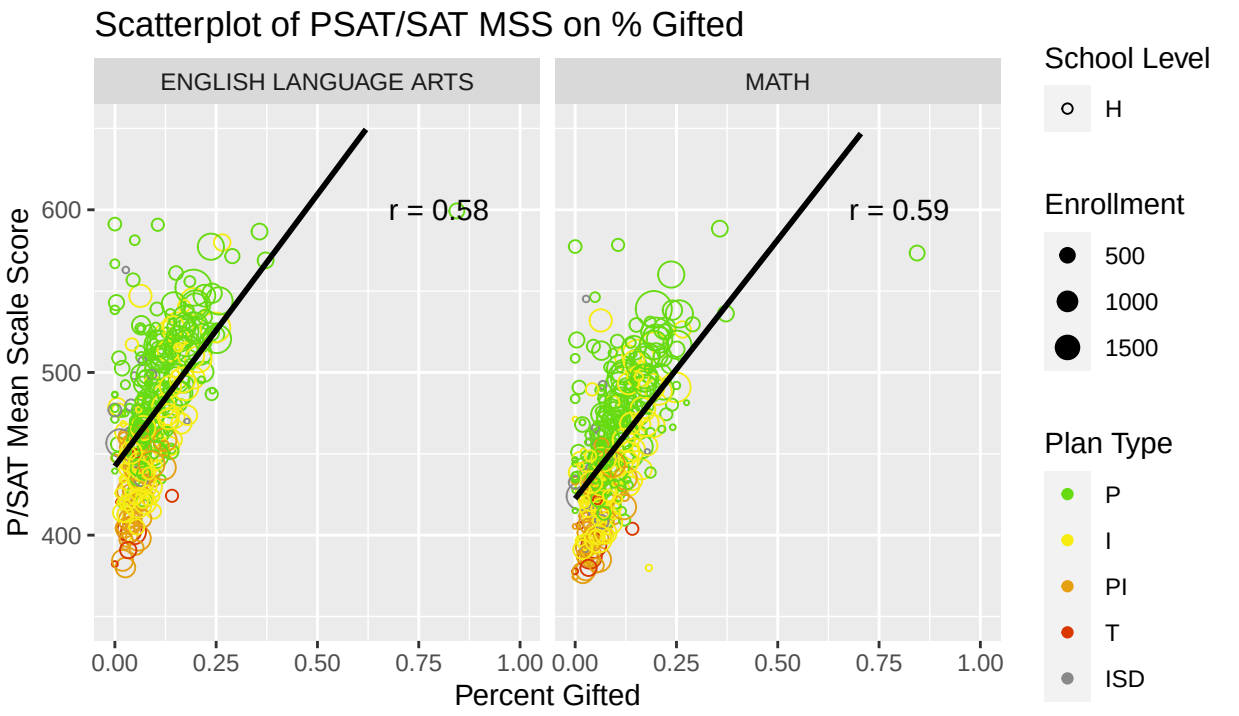
Students on IEPs




Scatterplot of PSAT/SAT MSS on % Students on IEPs
ENGLISH LANGUAGE ARTS
MATH
r = −0.5
r = −0.48
P/SAT Mean Scale Score
600
500
400
0.00
0.25
0.50
0.75
1.00
Percent Students on IEPs
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD
Scatterplot of PSAT/SAT MGP on % Students on IEPs
ENGLISH LANGUAGE ARTS
MATH
r = −0.3
r = −0.32
P/SAT Median SGP
100
75
50
25
0
0.00
0.25
0.50
0.75
1.00
Percent Students on IEPs
School Level
H
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD

Gifted Students





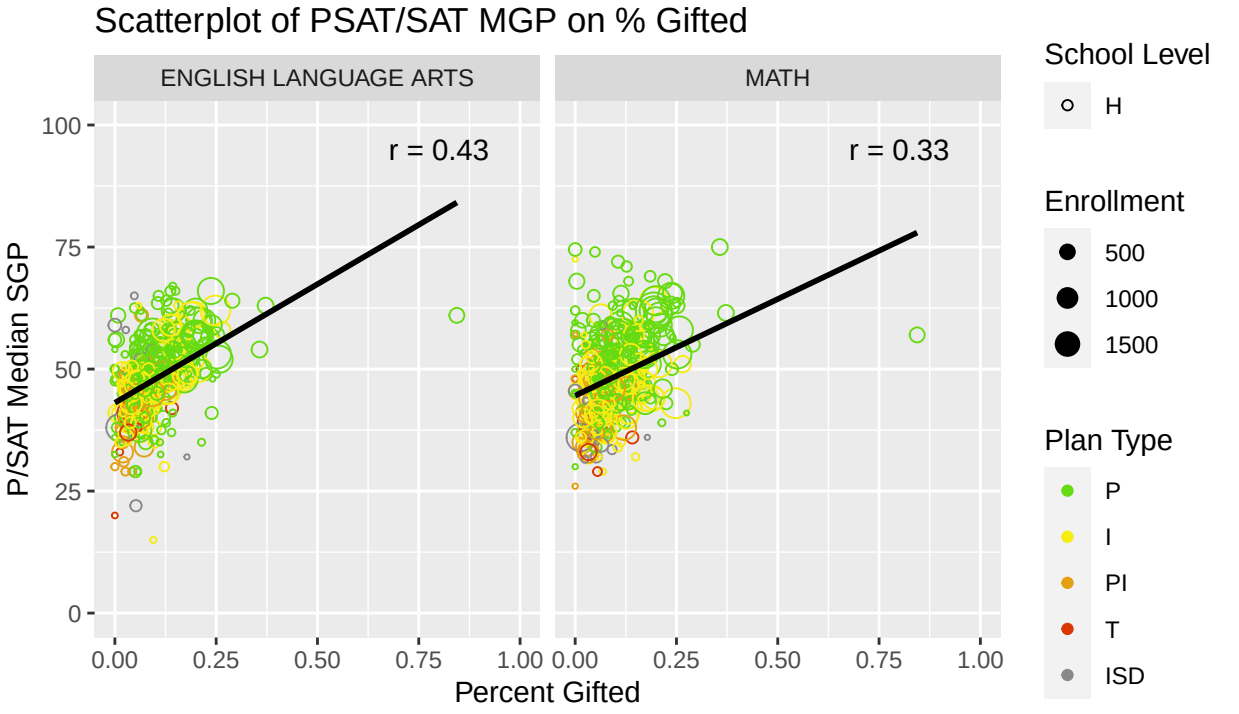


Table of Correlations - Achievement/Growth and Demographics

The table below reports each of the correlations from figures in this section in a table for easy comparison. The table also includes two additional columns which show disaggregated CMAS correlations between elementary and middle levels. Correlations are color-coded according to the strength of association (see table note).

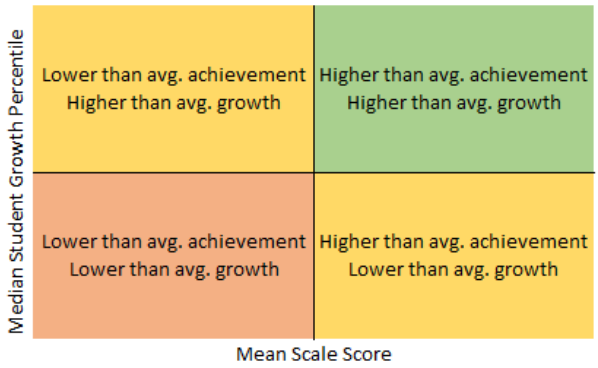
Table 1. Correlations Between Demographics and MSS/MGP

	MSS		MGP	
	Elem+Mid	High	Elem+Mid	High
	English Language Arts			
% Multilingual	-0.56	-0.57	-0.14	-0.16
% Minority	-0.68	-0.64	-0.2	-0.26
% FRL	-0.8	-0.79	-0.3	-0.45
% IEP	-0.42	-0.5	-0.17	-0.3
% Gifted	0.5	0.58	0.19	0.43
	Math			
% Multilingual	-0.54	-0.47	-0.09	-0.25
% Minority	-0.66	-0.57	-0.17	-0.33
% FRL	-0.79	-0.71	-0.25	-0.44
% IEP	-0.39	-0.48	-0.14	-0.32
% Gifted	0.43	0.59	0.18	0.33

Note. Correlations are color-coded according to the magnitudes described at the beginning of this document: Green = very weak or no relationship; yellow = weak relationship; orange = moderate relationships; red = strong relationship

Relationship Between Achievement and Growth

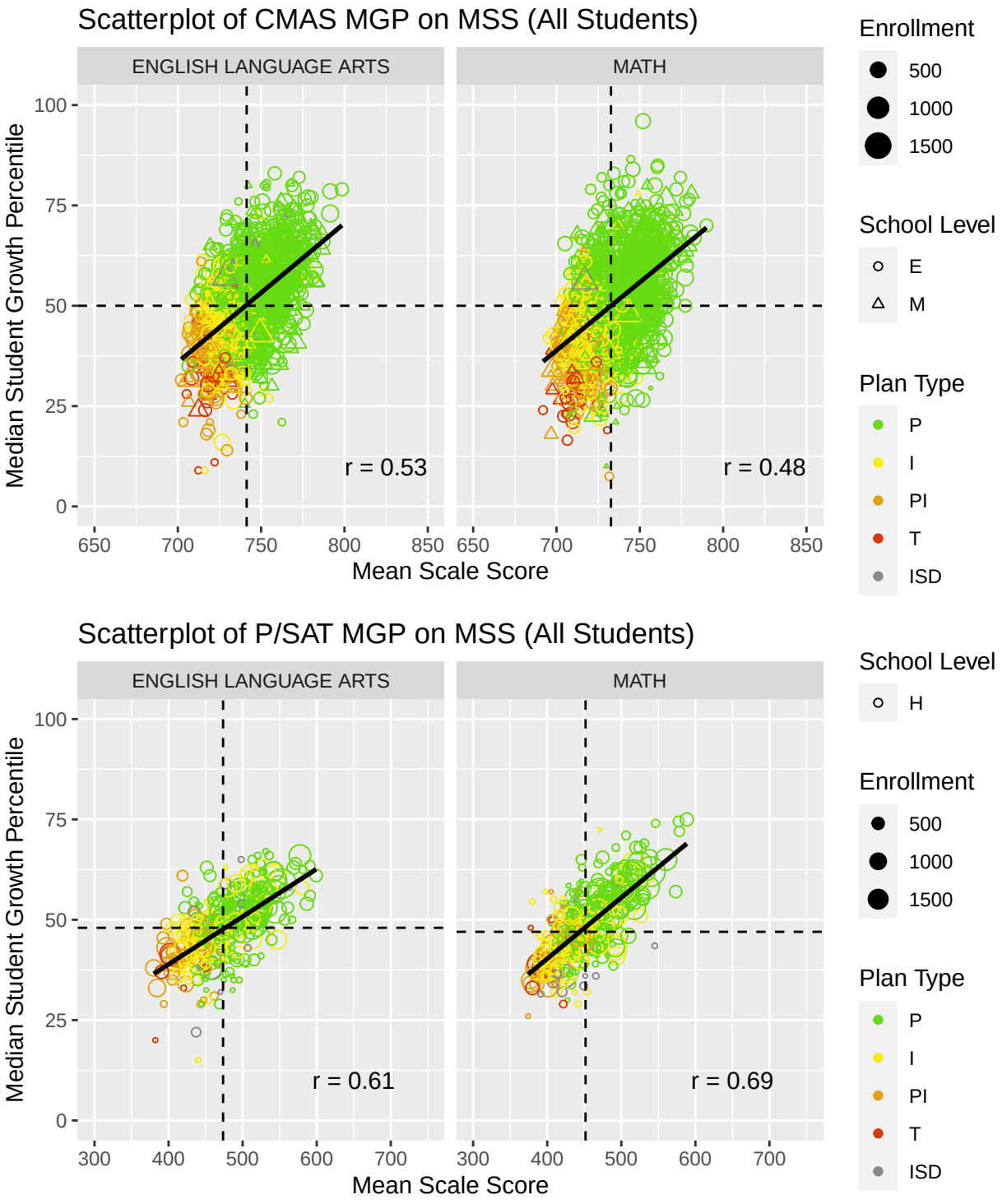
The scatterplots below show school-level growth (MGP) on the y-axis and achievement (MSS) on the x-axis. In addition, each plot below is bisected vertically at the overall Mean Scale Score for the demographic group in question and horizontally at that group's overall Median Growth Percentile. This means that we can interpret where each school falls on the plot in relation to the diagram below:



