Psychometric Analysis Report for the
Michigan English Language Arts (ELA), Mathematics, Science, and SAT
Student Growth Percentile and Adequate Growth Percentile Reporting

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DRC Psychometric Services Michigan Project Team -
Data Recognition Corporation -

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Introduction

The use of student growth models is common in K-12 testing. The most commonly used approaches by states are conditional growth percentile models, which include student growth percentiles (SGPs, Betebenner, 2008; 2009; 2011) or an alternative known as percentile rank residuals (Castellano & Ho, 2013). Both models attempt to describe individual student growth relative to other students who are academically similar by using prior test scores as predictors. Adequate growth percentiles (AGPs, Betebenner, 2008; 2009; 2011) which use quantile regression models, provide the likelihood students are on track to reaching or maintaining proficiency at some time point in the future. Individual level results from these models can be aggregated at a group level.

SGP analyses were conducted for the M-STEP, SAT, and WIDA, and PRR analysis was conducted for MI-Access assessments. AGP analyses were conducted for M-STEP.

Methodology

Student Growth Percentiles (SGP)

For assessments with a sufficient sample size (M-STEP, SAT, and WIDA Access) student growth percentiles (SGPs) were calculated using the R SGP package (Betebenner et. al., 2015) version 1.7-7.7 as compiled from the master branch of the SGP GitHub repository. SGPs defined this way take a normative approach.

Specially, let Y_t denote an assessment score at time , the expected value of Y_t at the -th quantile, $Q_{Y_t}(\tau|Y_{t-1},...,Y_1)$ based on prior assessment scores $Y_{t-1},...,Y_1$, is then given by (Betebenner, 2011, p17)

$$Q_{Y_t}(\tau|Y_{t-1},...,Y_1) = \sum_{j=1}^{t-1}\sum_{i=1}^{3}\phi_{ij}(Y_j)\beta_{ij}(\tau) \quad (1)$$

Where ϕ_{ij}, $i=1,2,3$ and $j=1,\ldots,t-1$ denote the B-spline basis functions for quantile τ. For instance, for τ =.5, Q_{Y_t} returns the estimated median expectation of Y_t for any combination of $Y_{t-1},...,Y_1$. This analysis used the default parameters of the SGP package which generates 1+7*(number of pretest) parameters per quantile. For example, for a 3-pretest model we have 1+7*3 = 22 parameters per quantile and we estimate 100 quantiles independently (from 0.005 to 0.995 in 0.01 increments).

Calculating a SGP from equation 1 requires prior test score information to determine predicted scores. The SGP for a student is defined as the midpoint of the (ranked) two quantiles between which the student's score falls.

$$= (\max\{\tau\boldsymbol{t}, \hat{Q}_\tau(Y|X=x) < y\boldsymbol{t}\} + \min(\{\tau\boldsymbol{t}, \hat{Q}_\tau(Y|X=x\boldsymbol{t}) > y\boldsymbol{t}\})\boldsymbol{t}*\boldsymbol{t}\frac{100\boldsymbol{t}}{2\boldsymbol{t}} \quad (2)$$

Where $x\boldsymbol{t}$ is the student *i's* vector of prior test scores.

Note that while the SGP package can simulate CSEMs, for the initial Fall 2017 SGP student data files, the -CSEM was not available.

Adequate Growth Percentiles (AGP)

Using the same methodology as described above for calculating SGPs, to calculate a projection or the trajectory a student needs to meet a certain target. An adequate growth percentile, AGP, is the SGP that a student needs to have to meet or exceed the proficient cut score (or any pre-determined achievement target) within a specified time frame (number of academic years).

Betebenner (2011) contextualizes AGPs in terms of "catch-up", "keep-up", or "move-up." Suppose that an AGP is calculated for a given students Y years away. The following would apply:

> **Catch-Up** is used for students currently not proficient who are expected to reach proficient within *Y* years or by the time they have finished their education, whichever comes first
>
> **Keep-Up** is used for students currently at or above proficient who are expected to remain at or above proficient for all *Y* years or by the time they have finished their education, whichever comes first.
>
> **Move-Up** is used for students currently proficient who are expected to advance beyond proficient within *Y* years or by the time they have finished their education, whichever comes first.

Additionally, a lagged AGP target is also calculated and this value is similar to the AGP. But in this case the current year AGP (i.e. 2017) using the quantile regression model. This gives information to determine if students are on track to reaching proficiency or if they will maintain proficiency over a specified number of years.

Percentile Rank Residuals (PRR)

For assessments with small sample sizes (MI-Access), the PRR method (Castellano & Ho, 2013) was used to estimate the conditional student growth percentiles. This method uses an ordinary least squares (OLS) model, where the predictors consist of past student achievement data.

$$Y_{tt} = \beta_0 + \beta_1 y t_{(t-1)t} + \beta_2 y t_{(t-2)t} + \varepsilon t_{tt} \qquad (5)$$

where Y_{tt} is the observed score on the assessment at time *t* for student *i*, $Y_{i,\,t-1}$ is the observed score at prior time 1 and $Y_{i,\,t-2}$ is the observed score at prior time 2.The βs are the regression coefficients, and ε_t is a residual error.

After estimating Equation 5, the residuals are calculated using Equation 6:

$$\hat{\varepsilon}_{tt} = y_t - \hat{y} t_{tt} \qquad (6)$$

where $\hat{\varepsilon} t_t$ is the residual for student *i* at time *t*, $\hat{y} t_t$ is the predicted score from equation 5.

Next, the residuals are rank ordered (Castellano & Ho, 2013, p. 195). -

$$RR_{it} = F(\hat{\varepsilon}_{it}) \times 100 = \frac{\#residuals \leq \hat{\varepsilon}_{it}}{n} \times 100 \quad (7)$$

where $\hat{\varepsilon}_{it}$ is the residual for student *i* at time *t* and *n* is the total sample size for all students with MI-Access FI results for a given posttest in 2016-17.

A standard error of measurement can be obtained by simulation for this method. Specifically, for a given posttest, y_t, and $CSEM(y_t)$ 100 posttest were simulated such that they follow a normal distribution given by Equation 8:

$$y_{ts} \sim N(mean = y_t, sd = CSEM(y_t)) \quad (8)$$

For each simulated y_{ts}, calculate the corresponding PRR using equations 5-7 while holding all other student data constant. Repeat this for each student.

Reporting Results

Results were reported at both the student and aggregate levels. This section provides a brief overview of the results provided to MDE.

For each assessment, results were reported for different content areas. Table 1 provides a list of the assessment and content areas combinations for which SGPs or PRRs were provided. Table 1 provides a list of the grades and domains for which results were reported. Content areas for which AGPs are calculated are also noted in Table 1.

Table 1: Applicable assessments by grade

Grade	M-STEP	SAT	MI-Access	WIDA
K				Overall Composite
1				Overall Composite
2				Overall Composite
3	ELA, Math		ELA, Math	Overall Composite
4	ELA, Math, Science		ELA, Math, Science	Overall Composite
5	ELA, Math, Social Studies		ELA, Math, Social Studies	Overall Composite
6	ELA, Math		ELA, Math	Overall Composite
7	ELA, Math, Science		ELA, Math, Science	Overall Composite
8	ELA, Math, Social Studies		ELA, Math Social Studies	Overall Composite
11	Science, Social Studies	ELA, Math	ELA, Math, Science, Social Studies	Overall Composite
12				Overall Composite

AGP Projections

For ELA and Math grades 4 through 8, AGP targets and/or lagged targets were computed for 1 to 4 years from 2017 or 8th grade, whichever comes first. For example, a grade 4 student had AGPs to grades 5,6,7,

and 8. While a grade 7 student had an AGP to 8th grade. Lagged AGP targets are calculated for Grades 4 through 8. Tables 2 and 3 show the grade progressions for AGP and AGP lagged targets.