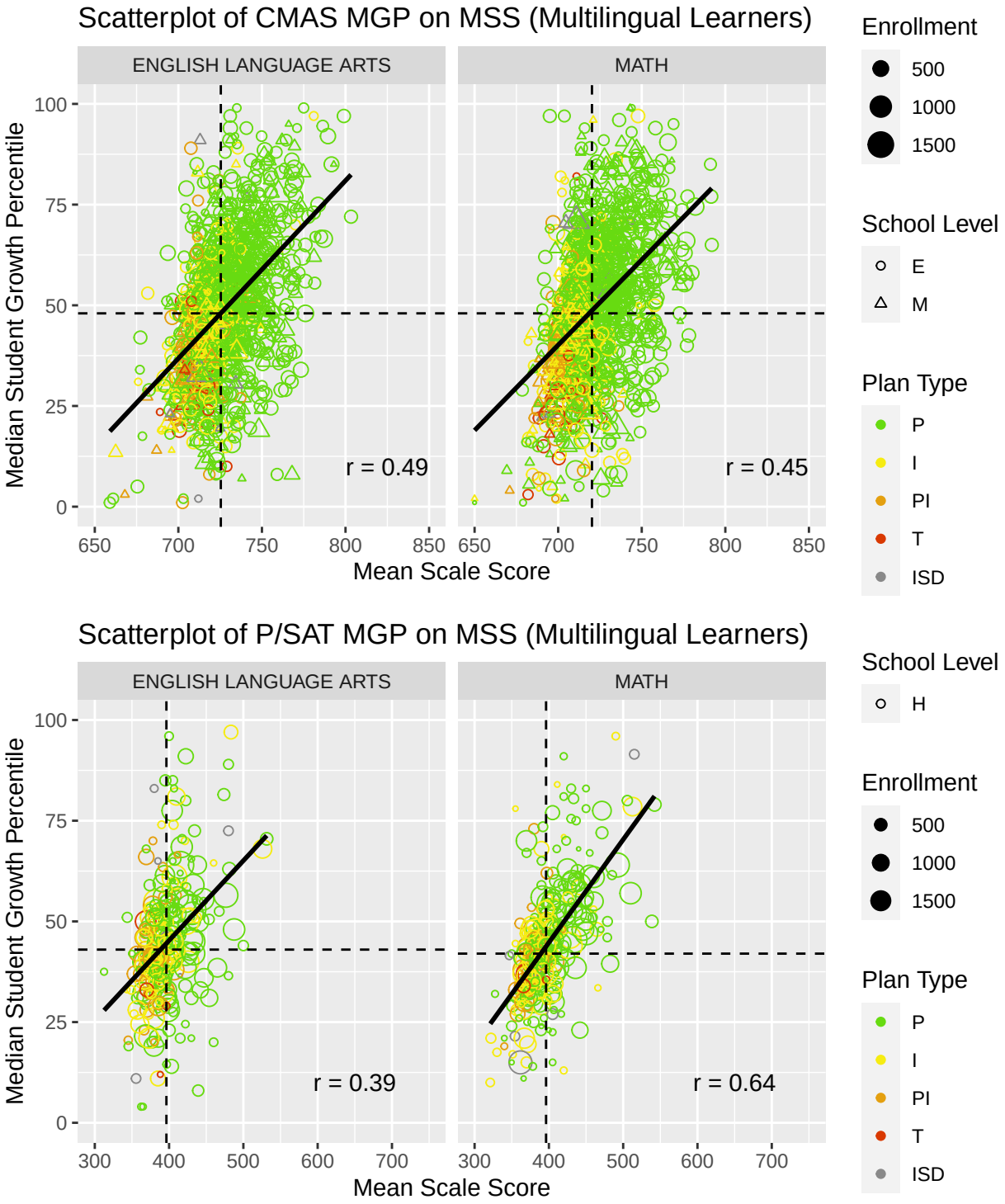
We note that there is less variability in correlations across different subgroups in the figures below. This is because the relationship between mean scale score and median growth percentile is partially mechanical in nature. In other words, there is, by definition, an association between MSS and MGP since the latter is constructed from the former.

Correlations are generally weak to moderate between achievement and growth, though we find the relationship to be somewhat stronger in high school math. Correlations are also slightly stronger for all students combined than for any individual subgroup, which suggests that growth is less highly correlated with achievement for students identified in these subgroups than for those in the general population. We note that these differences are small, however, and that further analysis would be required to explain this pattern or evaluate its significance.

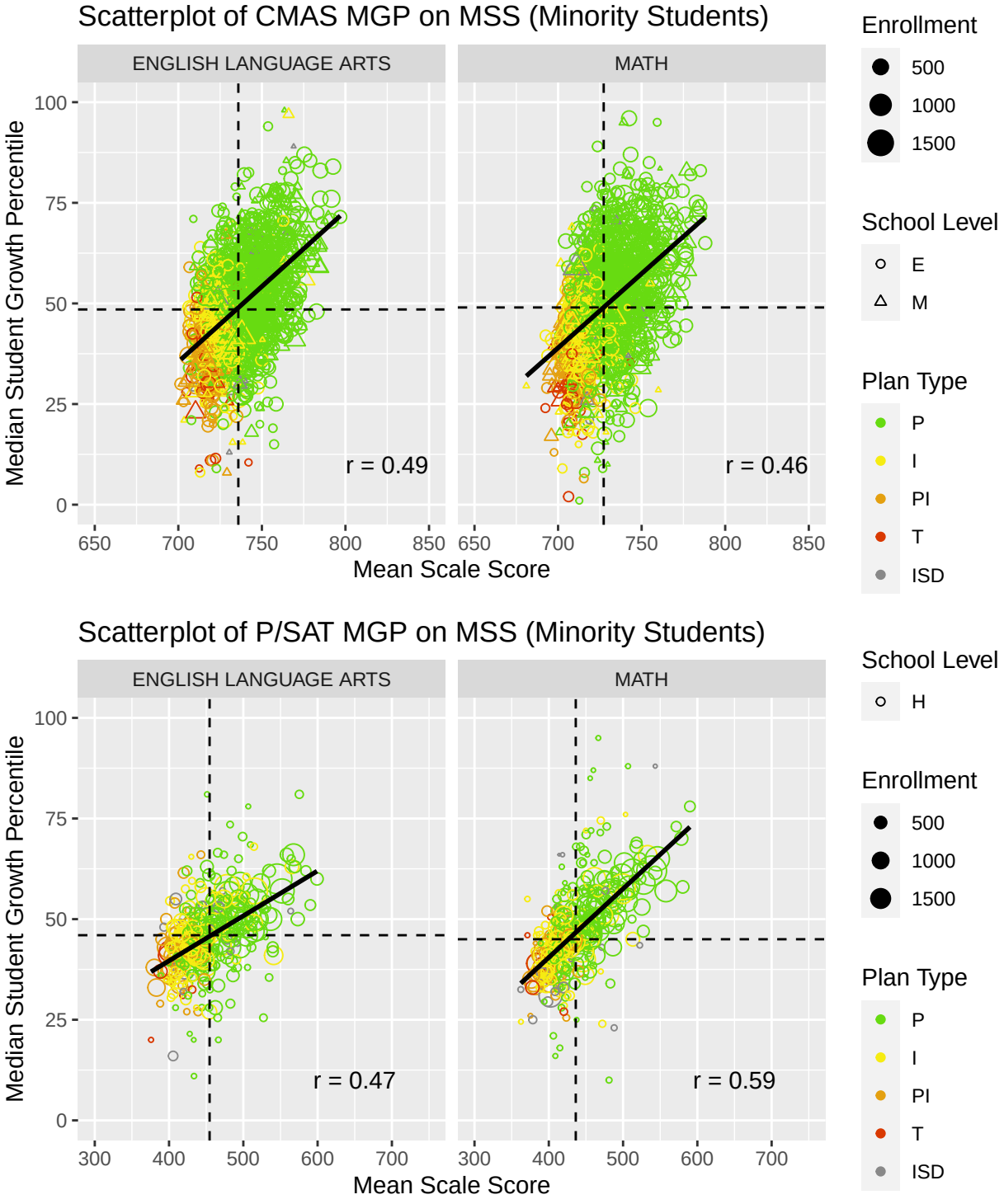
All Students



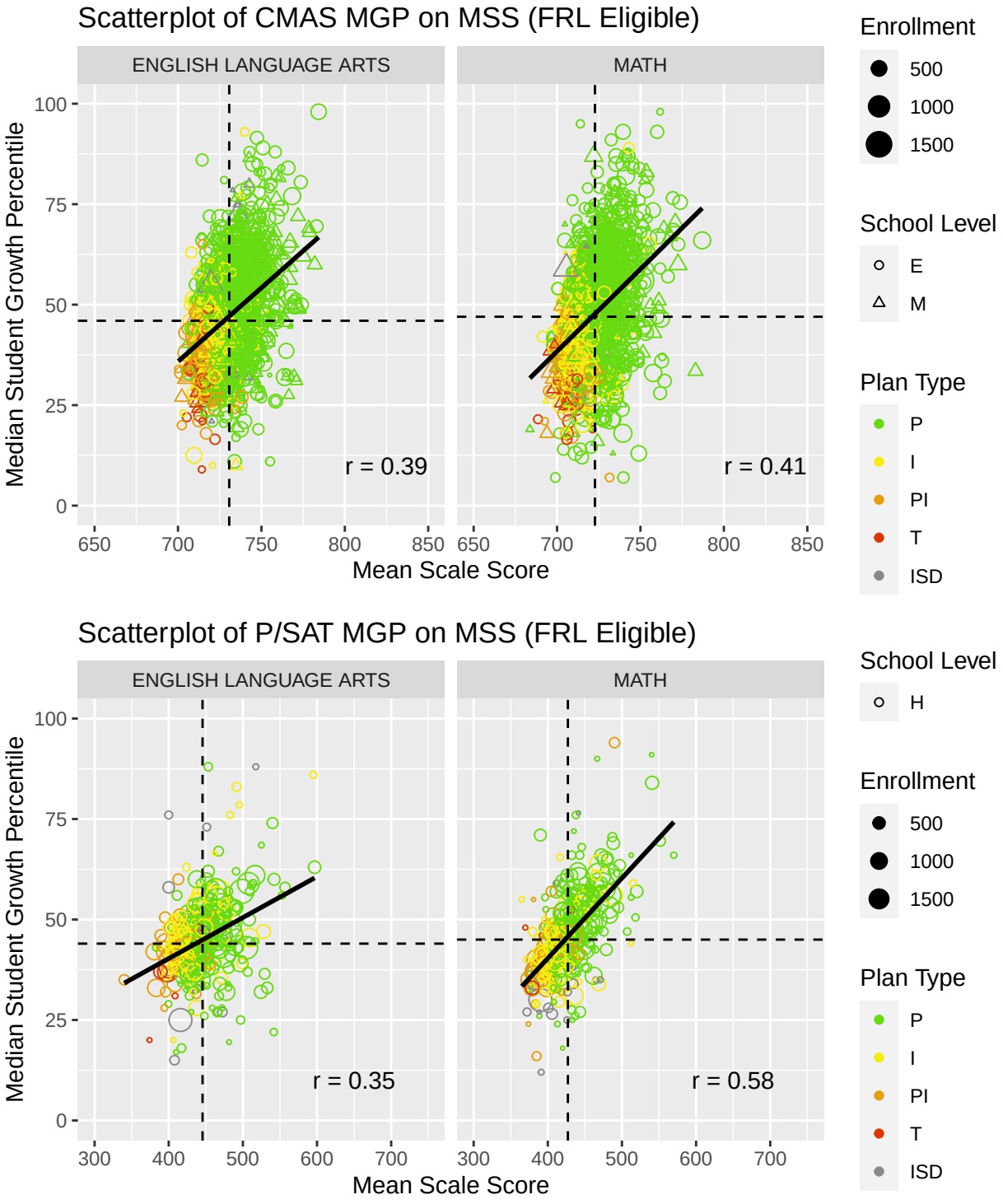
Multilingual Learners



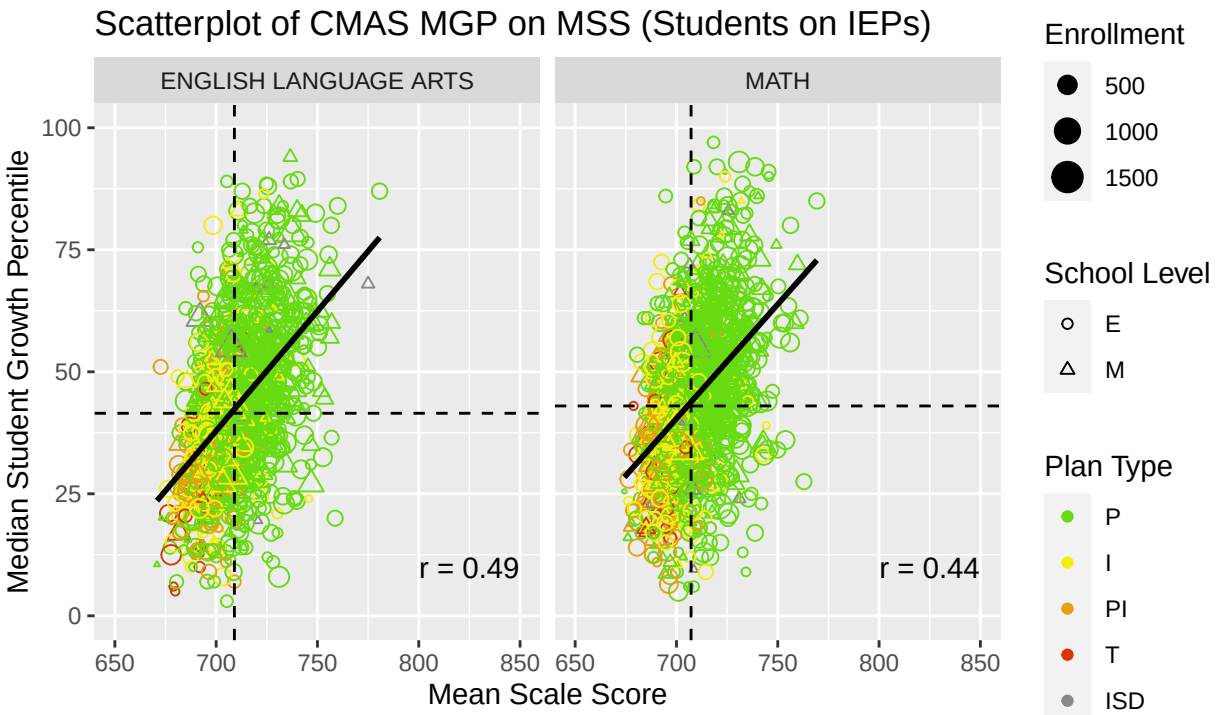
Minority Students

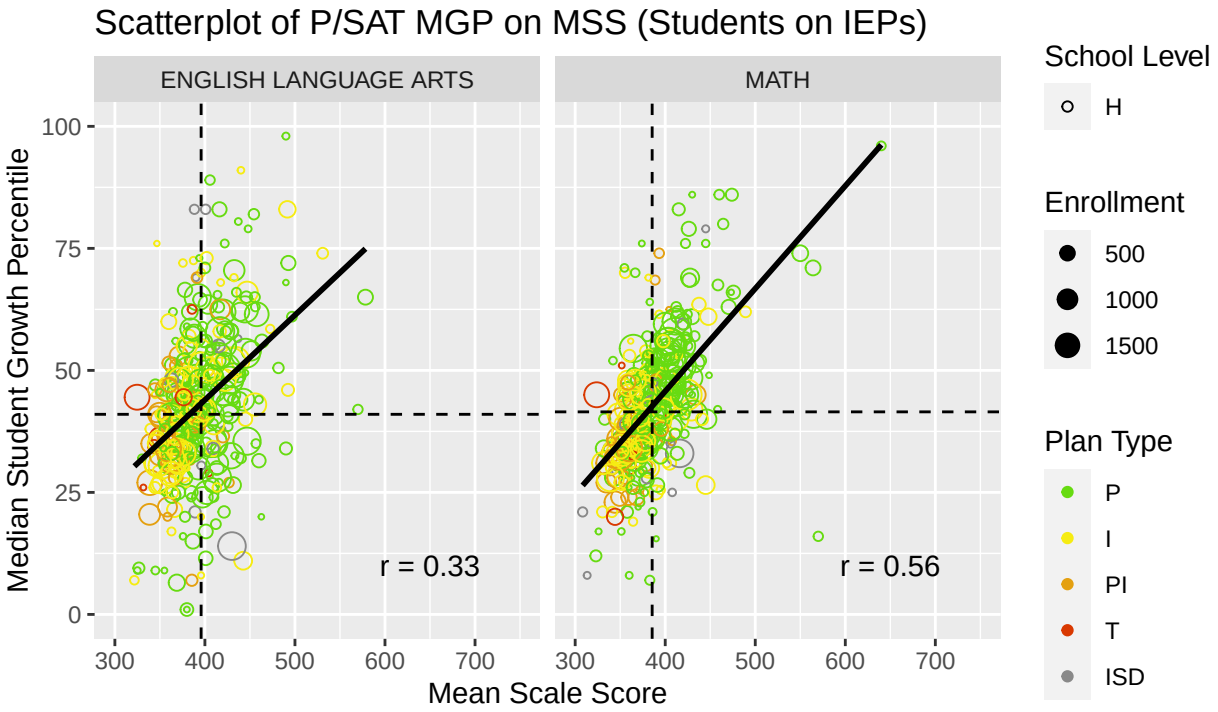


FRL-Eligible Students



Students on IEPs





Gifted Students

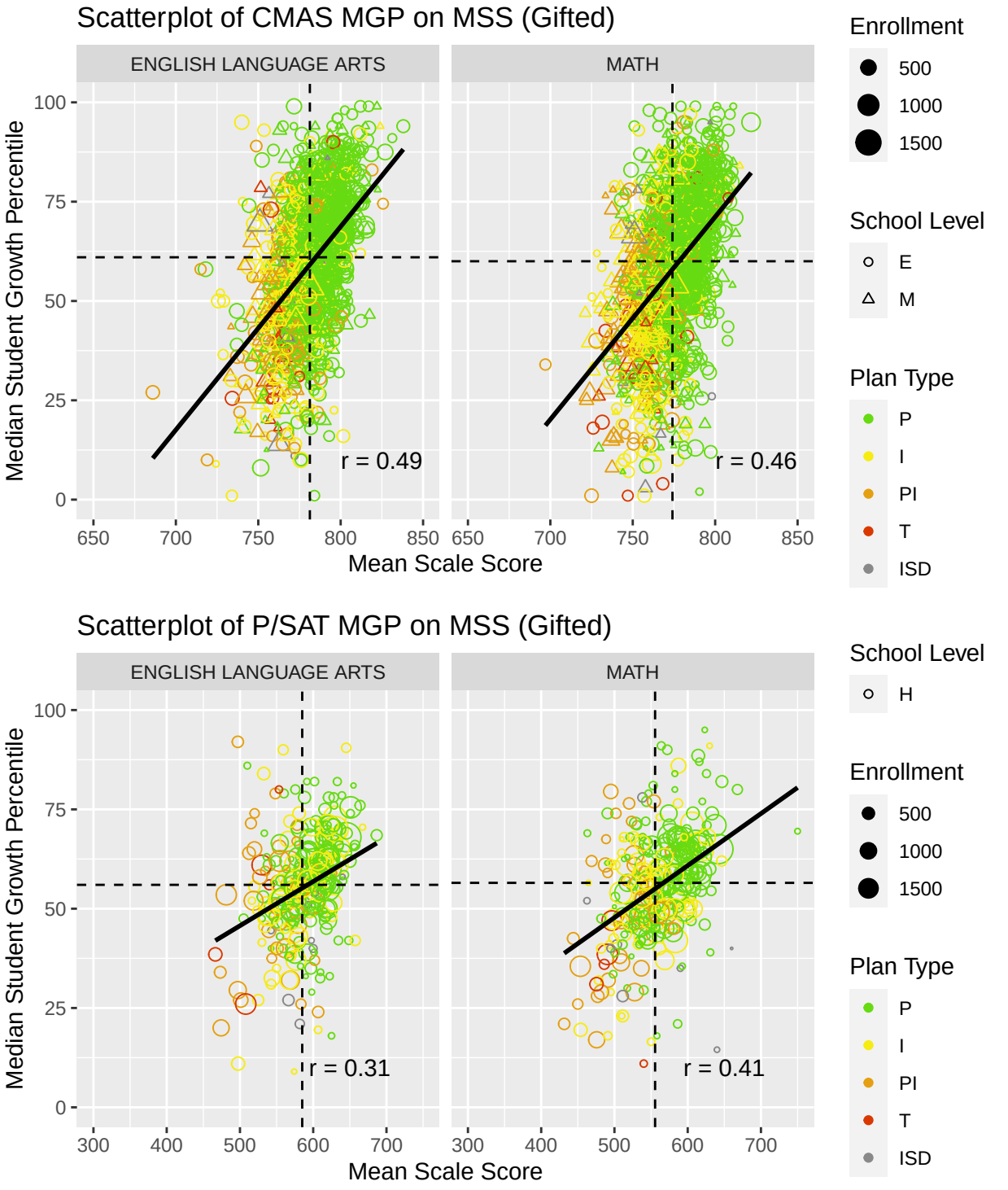


Table of Correlations - MSS & MGP

The table below reports each of the correlations from figures in this sectionfor easy comparison. Correlation magnitudes are color-coded according to the strength of association (see table note).

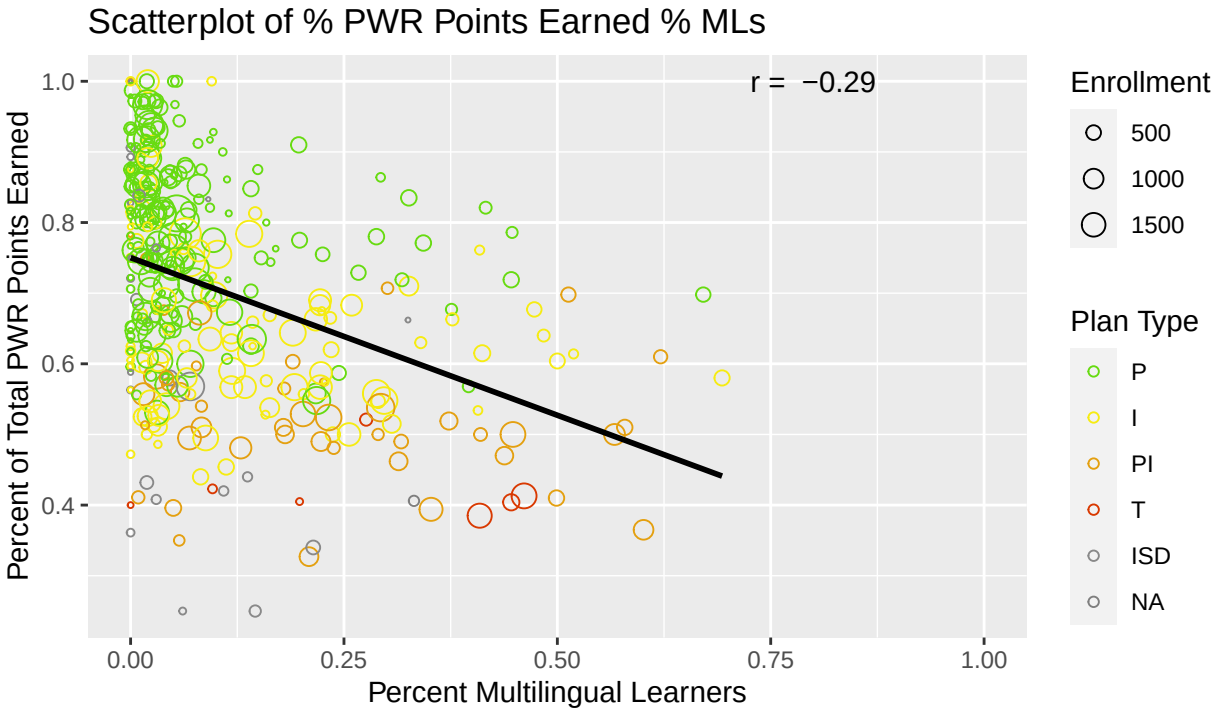
Table 2. Correlations Between MSS and MGP

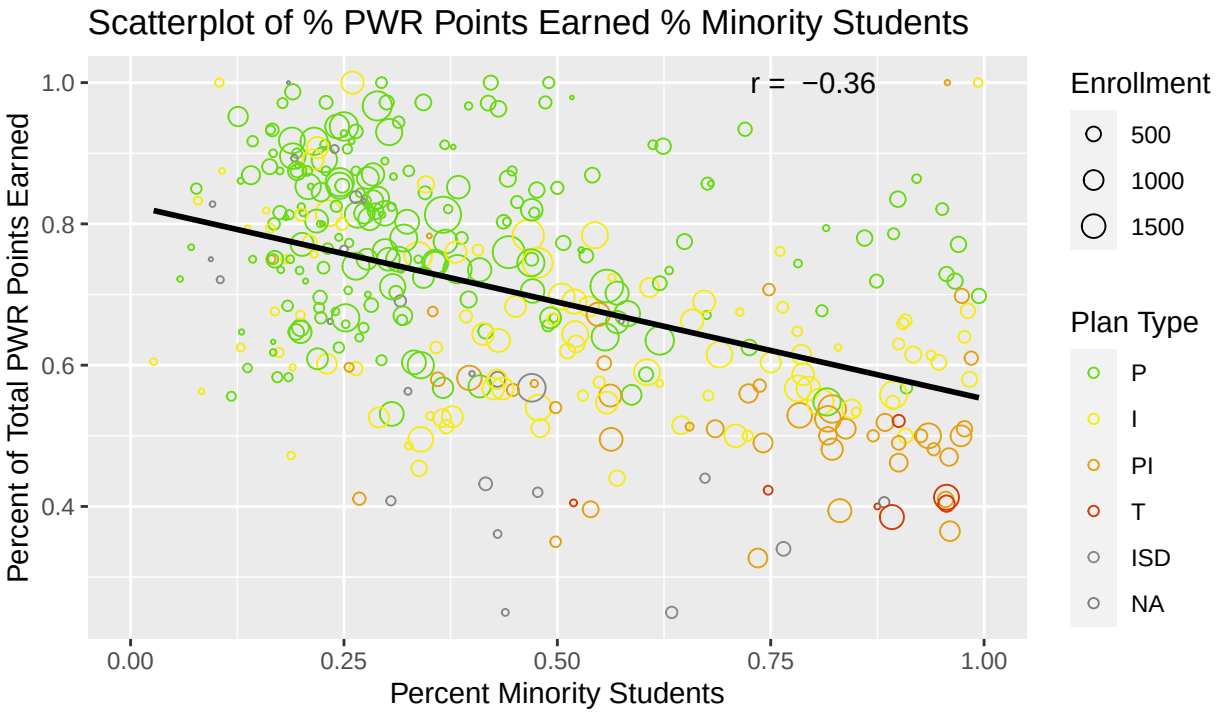
	CMAS		PSAT/SAT	
	ELA	Math	ELA	Math
All Students	0.53	0.48	0.61	0.69
% Multilingual	0.49	0.45	0.39	0.64
% Minority	0.49	0.46	0.47	0.59
% FRL	0.39	0.41	0.35	0.58
% IEP	0.49	0.44	0.33	0.56
% Gifted	0.49	0.46	0.31	0.41