Table 2: M-STEP Math and ELA AGP targets by grade, projection year, and grade projected to

	Projected AGP Target Year			
Grade	1 Year 2018	2 Year 2019	3 Year 2020	4 Year 2021
4	5th grade	6th grade	7th grade	8th grade
5	6th grade	7th grade	8th grade	
6	7th grade	8th grade		
7	8th grade			
8				

Table 3: M-STEP Math and ELA AGP lagged targets by grade and projection year

	Projected AGP Lagged Target Year			
Grade 2016	**Current Year 2017**	**Current +1 Year 2018**	**Current +2 Year 2019**	**Current +3 Year 2020**
3	4th grade	5th grade	6th grade	7th grade
4	5th grade	6th grade	7th grade	8th grade
5	6th grade	7th grade	8th grade	
6	7th grade	8th grade		
7	8th grade			

Categorization of Individual (Level) Growth Percentiles

Individual (level) growth percentiles (either SGP or PRR) will also be assigned one of three categorical descriptors based on MDE reporting policies, which are defined as:

- Low: SGP 1-29
- Medium: SGP 30-69
- High: SGP 70-99

Additionally, individual (level) growth percentiles (either SGP or PRR) will also be assigned one of five categorical descriptors based on historical MDE accountability policies. These five categorical descriptors are no longer used in MDE accountability processes but were still calculated for analysis purposes. The five categorical descriptors are defined as:

- Significant Decline (SGP 0-19
- Decline (SGP 20-39)
- Maintain (SGP 40-59)
- Improvement (SGP 60-79)
- Significant Improvement (SGP 80-99)

Valid Test Sequence Rules

Identified suitable pathways and their information can be found in Table 4 for the SGP method (M-STEP/SAT), the PRR approach (MI-Access FI), and the SGP method (WIDA Access).

Table 4: M-STEP Testing Program Valid Sequence for SGP/AGP calculations

Program	Grade 2017	Prior Year 1	Prior Year 2
M-STEP ELA & Math	4	M-STEP 3rd grade Spring 2016	
	5	M-STEP 4th grade Spring 2016	M-STEP 3rd grade Spring 2015
	6	M-STEP 5th grade Spring 2016	M-STEP 4th grade Spring 2015
	7	M-STEP 6th grade Spring 2016	M-STEP 5th grade Spring 2015
	8	M-STEP 7th grade Spring 2016	M-STEP 6th grade Spring 2015
SAT	11	MEAP 8th grade Fall 2013	MEAP 7th grade Fall 2012
M-STEP Science	11	MEAP 8th grade Fall 2013	MEAP 5th grade Fall 2010
MI-Access ELA & Math	4	MI-Access 3rd grade Spring 2016	
	5	MI-Access 4th grade Spring 2016	MI-Access 3rd grade Spring 2015
	6	MI-Access 5th grade Spring 2016	MI-Access 4th grade Spring 2015
	7	MI-Access 6th grade Spring 2016	MI-Access 5th grade Spring 2015
	8	MI-Access 7th grade Spring 2016	MI-Access 6th grade Spring 2015
	11	MI-Access 8th grade Fall 2013	MI-Access 7th grade Fall 2012
MI-Access Science	11	MI-Access 8th grade Fall 2013	MI-Access 5th grade Fall 2010
WIDA	1	WIDA Kindergarten Spring 2016	
	2	WIDA 1st grade Spring 2016	WIDA Kindergarten Spring 2015
	3	WIDA 2nd grade Spring 2016	WIDA 1st grade Spring 2015
	4	WIDA 3rd grade Spring 2016	WIDA 2nd grade Spring 2015
	5	WIDA 4th grade Spring 2016	WIDA 3rd grade Spring 2015
	6	WIDA 5th grade Spring 2016	WIDA 4th grade Spring 2015
	7	WIDA 6th grade Spring 2016	WIDA 5th grade Spring 2015
	8	WIDA 7th grade Spring 2016	WIDA 6th grade Spring 2015
	9	WIDA 8th grade Spring 2016	WIDA 7th grade Spring 2015
	10	WIDA 9th grade Spring 2016	WIDA 8th grade Spring 2015
	11	WIDA 10th grade Spring 2016	WIDA 9th grade Spring 2015
	12	WIDA 11th grade Spring 2016	WIDA 10th grade Spring 2015

Minimum Number of Students

A minimum of 5,000 students will be required for the SGP M-STEP & SAT run. -
A minimum of 1,000 students is preferred for the MI-Access FI PRR run. -
A minimum of 2,000 students will be required for the SGP WIDA Access for ELLs 2.0 run. -

Repeat Test Takers

Students who repeated the grade immediately before the posttest will not be included in either the SGP or the PRR analysis, thus the SGPs were not calculated for these students. For instance, if posttest score (Y_t) and prior 1 year score (Y_{t-1}) are with the same grade, the student is not included in the analysis and does not receive an SGP.

Skipped Grades

Students who skipped the grade immediately prior to the posttest will not be included in the analysis (i.e. 5th grade posttest following skipping 4th grade in the previous example.) In addition, if a student has a test sequence with a skipped grade, only the grade prior will be used to calculate the SGP.

Gaps in Test Sequence

Some students in the dataset are missing certain years of test scores. This may be due to student mobility, missed test windows, or other factors (e.g., Grade 3 M-STEP ELA in Spring 2015, followed by Grade 5 M-STEP ELA in Spring 2017). Students with a gap will not be included unless they have a recent, valid sequence leading up to the posttest.

Home School and Private School Exclusion

All home schooled and private school test records will be excluded from computing SGP. MDE will ensure that students who were previously tested as home schooled or at a private school are also excluded from the data pull.

Student Level Results for SGPs and PRRs

Student level results provided to MDE for SGPs and PRRs included:

1. Demographic and assessment information
2. SGPs
3. SGP standard errors
4. SGP Growth Level Code
5. SGP Norm Group
6. Estimation Method
7. Prior achievement information used

Student Level Results for AGPs

Student level results provided to MDE for AGPs included:

1. Demographic and assessment information
2. AGP Years Projected (1-4)
3. AGP Target
4. AGP Lagged Target
5. AGP Stay/Move Up Target
6. AGP Lagged Stay/Move Up Target

Aggregation

Results were aggregated by assessment and accountability at the state, district, and school level using a variety of subgroups specified by MDE. Aggregation results included:

1. Count of students included
2. Average (arithmetic mean) of the SGPs
3. Standard deviation of SGPs

4. - Count of students at each of five growth levels (Significant Improvement, Improvement, - Maintain, Decline, Significant Decline) -
5. - Percentage of students at each of these five levels as a percentage of total students with SGPs
6. - Count of students at each of three growth levels (Low, Medium, High)
7. - Percentage of students at each of these three levels as a percentage of total students with SGPs.
8. - Building z-score

Quality Control

DRC's psychometric team verified the data coming from MDE followed the rules, structure, and specifications agreed upon by both DRC and MDE. Any issues around unexpected data or missing fields were addressed by MDE.

To ensure that the proper growth model was used, base R code was written by the psychometrician and verified by a consultant and a statistical analyst. The code for each subject was reviewed and SGP, PRR, or AGP values were internally checked for reasonability. Two staff members from the psychometric services team verified aggregate results by independent replication, and MDE reviewed the reasonability of the aggregate and individual SGP, PRR, or AGP results. Results went through several iterations of independent replication and MDE review until all discrepancies were resolved.

Summary of Results

Tables 5 through 9 provide a summary of the number of students and median growth SGPs or PRR values by aggregate levels. Tables 5 and 6 provide the summary of number of students and median growth (SGP or PRR) by testing program, calculation method, content area, and grade. Table 7 provides the results by calculation method, content area, and grade. Table 8 provides the results by content area and grade and Table 9 provides the results by grade. As expected with these methods, the median values tend to be near 50.