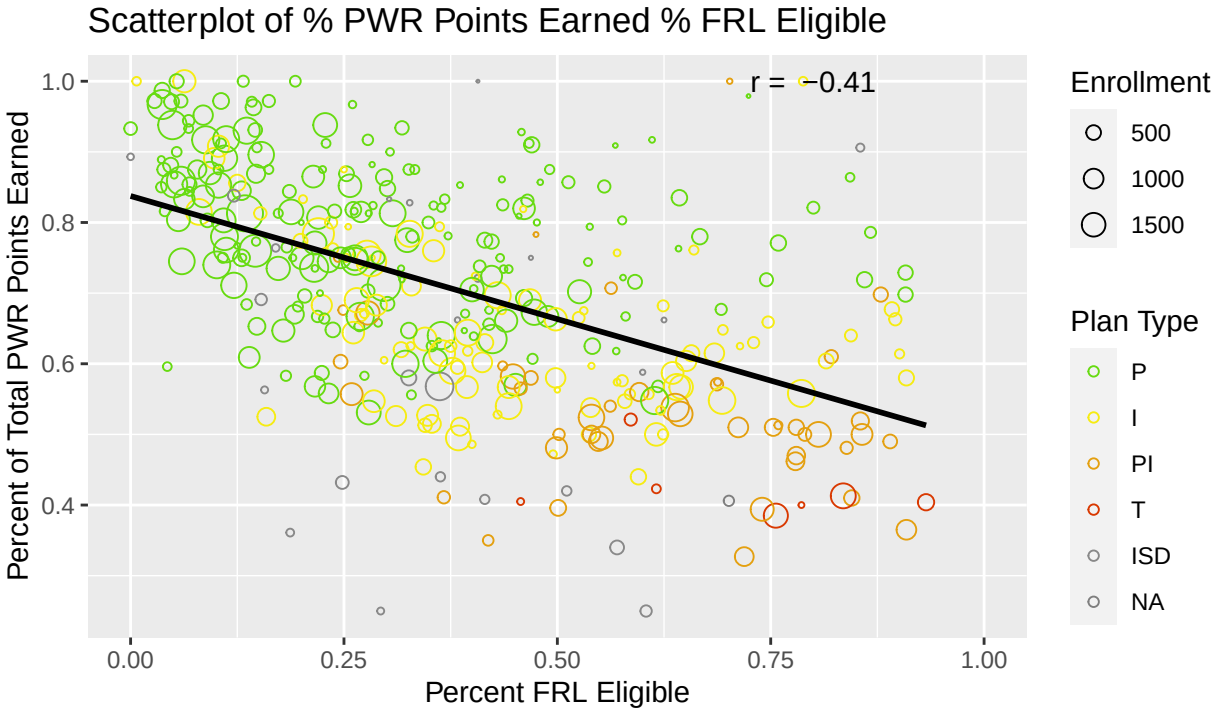
Note . Correlations are color-coded according to the magnitudes described at the beginning of this document: Green = very weak or no relationship; yellow = weak relationship; orange = moderate relationships; red = strong relationship

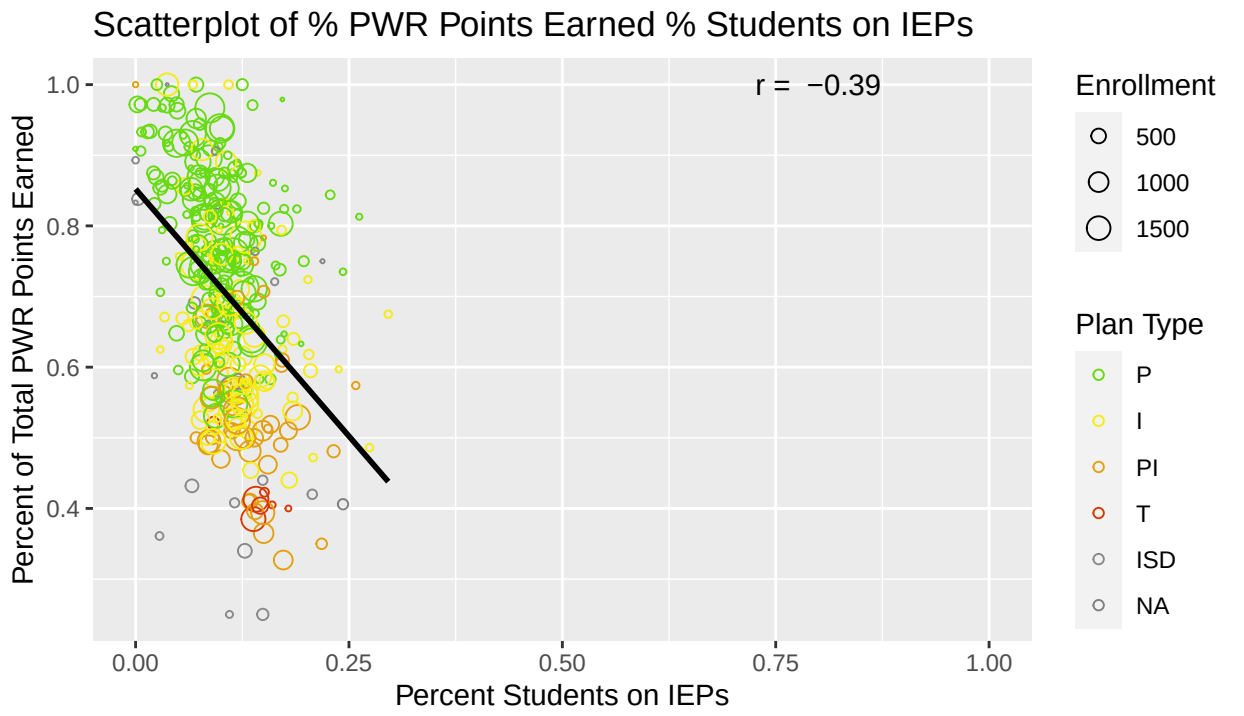
PWR Percent of Total Points Earned and Demographics

In this section, we present scatterplots showing the relationship between total percent of points earned on the PWR indicator and school demographics.




Scatterplot of % PWR Points Earned % Minority Students
r = −0.36
Percent of Total PWR Points Earned
1.0
0.8
0.6
0.4
0.00
0.25
0.50
0.75
1.00
Percent Minority Students
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD
NA


Scatterplot of % PWR Points Earned % FRL Eligible
r = −0.41
Percent of Total PWR Points Earned
1.0
0.8
0.6
0.4
0.00
0.25
0.50
0.75
1.00
Percent FRL Eligible
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD
NA



PWR Subindicators and Student Demographics

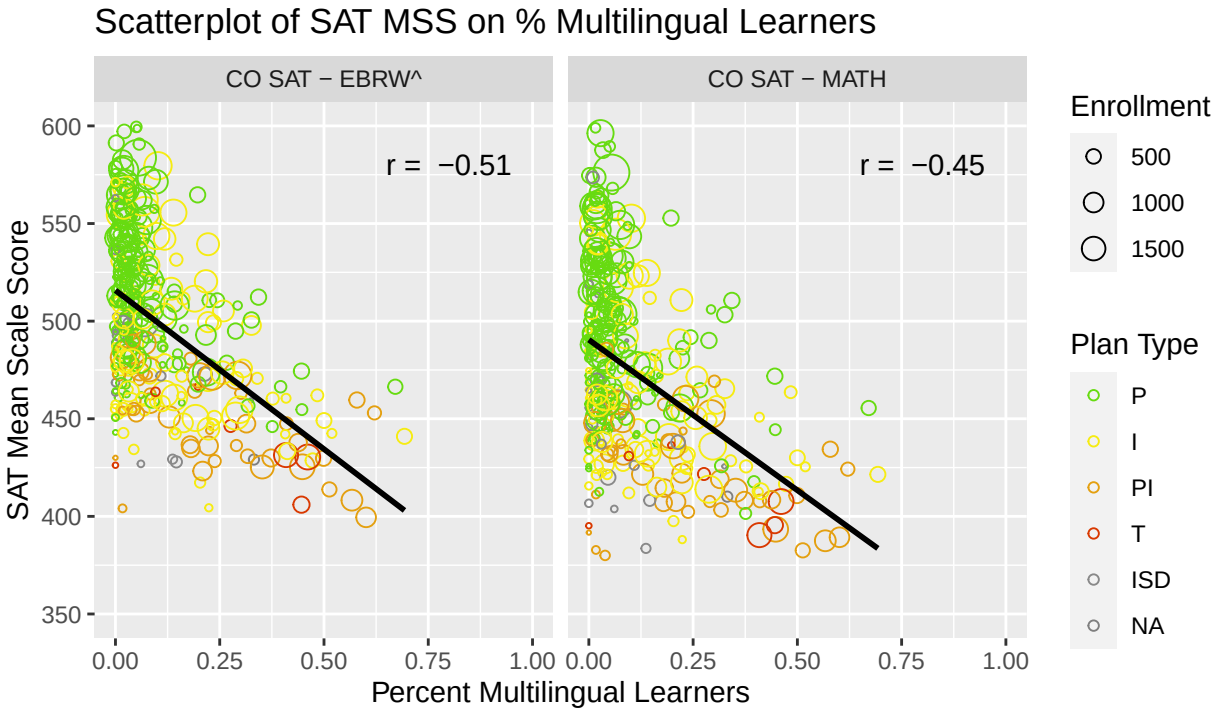
In this section, we present scatterplots showing the relationship between Postsecondary & Workforce Readiness (PWR) subindicators and student demographics. For each subgroup, three plots are presented. The first shows SAT mean scale scores for Evidenced Based Reading and Writing (EBRW) and Math on the y-axis; the second shows rates for graduation and matriculation on the y-axis; the third shows drop-out rates on the y-axis.

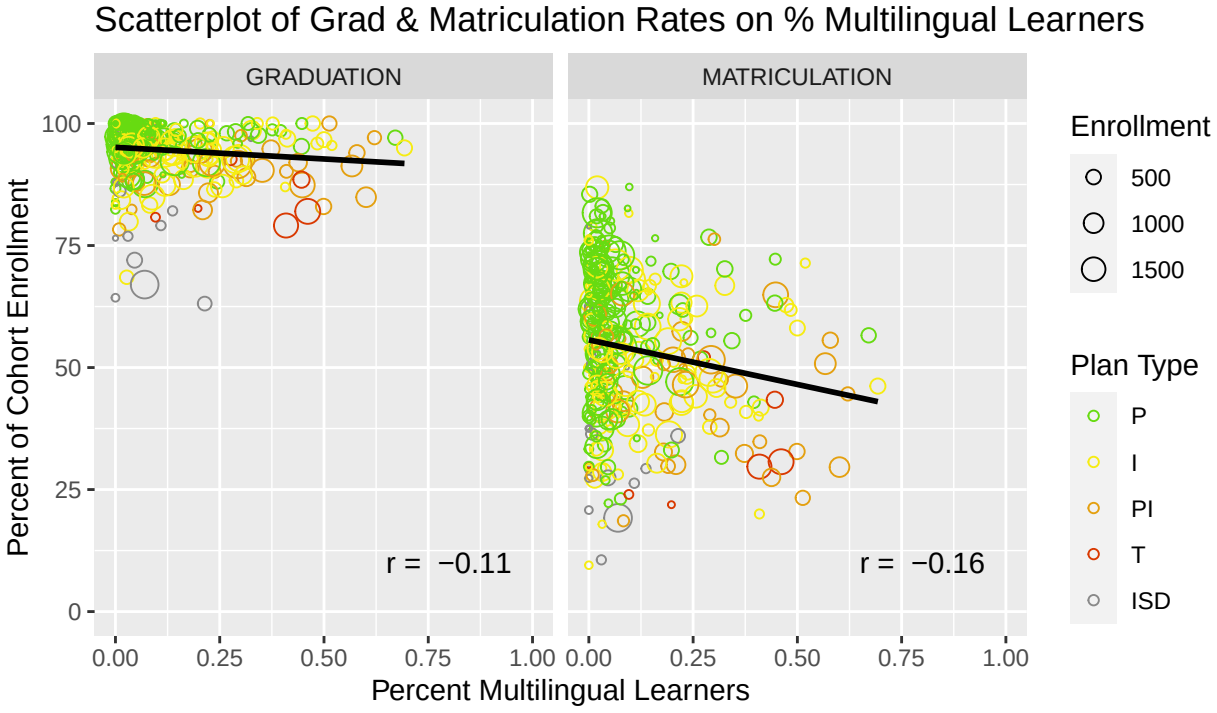
The following criteria apply for all analyses below:

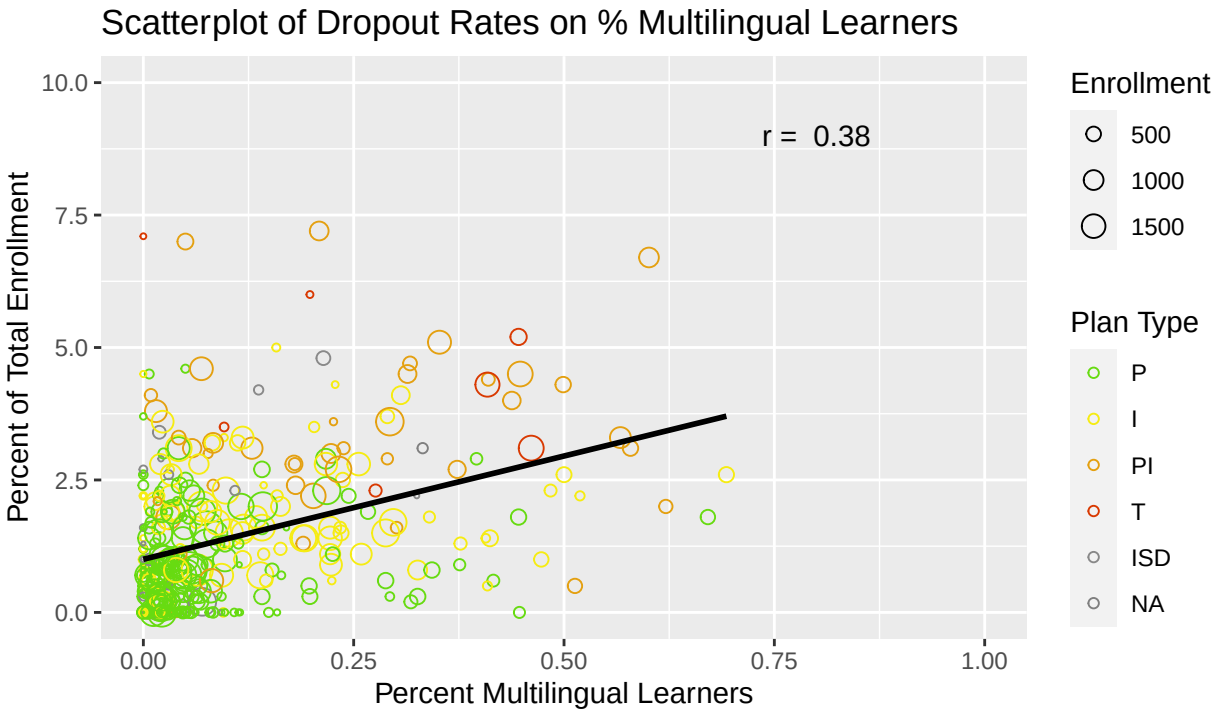
- Analysis remains at the school level.
- SAT scores are from 2023 test administrations. Other measures are lagged by 1 year (2022 data).
- Data does not include schools designated as Alternative Education Campuses (AECs).
- Graduation reflects each school's "Best-of" rate (i.e., 4-,5-, 6-, or 7-year).
- Matriculation reflects overall rates, including 2-year, 4-year, military, and CTE.

In general, we observe moderate to strong relationships between SAT scores and demographics, whereas other PWR measures tend to be more weakly associated with demographics. In particular, relationships between graduation rates and demographics are very weak, those between matriculation and demographics are very weak to weak, and those between dropout rates and demographics are somewhat stronger. Table 3, at the end of the following section, reports these correlations together for ease of comparison.