Table 5: Number of cases and median SGP by testing program, content area, and grade.

Testing Program	Content Area	Grade	N	Median
M-STEP	English Language Arts	4	103,630	50
		5	103,625	50
		6	102,305	50
		7	105,481	50
		8	104,321	50
	Mathematics	4	103,569	50
		5	103,718	50
		6	102,155	50
		7	105,364	50
		8	104,485	50
	Science	11	94,157	50
SAT	English Language Arts	11	92,728	50
	Mathematics	11	92,880	50
WIDA	WIDA	1	8,521	50
		2	9,077	50
		3	9,586	50
		4	7,084	50
		5	6,261	51
		6	5,458	51
		7	5,466	51
		8	5,465	51
		9	5,102	50
		10	4,042	51
		11	2,961	51
		12	2,343	51

Table 6: Number of cases and median PRR by testing program, content area, and grade.

Testing Program	Content Area	Grade	N	Median
MI-Access	English Language Arts	4	1,137	50
		5	1,309	52
		6	1,346	50
		7	1,381	51
		8	1,335	50
		11	852	50
	Mathematics	4	1,177	50
		5	1,359	51
		6	1,414	51.5
		7	1,502	51.5
		8	1,462	50
		11	910	51
	Science	11	925	50

Table 7: Number of cases and median growth by method, content area, and grade.

Method	Content Area	Grade	N	Median
PRR	English Language Arts	4	1,137	50
		5	1,309	52
		6	1,346	50
		7	1,381	51
		8	1,335	50
		11	852	50
	Mathematics	4	1,177	50
		5	1,359	51
		6	1,414	51.5
		7	1,502	51.5
		8	1,462	50
		11	910	51
	Science	11	925 -	50
SGP	English Language Arts	4	103,630	50
		5	103,625	50
		6	102,305	50
		7	105,481	50
		8	104,321	50
		11	92,728	50
	Mathematics	4	103,569	50
		5	103,718	50
		6	102,155	50
		7	105,364	50
		8	104,485	50
		11	92,880	50
	Science	11	94,157	50

Table 8: Number of cases and median growth by content area and grade.

Content Area	Grade	N	Median
English Language Arts	4	104,767	50 -
	5	104,934	50 -
	6	103,651	50 -
	7	106,862	50 -
	8	105,656	50 -
	11	93,580	50 -
Mathematics	4	104,746	50 -
	5	105,077	50 -
	6	103,569	50 -
	7	106,866	50 -
	8	105,947	50 -
	11	93,790	50 -
Science	11	95,082	50 -

Table 9: Number of cases and median growth by grade.

Grade	N	Median
1	8,521	50 -
2	9,077	50 -
3	9,586	50 -
4	216,597	50 -
5	216,272	50 -
6	212,678	50 -
7	219,194	50 -
8	217,068	50 -
9	5,102	50 -
10	4,042	51 -
11	285,413	50 -
12	2,343	51 -

Goodness of Fit

To examine the fit of the growth models, the correlations between the outcome score (2017) and the prior achievement score was calculated. Tables 10 and 11 provide the correlations by program, content area, and grade. All correlations are acceptable and within the moderate range. For the M-STEP program, all correlations are consistent within content area. In Mathematics and English Language Arts, correlations above 0.80, for Science it is 0.75. With the SAT correlations are slightly lower; 0.73 for English Language Arts and 0.80 for Mathematics. WIDA correlations are fairly consistent but lower, ranging from 0.65 to 0.79. Finally, the correlations for MI-Access are consistent within content area but lower ranging from 0.52 to 0.66 for English Language Arts, from 0.48 to 0.65 for Mathematics, and 0.58 for Science.

Table 10: Correlation between current SS and prior SS by testing program, content area, and grade for SGP models.

Testing Program	Content Area	Grade	N	Correlation
M-STEP	English Language Arts	4	103,630	0.82
		5	103,625	0.83
		6	102,305	0.83
		7	105,481	0.84
		8	104,321	0.83
	Mathematics	4	103,569	0.84
		5	103,718	0.85
		6	102,155	0.85
		7	105,364	0.87
		8	104,485	0.84
	Science	11	94,157	0.75
SAT	English Language Arts	11	92,728	0.73
	Mathematics	11	92,880	0.80
WIDA	WIDA	1	8,521	0.65
		2	9,077	0.75
		3	9,586	0.78
		4	7,084	0.73
		5	6,261	0.74
		6	5,458	0.71
		7	5,466	0.75
		8	5,465	0.79
		9	5,102	0.76
		10	4,042	0.77
		11	2,961	0.75
		12	2,343	0.73

Table 11: Correlation between current SS and prior SS by testing program, content area, and grade for PRR model. -

Testing Program	Content Area	Grade	N	Correlation
MI-Access	English Language Arts	4	1,137	0.60
		5	1,309	0.59
		6	1,346	0.62
		7	1,381	0.66
		8	1,335	0.64
		11	852	0.52
	Mathematics	4	1,177	0.53
		5	1,359	0.55
		6	1,414	0.48
		7	1,502	0.60
		8	1,462	0.65
		11	910	0.55
	Science	11	925	0.58

Distributions of SGPs and PRRs

The distributions of SGPs and PRRs are provided in Figure 1 through Figure 3, which shows that SGPs tend to uniformly range from 1 to 99. While the PRRs also range from 1 to 99, they are a bit less stable due to the small sample sizes used in the calculations. It should be noted that the differences distributions of PRRs and SGPs across grade and content area tend to be relatively small given the scale of the density plots range from 0 to 0.012.