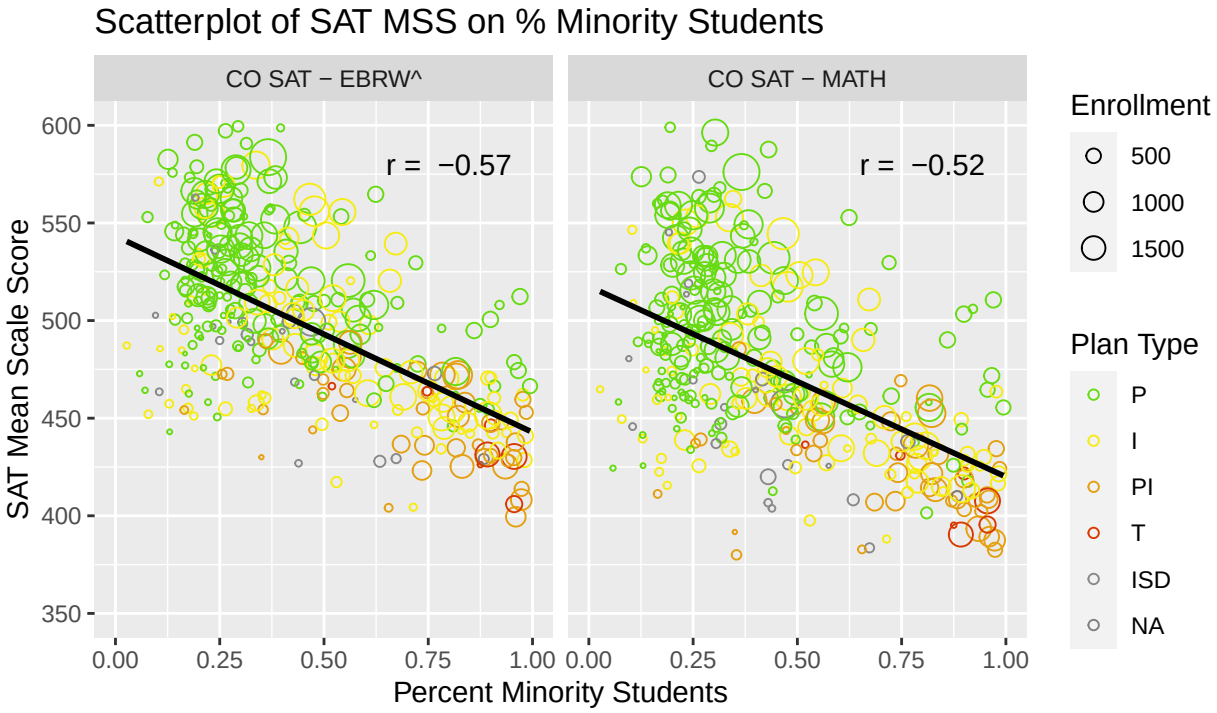
Multilingual Learners

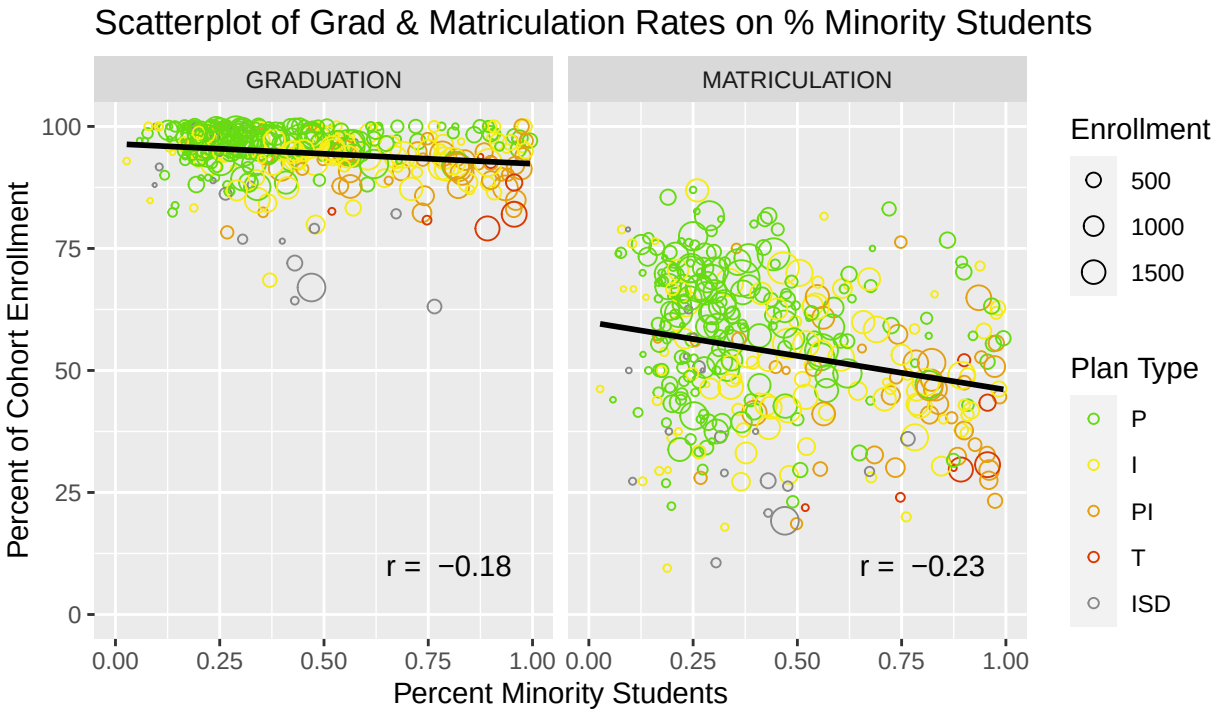


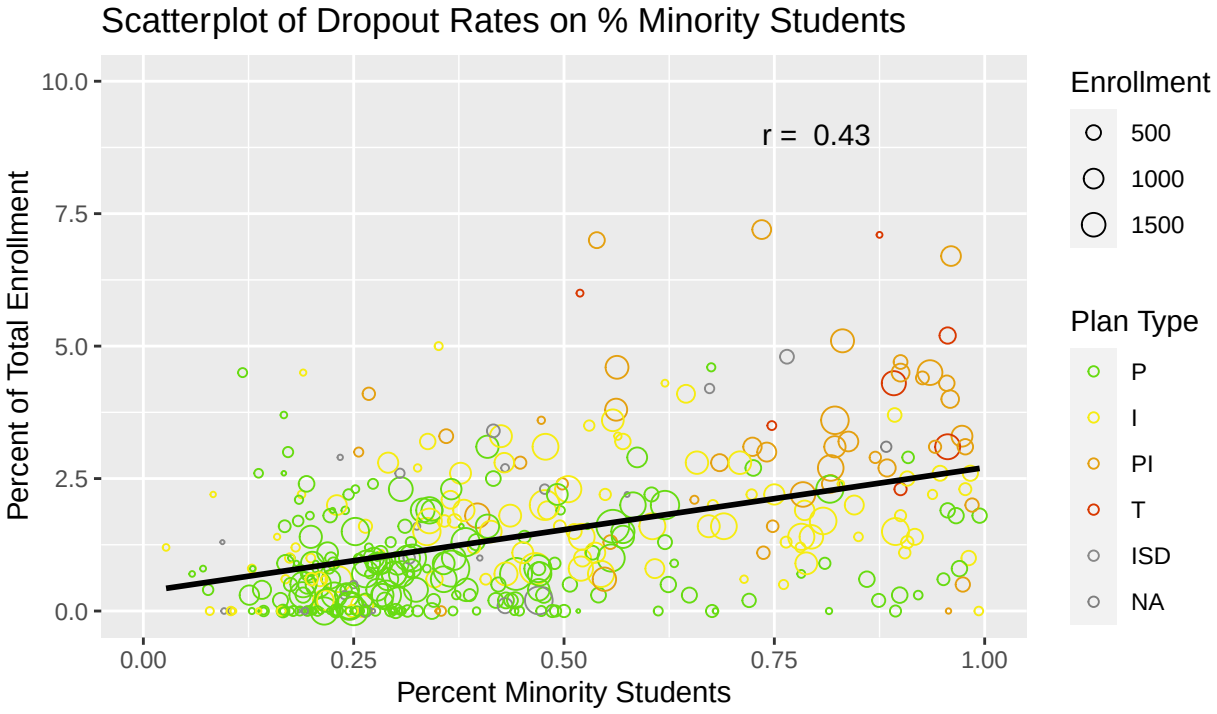




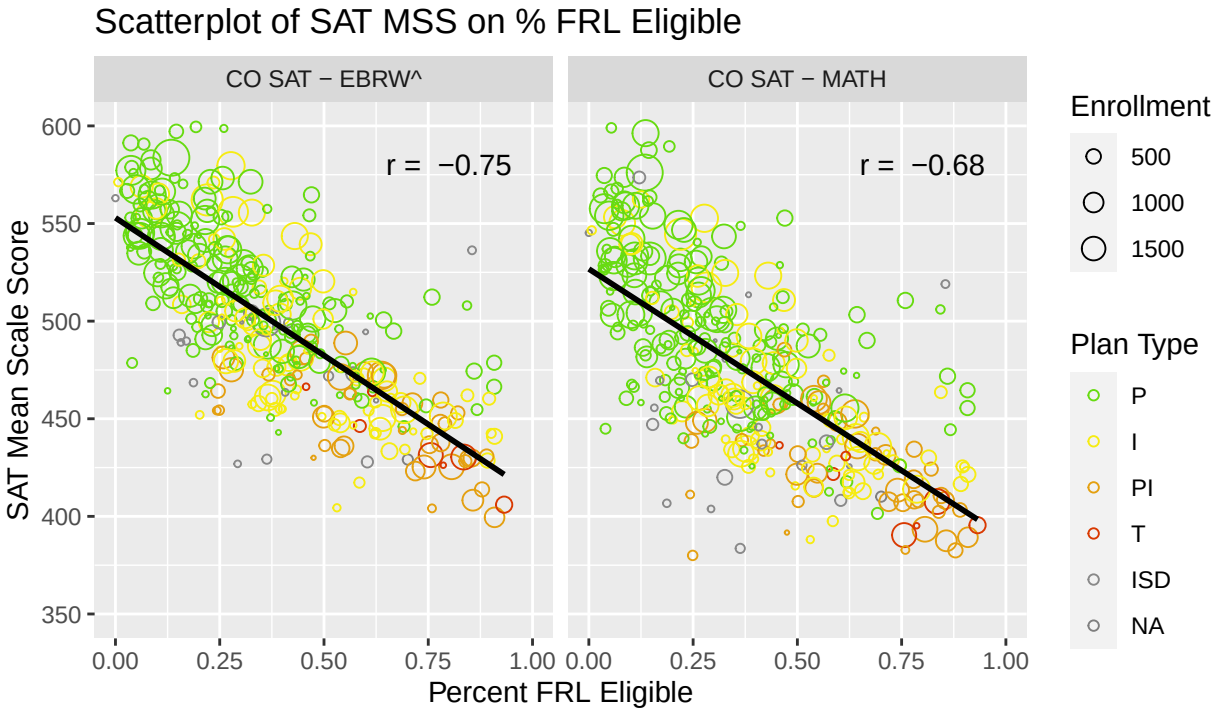
Minority Students

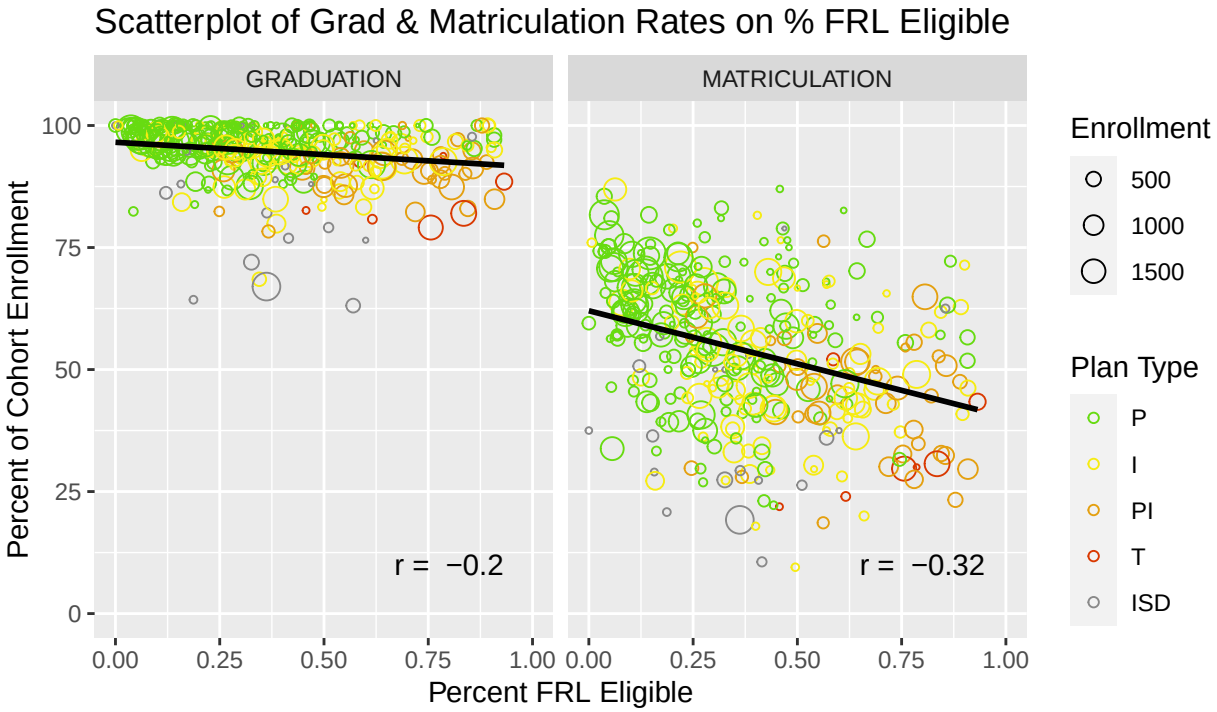


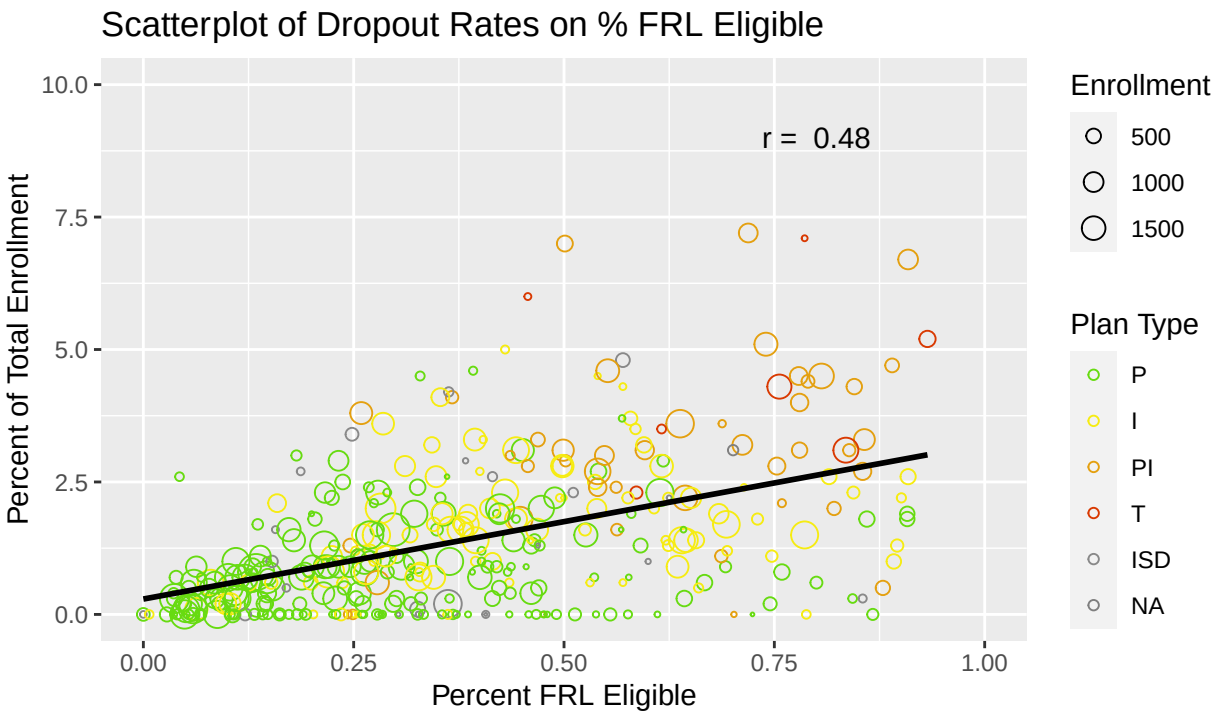

Scatterplot of Grad & Matriculation Rates on % Minority Students
GRADUATION
MATRICULATION
Percent of Cohort Enrollment
Percent Minority Students
r = −0.18
r = −0.23
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD


Scatterplot of Dropout Rates on % Minority Students
Percent of Total Enrollment
Percent Minority Students
r = 0.43
Enrollment
500
1000
1500
Plan Type
P
I
PI
T
ISD
NA

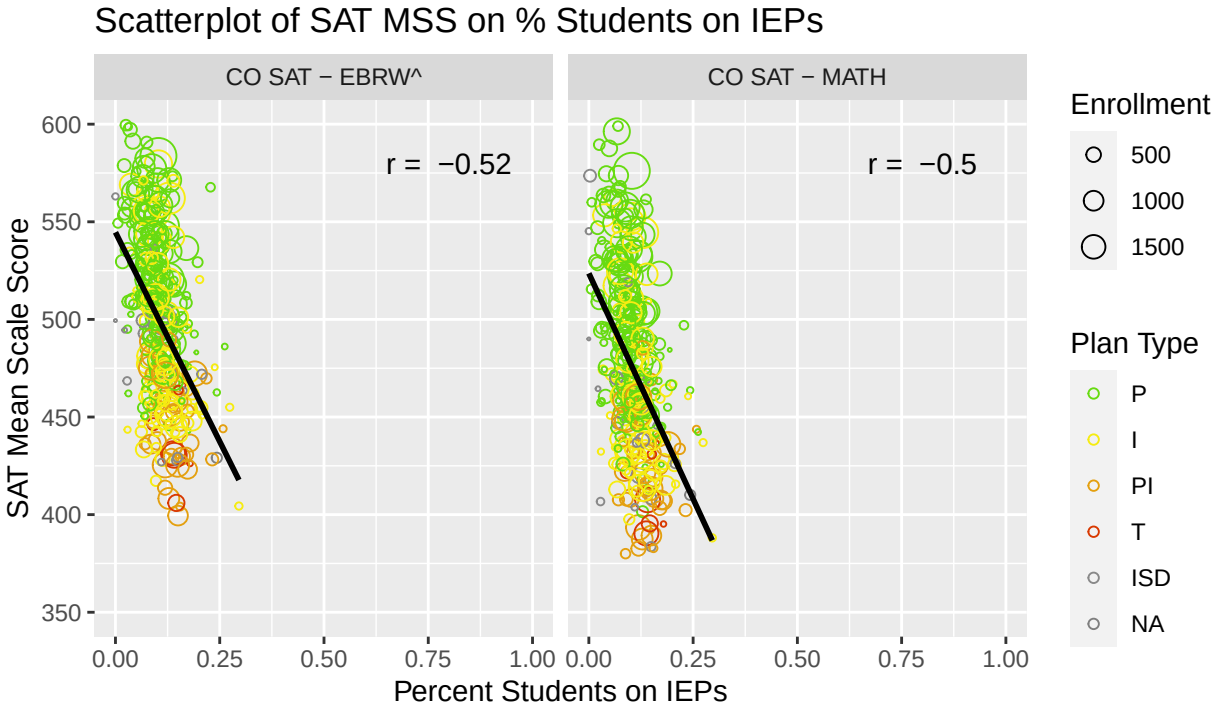
FRL Eligible

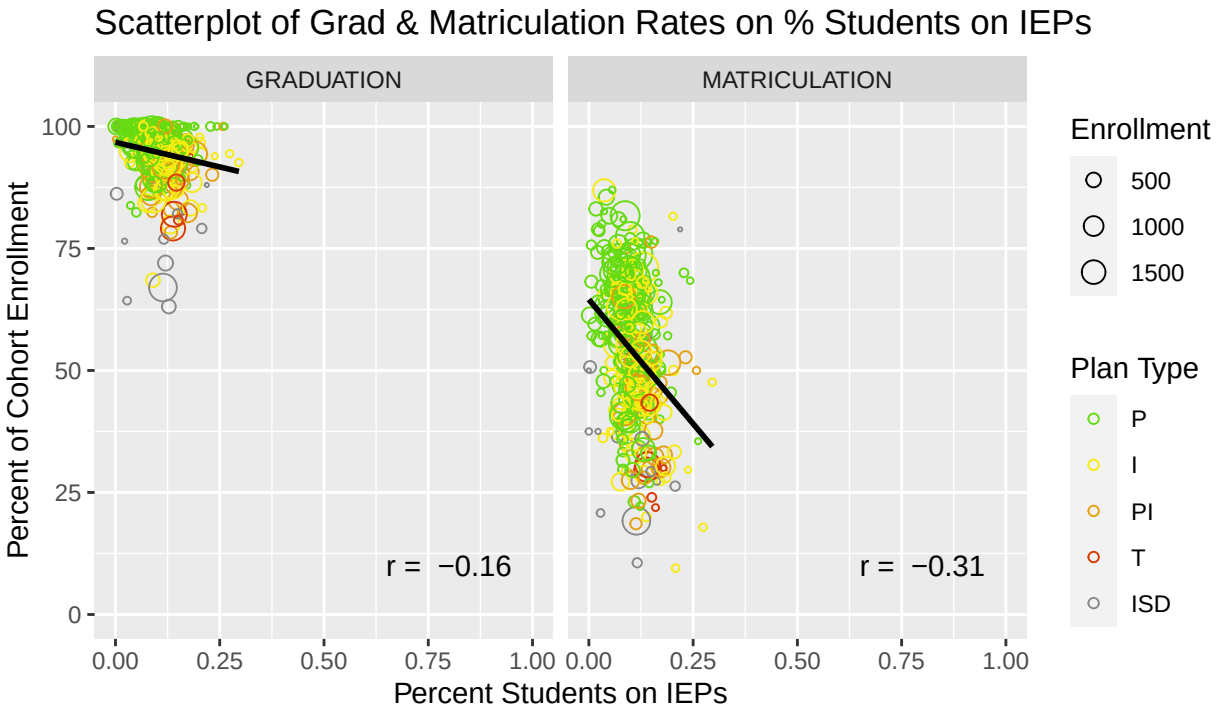


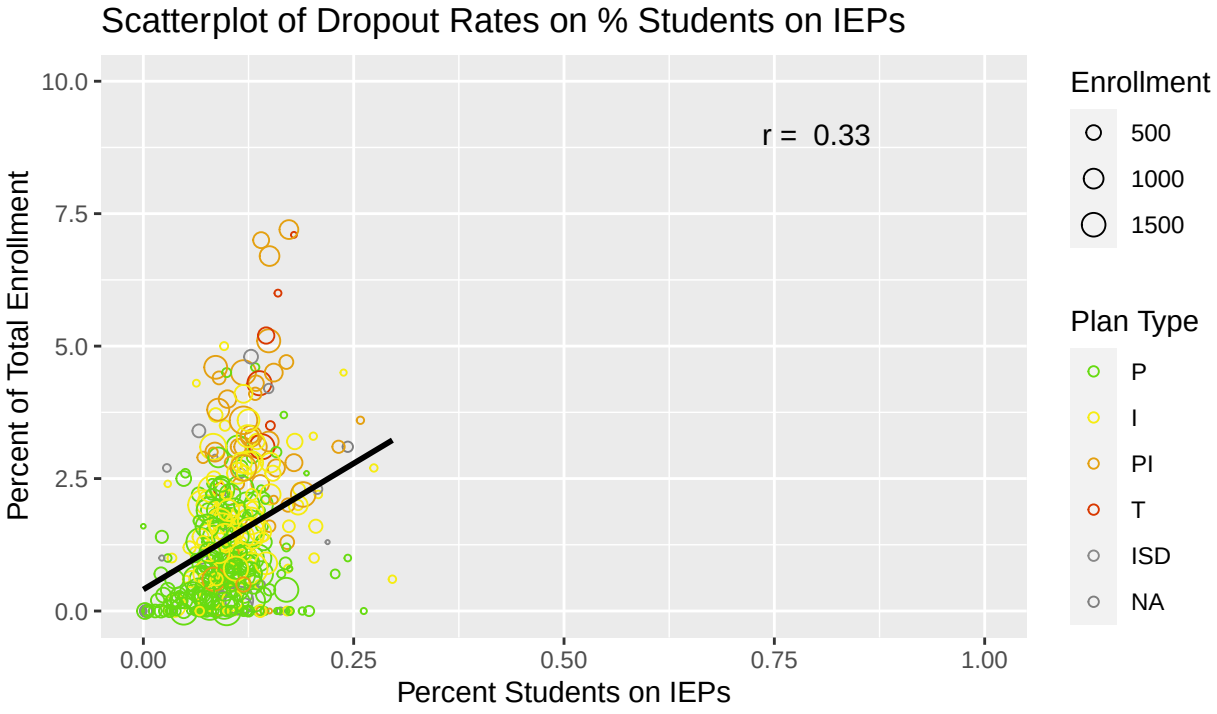




Students on IEPs





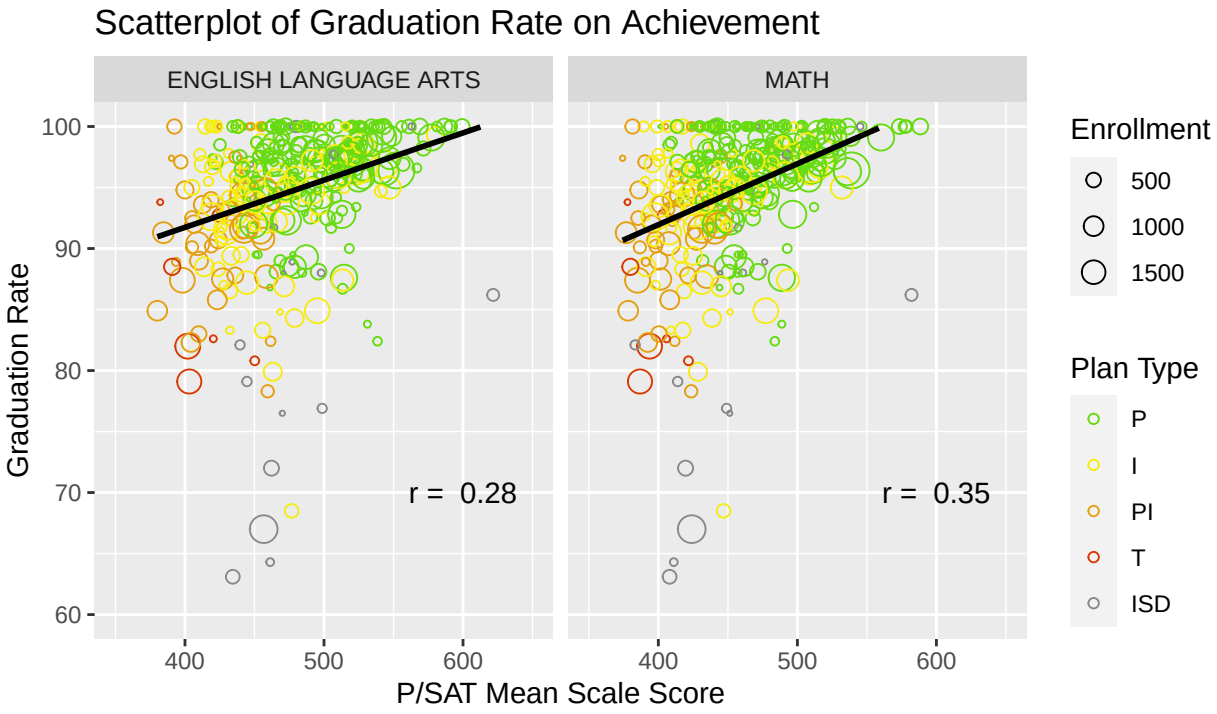


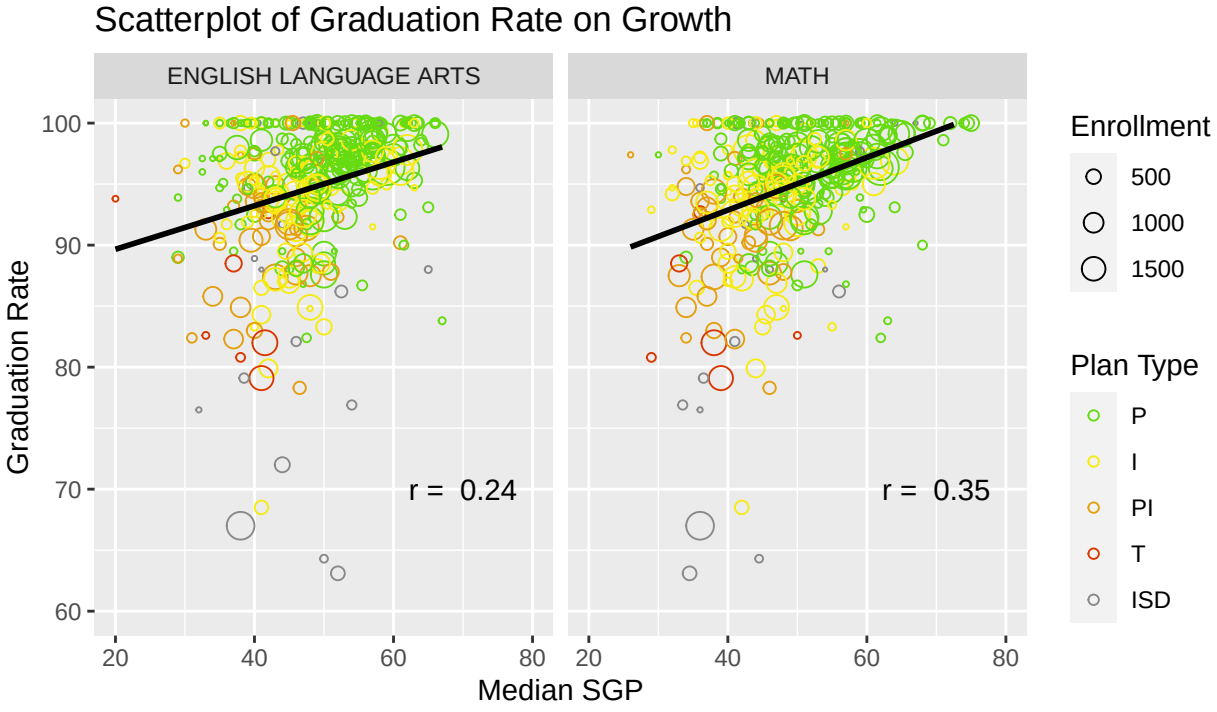
PWR Measures and Growth/Achievment

The scatterplots below show PWR measures on the y-axis and achievement (MSS) or growth (MGP) on the x-axis. Table 3, at the end of this section, presents these correlations together with those from the preceding section. We observe matriculation and dropout rates to be more strongly associated with achievement than with growth, though this difference is somewhat less pronounced when looking at Math as compared to

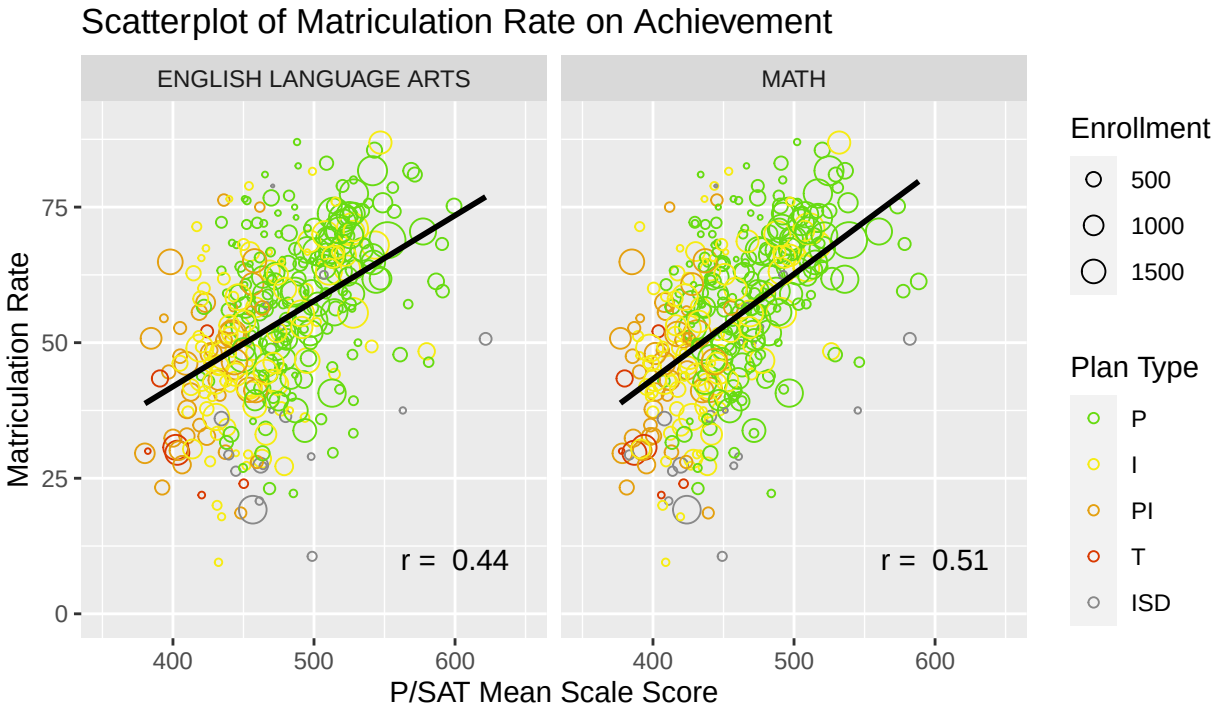
ELA. Graduation rates are more weakly related to achievement than are matriculation and dropout rates, though this pattern does not appear to extend to growth, where correlations are very weak to weak across each PWR measure (excluding SAT scores).