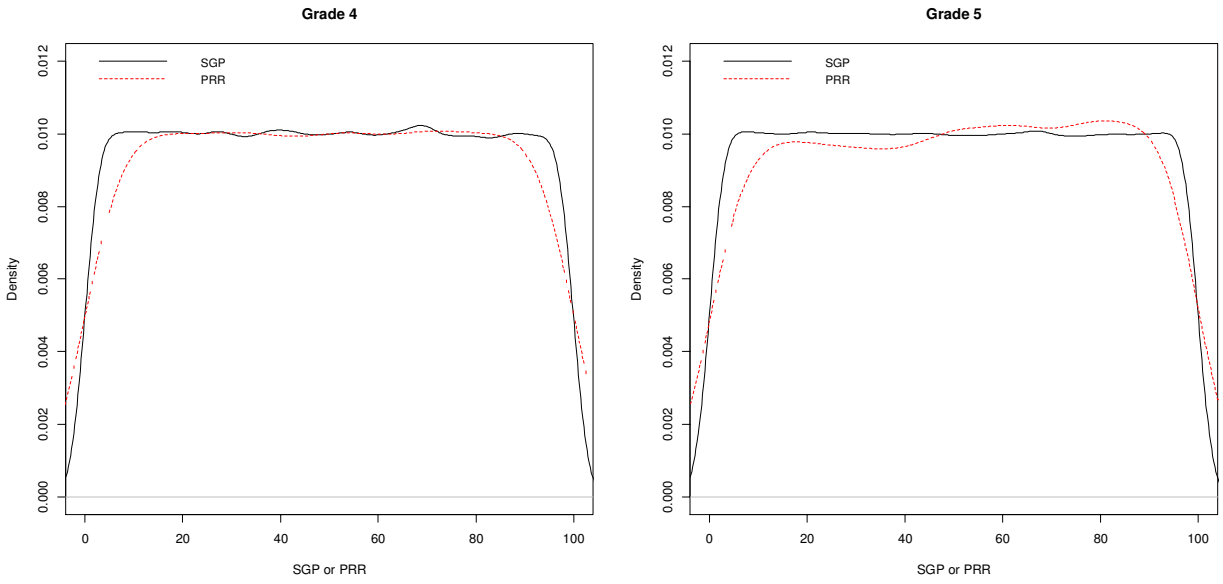


Figure 1. Distribution of SGP/PRR for Mathematics Grades, 4 and 5

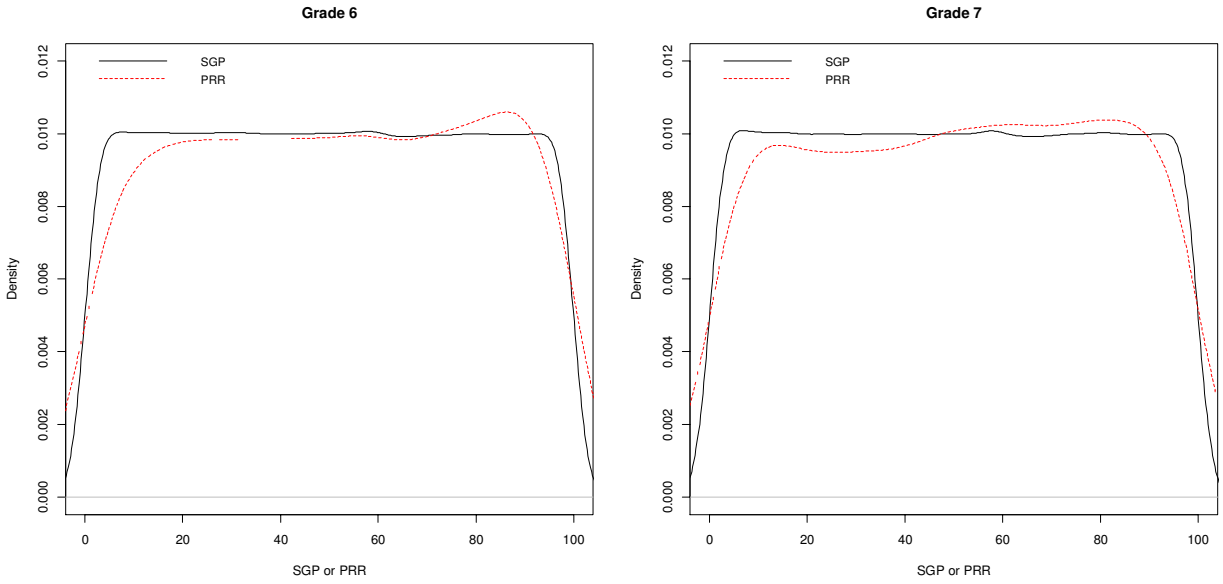


Figure 2. Distribution of SGP/PRR for Mathematics Grades, 6 and 7

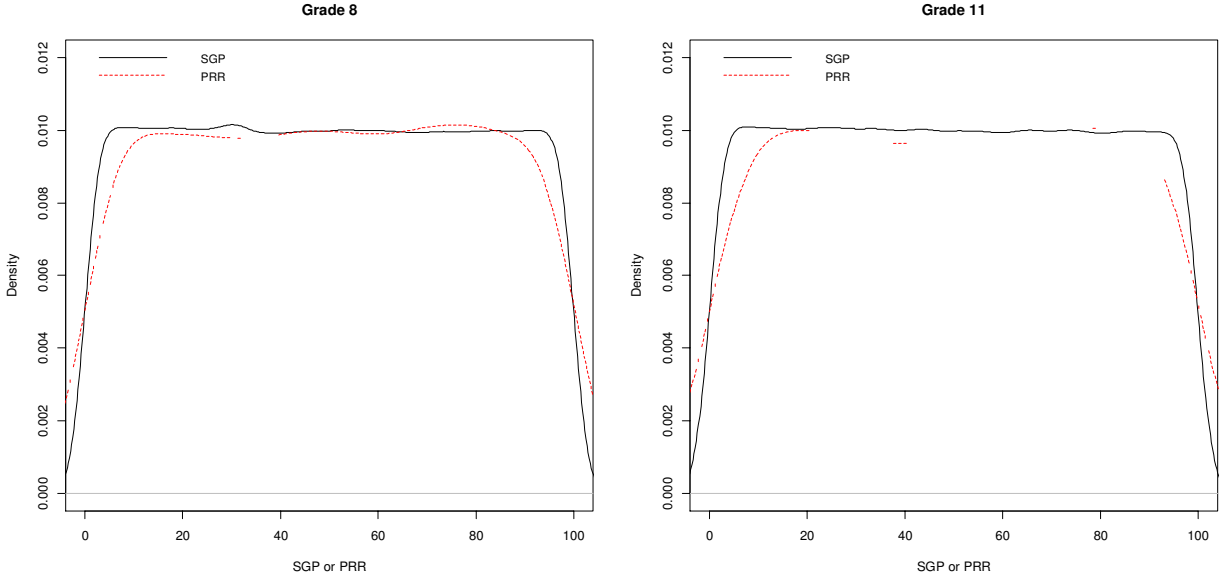


Figure 3. Distribution of SGP/PRR for Mathematics Grades, 8 and 11

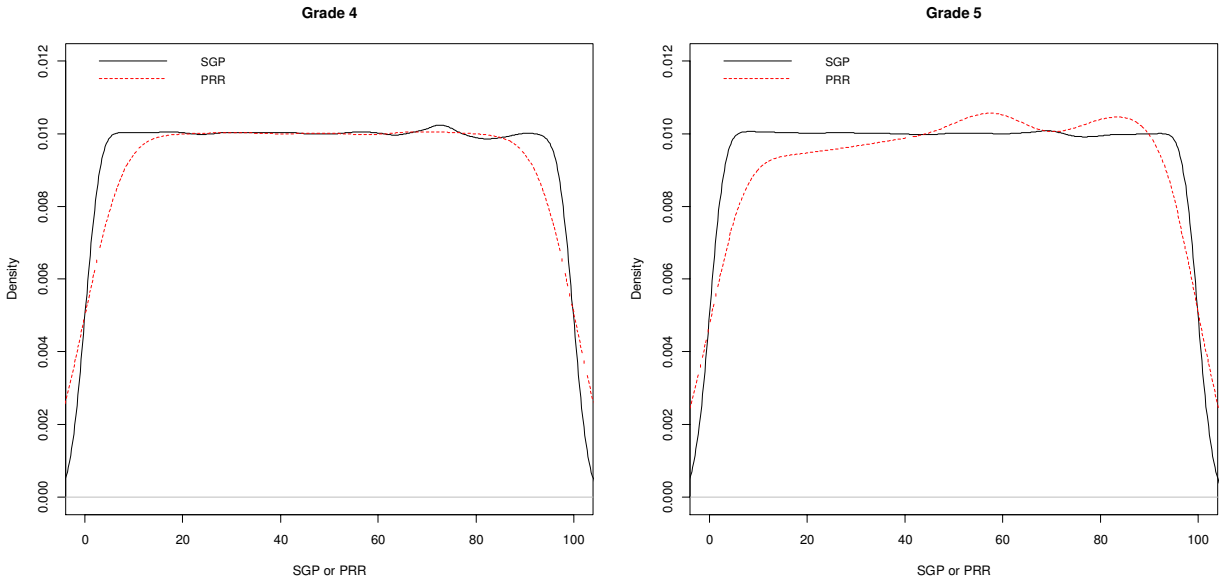


Figure 4. Distribution of SGP/PRR for English Language Arts Grades, 4 and 5

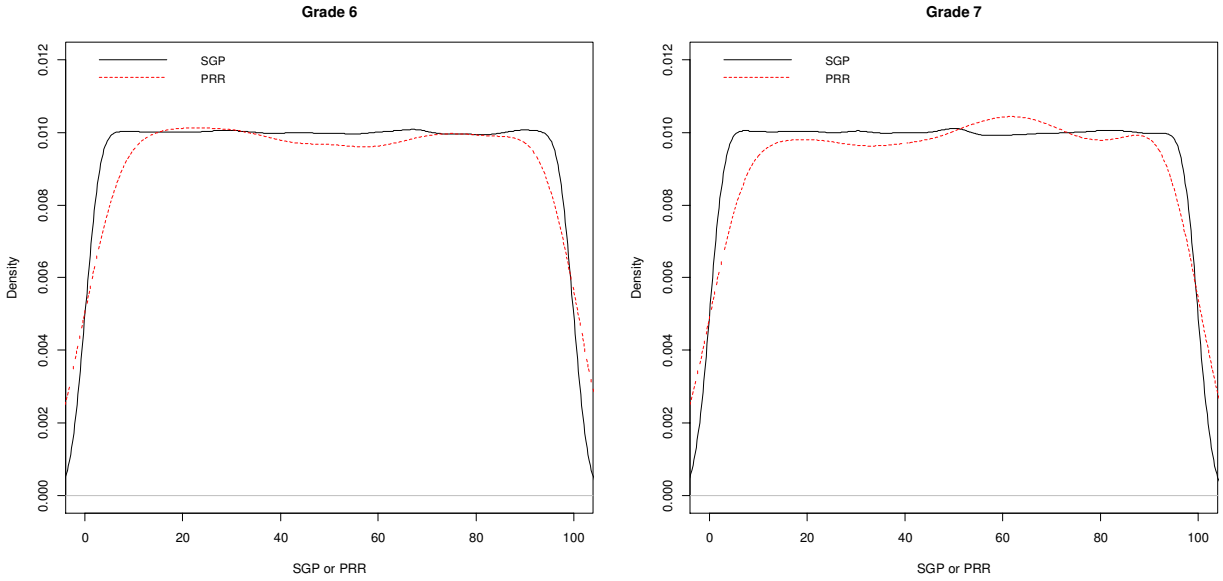


Figure 5. Distribution of SGP/PRR for English Language Arts Grades, 6 and 7 -

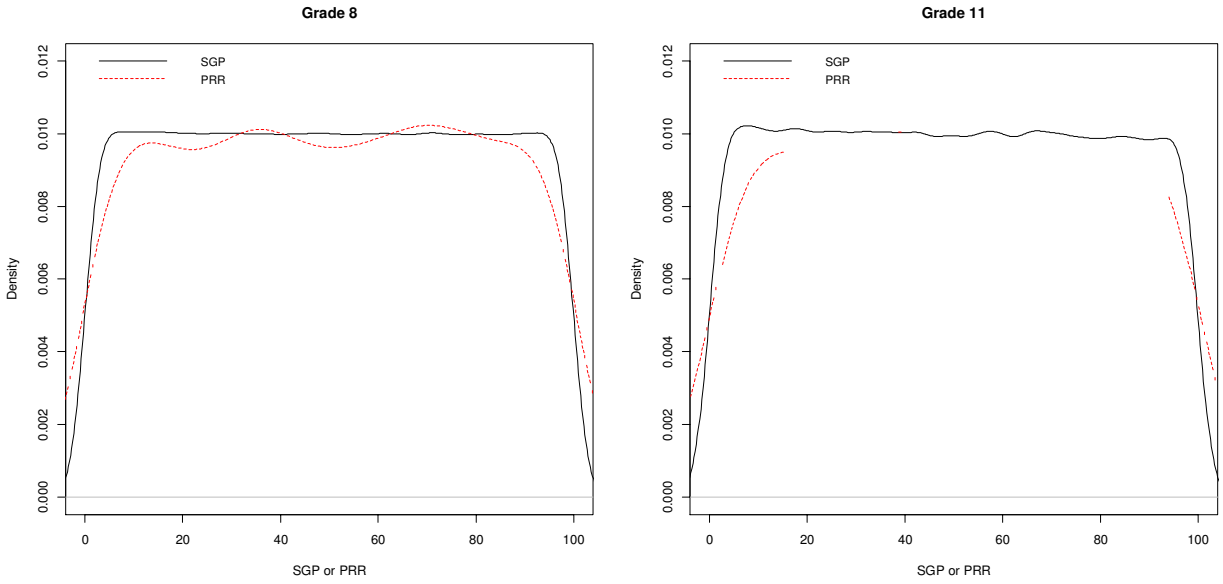


Figure 6. Distribution of SGP/PRR for English Language Arts Grades, 8 and 11

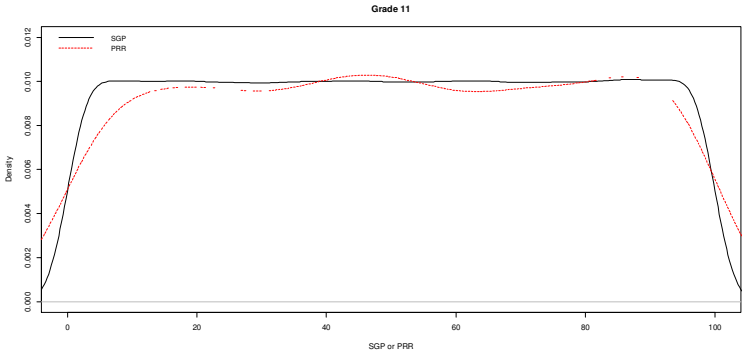


Figure 7. Distribution of SGP/PRR for Science, Grade 11

Checks for Neutrality

Since the growth models used in this analysis do not control for demographic variables, particularly those that may have some impact on student growth rates and trajectories, it is unknown whether the results are biased, especially when aggregated at the school or district level (Education Analytics, 2015). Thus, it is important to look at the relationship between the aggregated growth measure, in this case median SGP and the variables of interest that were not controlled for in the growth models. It is important to note that it is unknown what the correlations "should be." Tables 12 and 13 provide the correlations between the median SGP for a school or a district (with more than 20 students) related to the percentage of each demographic for that building or district. Graphs of these relationships can be found in the appendix.

Table 12: Correlations between Median SGP and Demographic at the school level.

Content Area	ED	SE	LEP	Non-White
English Language Arts	-0.32	-0.15	0.06	-0.16
Mathematics	-0.38	-0.12	-0.01	-0.25
Science	-0.44	-0.23	-0.08	-0.37
WIDA	-0.33	-0.18		-0.09

Table 13: Correlations between Median SGP and Demographic at the district level.

Content Area	ED	SE	LEP	Non-White
English Language Arts	-0.25	-0.23	0.06	0.02
Mathematics	-0.33	-0.18	0.03	-0.18
Science	-0.32	-0.11	-0.08	-0.28
WIDA	-0.33	-0.24		-0.14

When aggregating growth model outcomes, it is also important to note that growth models, as with most regression models, have issues (more variability or less precision) when sample sizes are small. This is also true when aggregating growth model results at the school level. Figure 8 provides the relationship between the number of students and SGP. This shows that there is less variability in median SGP as the number of students increase.

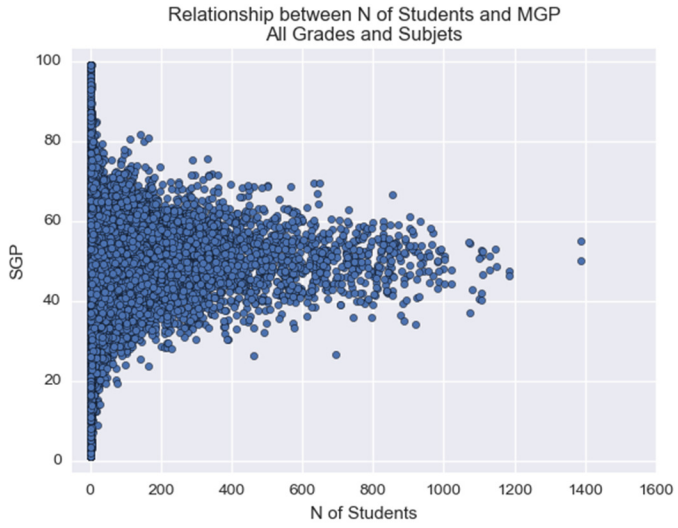


Figure 8. Number of Students versus SGP

AGP Outcomes

In 2017, AGPs and target AGPs were computed for M-STEP ELA and Mathematics, grades 4 through 8. The number of years projected in the model was varied between 1 and 4. Details can be found in Tables

2 and 3. One way to aggregate these results is to compare the percentage of students meeting targets by their 2017 performance level, grade, and years projected. Tables 14 and 15 do this by showing the percentage of students, by grade, who have a 2017 SGP greater than their 2017 lagged AGP, broken down by proficiency level, grade, and years projected. For example, in Grade 4 ELA, 67% of proficient students are on track to remain proficient (or reach advanced) in three years' time. These tables show that students who end in the highest performance level (Advanced) do so because they consistently grew at levels surpassing that which was necessary to achieve and maintain proficiency. Similarly, they also show that students who end in the lowest performance level (Not Proficient) do so because they consistently grew at levels well below what was necessary to reach proficiency.

Table 14: Percentage of students whose 2017 SGP exceeds their lagged by performance level and years projected for M-STEP ELA.

		Not Proficient		Partially Proficient		Proficient		Advanced	
Grade	Years Projected	N Total	% 2017 SGP Exceeds Lagged AGP	N Total	% 2017 SGP Exceeds Lagged AGP	N Total	% 2017 SGP Exceeds Lagged AGP	N Total	% 2017 SGP Exceeds Lagged AGP
4	1	35,539	0%	21,875	23%	22,991	90%	23,225	100%
	2	35,539	1%	21,875	29%	22,991	71%	23,225	98%
	3	35,539	4%	21,875	36%	22,991	67%	23,225	95%
	4	35,539	7%	21,875	39%	22,991	66%	23,225	93%
5	1	26,083	0%	24,008	5%	32,600	78%	20,934	100%
	2	26,083	0%	24,008	19%	32,600	70%	20,934	98%
	3	26,083	2%	24,008	27%	32,600	68%	20,934	97%
	4	26,083	2%	24,008	27%	32,600	68%	20,934	97%
6	1	29,452	0%	27,691	13%	29,895	86%	15,267	100%
	2	29,452	1%	27,691	26%	29,895	79%	15,267	100%
	3	29,452	1%	27,691	26%	29,895	79%	15,267	100%
	4								
7	1	29,781	0%	27,793	14%	33,760	90%	14,147	100%
	2	29,781	0%	27,793	14%	33,760	90%	14,147	100%
	3								
	4								
8	1	23,656	0%	29,970	0%	36,854	96%	13,841	100%
	2								
	3								
	4								

Table 15: Percentage of students whose 2017 SGP exceeds their lagged by performance level and years projected for M-STEP Math.

		Not Proficient		Partially Proficient		Proficient		Advanced	
Grade	Years Projected	N Total	% 2017 SGP Exceeds Lagged AGP	N Total	% 2017 SGP Exceeds Lagged AGP	N Total	% 2017 SGP Exceeds Lagged AGP	N Total	% 2017 SGP Exceeds Lagged AGP
4	1	24,785	0%	34,817	1%	27,063	68%	16,904	100%
	2	24,785	0%	34,817	10%	27,063	64%	16,904	99%
	3	24,785	0%	34,817	20%	27,063	63%	16,904	97%
	4	24,785	1%	34,817	23%	27,063	60%	16,904	94%
5	1	35,774	0%	31,131	10%	19,330	81%	17,483	100%
	2	35,774	0%	31,131	26%	19,330	76%	17,483	99%
	3	35,774	3%	31,131	30%	19,330	67%	17,483	95%
	4	35,774	3%	31,131	30%	19,330	67%	17,483	95%
6	1	33,341	0%	33,415	15%	19,445	88%	15,954	100%
	2	33,341	0%	33,415	24%	19,445	74%	15,954	98%
	3	33,341	0%	33,415	24%	19,445	74%	15,954	98%
	4								
7	1	36,690	0%	29,919	10%	20,840	76%	17,915	100%
	2	36,690	0%	29,919	10%	20,840	76%	17,915	100%
	3								
	4								
8	1	40,854	0%	28,068	1%	17,413	93%	18,150	100%
	2								
	3								
	4								

References

Betebenner, D. W. (2011). *A technical overview of the student growth percentile methodology: Student growth percentiles and percentile growth projections/trajectories.* Downloaded March 9, 2018 from http://www.nj.gov/education/njsmart/performance/SGP_Technical_Overview.pdf.

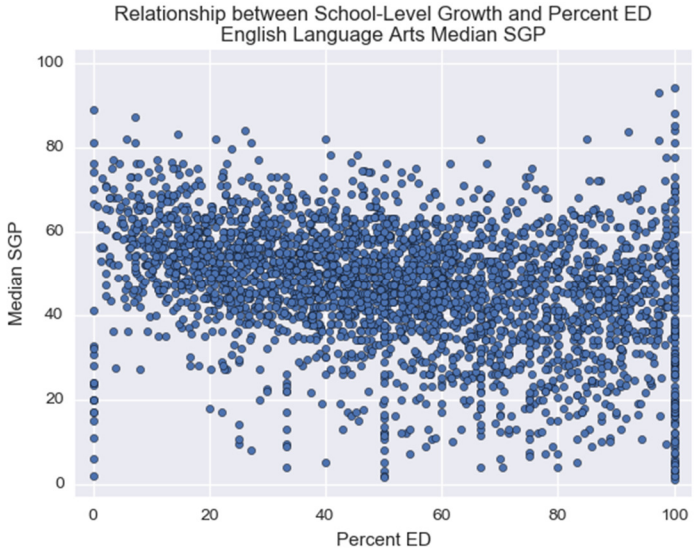
Betebenner, D. W., VanIwaarden, A., Domingue, B., and Shang, Y. (2016). SGP: An R Package for the Calculation and Visualization of Student Growth Percentiles & Percentile Growth Trajectories. R package version 1.5-0.0. https://cran.r-project.org/web/packages/SGP/

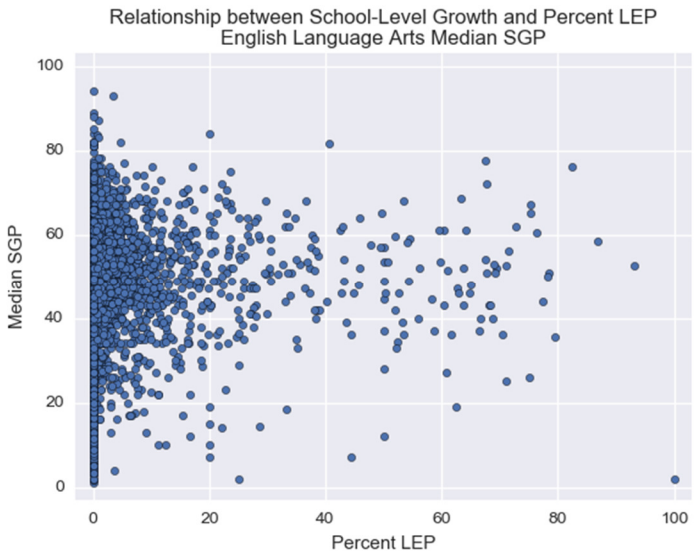
Castellano, K.E., and Ho, A.D. (2015). Practical Differences Among Aggregate-Level Conditional Status Metrics: From Median Student Growth Percentiles to Value-Added Models. Journal of Educational and Behavioral Statistics, 40(1), 35-68. doi:10.3102/107699861454848