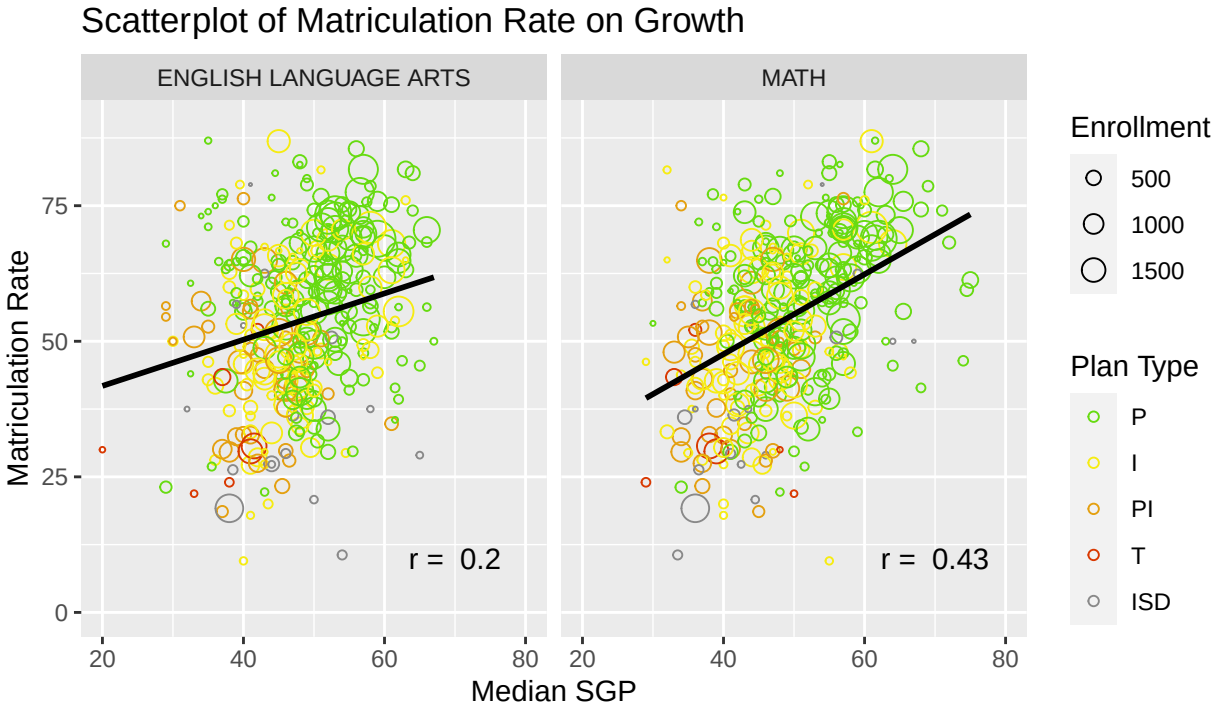
Graduation Rates



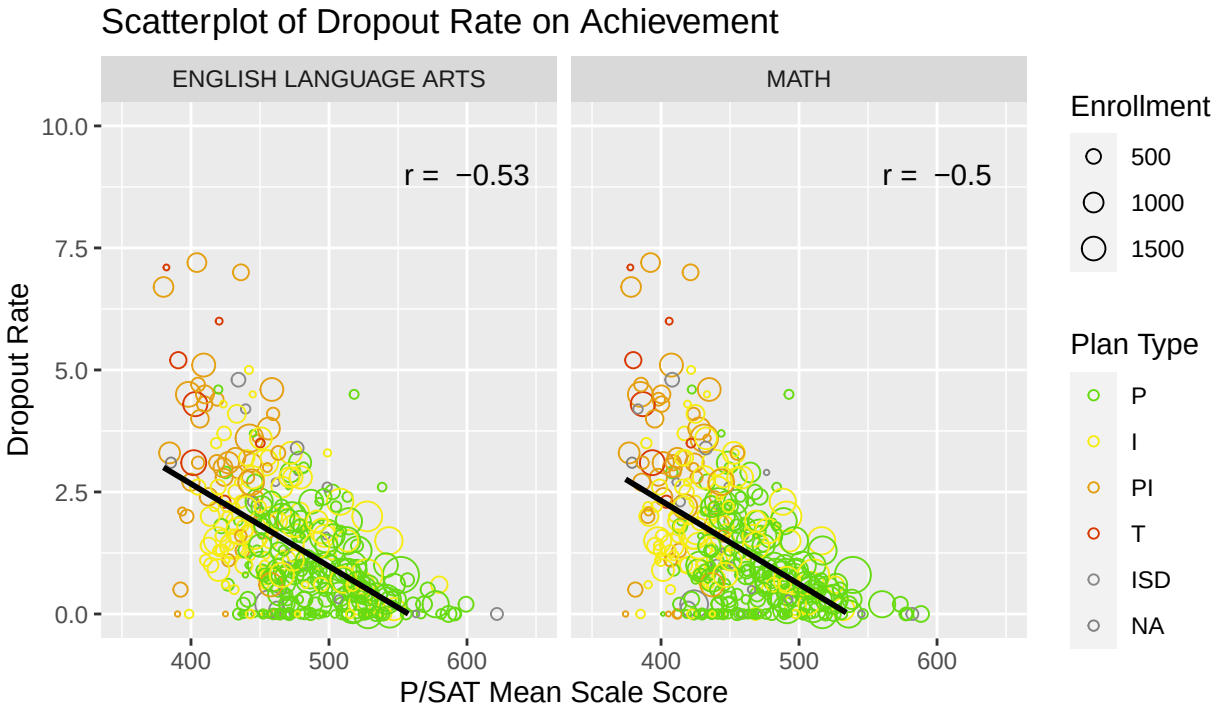


Matriculation Rates





Dropout Rates



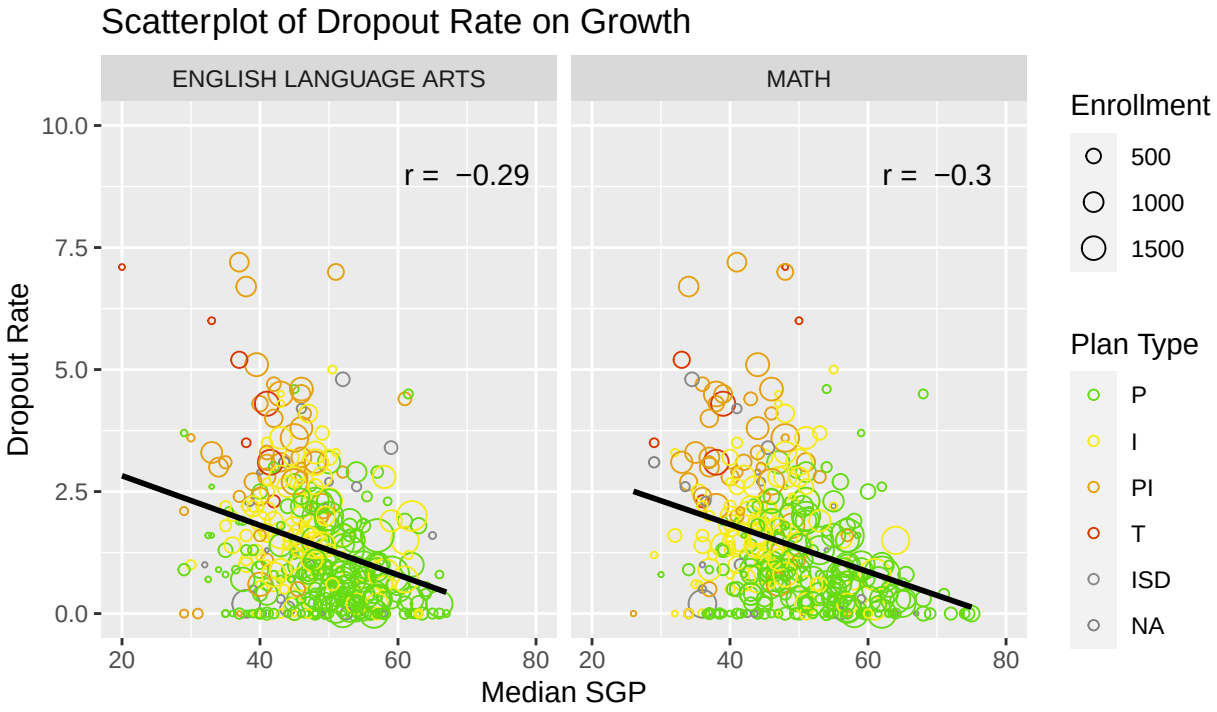


Table of Correlations - PWR Measures, Demographics, and Achievement/Growth

The table below reports each of the correlations from figures in both PWR related sections for easy comparison. Correlation magnitudes are color-coded according to the strength of association (see table note).

Table 3. Correaltions Between PWR, Demographics, and Achievement/Growth

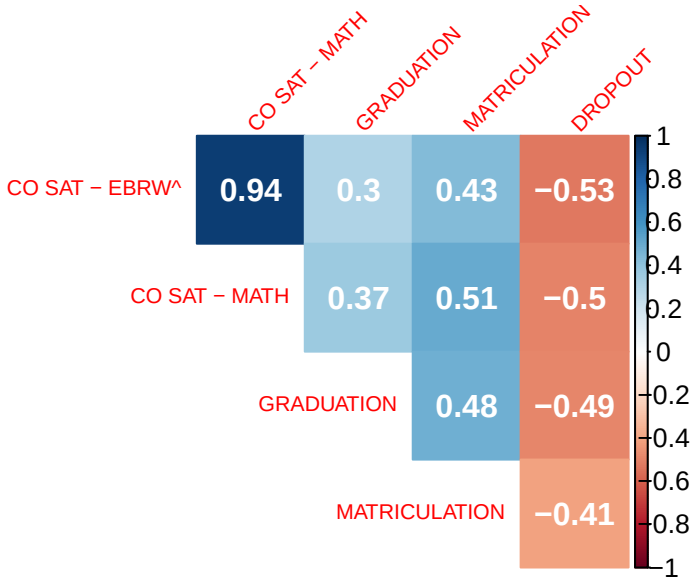
	% PWR Points Earned	SAT-EBRW	SAT-Math	Grad	Matr	Dropout
% Multilingual	-0.29	-0.51	-0.45	-0.11	-0.16	0.38
% Minority	-0.36	-0.57	-0.52	-0.18	-0.23	0.43
% FRL	-0.41	-0.75	-0.68	-0.2	-0.32	0.48
% IEP	-0.39	-0.52	-0.5	-0.16	-0.31	0.33
ELA MSS		-	-	0.28	0.44	-0.53
ELA MGP		-	-	0.24	0.2	-0.29
Math MSS		-	-	0.35	0.51	-0.5
Math MGP		-	-	0.35	0.43	-0.3

Note . Correlations are color-coded according to the magnitudes described at the beginning of this document: Green = very weak or no relationship; yellow = weak relationship; orange = moderate relationships; red = strong relationship

Inter-relationship of PWR Measures

The following correlation matrix reports associations between each pairwise combination of PWR subindicators. Positive correlations are shown in blue and negative in red, with darker shades corresponding to stronger associations.

As expected, there is a very strong relationship between SAT EBRW and SAT Math scores. Other correlations between PWR measures range between 0.3 (graduation and SAT EBRW) and -0.53 (dropout and SAT EBRW). Generally, dropout rates appear most strongly related to other PWR outcomes whereas graduation rates are, on the whole, least strongly related.



Variance Explained by Demographics

In this section, we specify a series of models using multiple regression to estimate the amount of variability in achievement and growth outcomes (at the school level) explained by school demographics. We specify the model as

$$Y_i = \beta_0 + \beta_1(FRL_i) + \beta_2(MIN_i) + \beta_3(ML_i) + \epsilon_i$$

where the dependent variable, Y_i, is either the achievement (MSS) or growth (MGP) outcome in ELA or math for school i. We include as dependent variables the school-level percent of students who are eligible for FRL, historically under-served minority students (non-White), and multilingual learners. We exclude students on IEPs and gifted students from this analysis, as these factors tend to be more directly associated with achievement scores. The table below shows the r-squared value for each model, or the percent of variance in the outcome variable that is explained when including these three predictors together in the regression model.

Table 4. Percent of Variance Explained

	E	M	H
ELA Achievement	69.2%	58.2%	62.1%
ELA Growth	11.8%	6.9%	25.8%
Math Achievment	65.5%	61.5%	50.6%
Math Growth	6.9%	11.6%	20.9%

In general, these findings offer confirmatory evidence regarding the relationship between achievement and growth and school demographics described earlier in this report. Excluding IEP and gifted status, school demographics explain between 50% and 70% of the variability in school level achievement measures. However, these same demographic factors explain far less of the variation in school level growth, particularly at the elementary and middle school levels (7% - 12%). Growth at the high school level is more closely associated with demographics than for elementary and middle schools, though still not nearly to the extent of achievement.