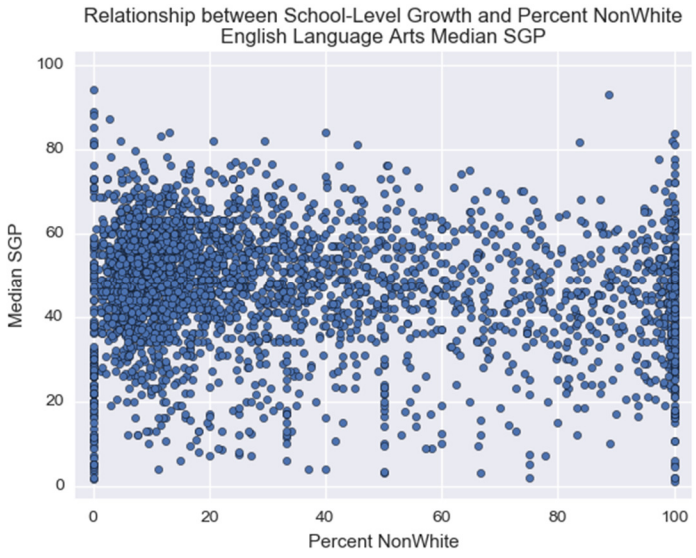
Castellano, K.E., and Ho, A.D. (2013). Contrasting OLS and Quantile Regression Approaches to Student "Growth" Percentiles. Journal of Educational and Behavioral Statistics, 38(2), 190-215. doi:10.3102/1076998611435413

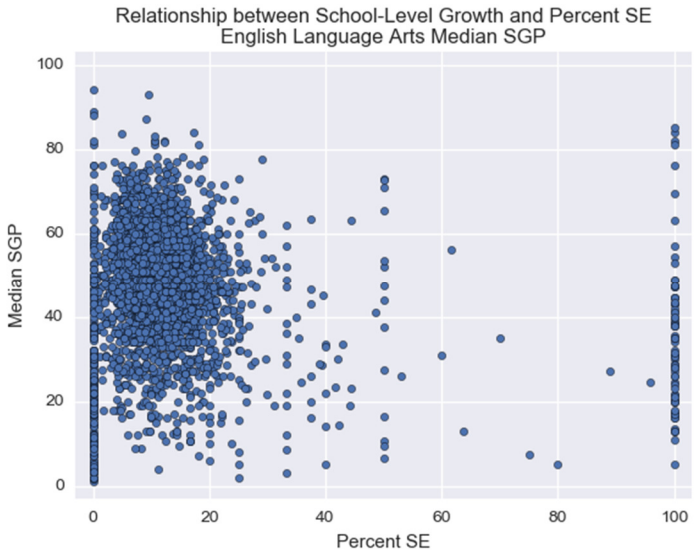
Education Analytics (2015). Michigan Department of Education Technical Report.

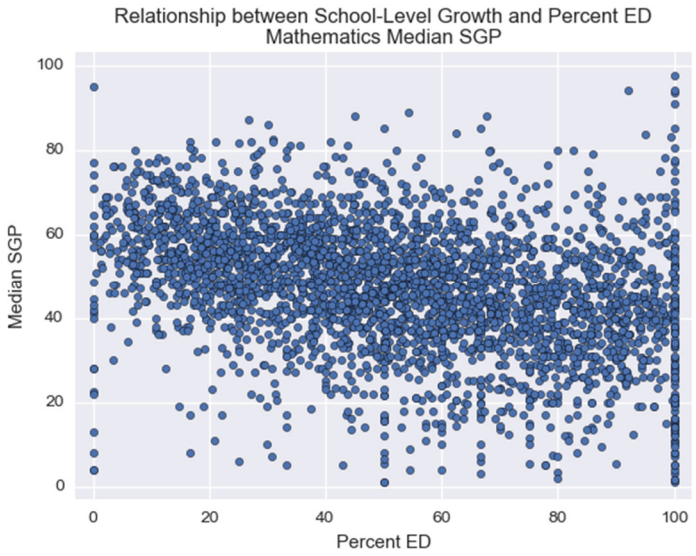
Appendix

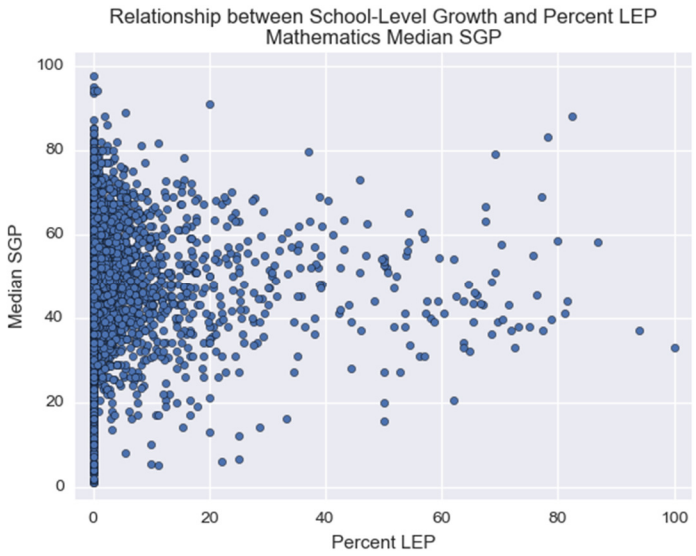

Relationship between School-Level Growth and Percent ED
English Language Arts Median SGP
Median SGP
Percent ED
0
20
40
60
80
100

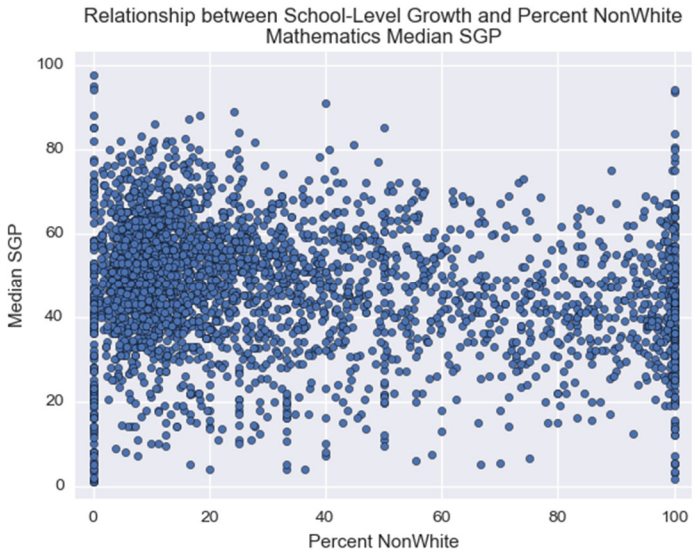

Relationship between School-Level Growth and Percent LEP
English Language Arts Median SGP
Median SGP
Percent LEP
0
20
40
60
80
100

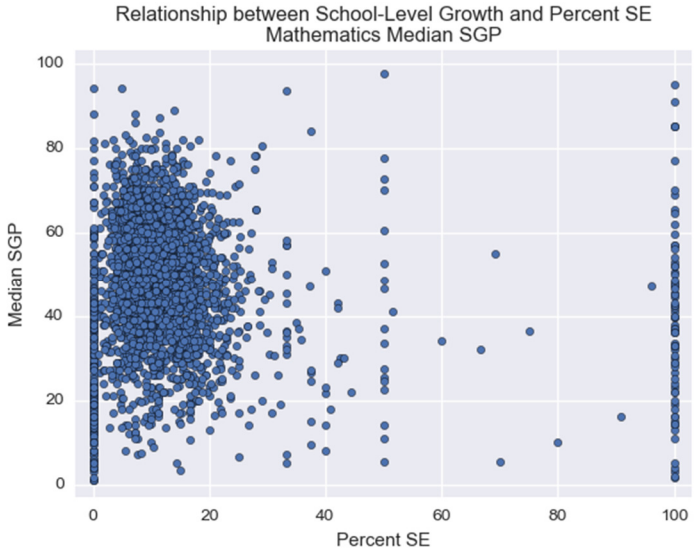

Relationship between School-Level Growth and Percent NonWhite
English Language Arts Median SGP
Median SGP
Percent NonWhite
0
20
40
60
80
100

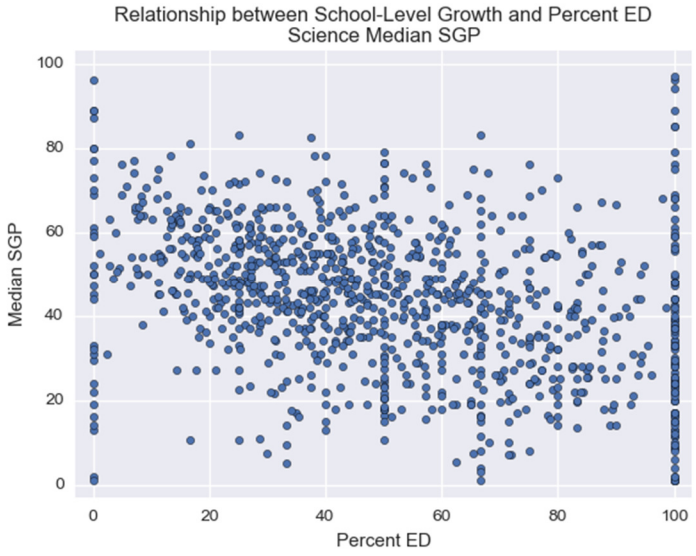

Relationship between School-Level Growth and Percent SE
English Language Arts Median SGP
Median SGP
Percent SE
0
20
40
60
80
100

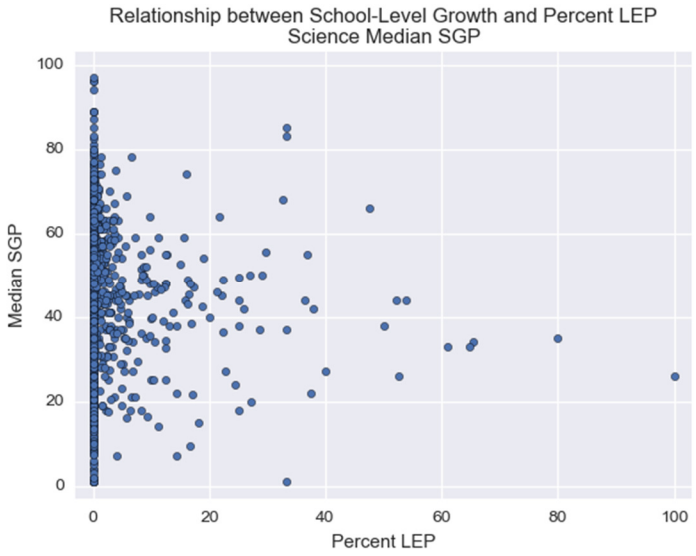

Relationship between School-Level Growth and Percent ED
Mathematics Median SGP
Median SGP
Percent ED
0
20
40
60
80
100

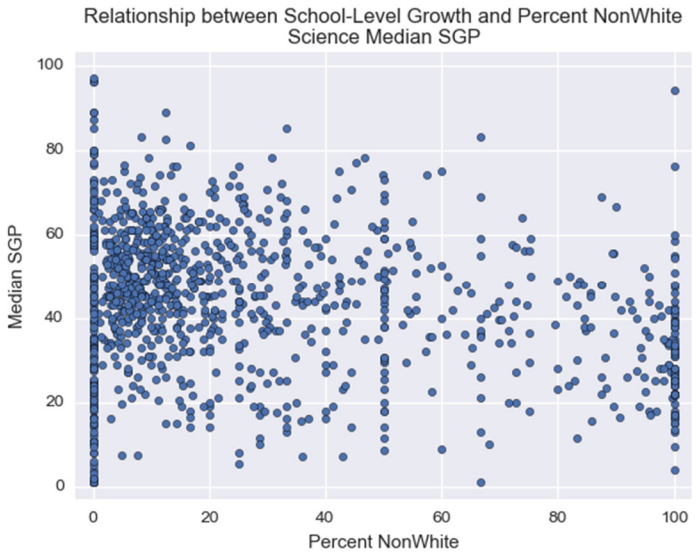

Relationship between School-Level Growth and Percent LEP
Mathematics Median SGP
Median SGP
Percent LEP
0
20
40
60
80
100

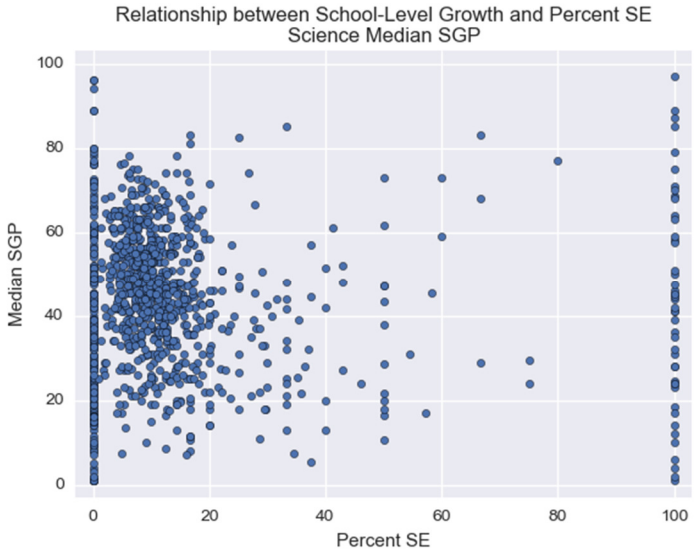

Relationship between School-Level Growth and Percent NonWhite
Mathematics Median SGP
Median SGP
Percent NonWhite
0
20
40
60
80
100


Relationship between School-Level Growth and Percent SE
Mathematics Median SGP
Median SGP
Percent SE
0
20
40
60
80
100


Relationship between School-Level Growth and Percent ED
Science Median SGP
Median SGP
Percent ED
0
20
40
60
80
100


Relationship between School-Level Growth and Percent LEP
Science Median SGP
Median SGP
Percent LEP
0
20
40
60
80
100


Relationship between School-Level Growth and Percent NonWhite
Science Median SGP
Median SGP
Percent NonWhite
0
20
40
60
80
100


Relationship between School-Level Growth and Percent SE
Science Median SGP
Median SGP
Percent SE
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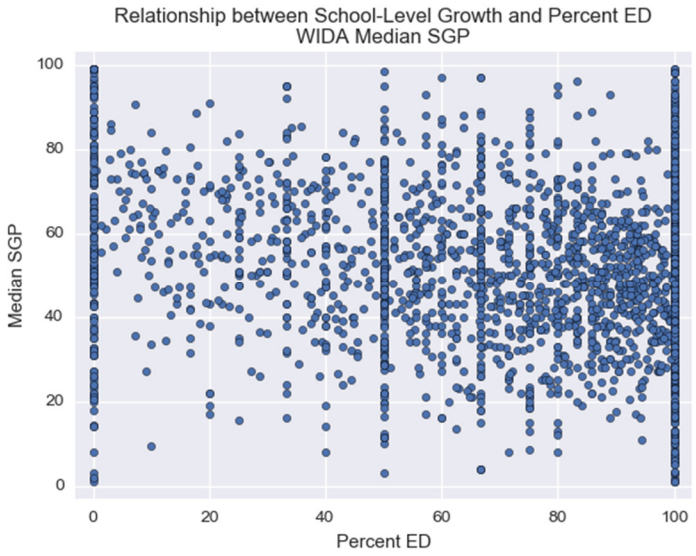
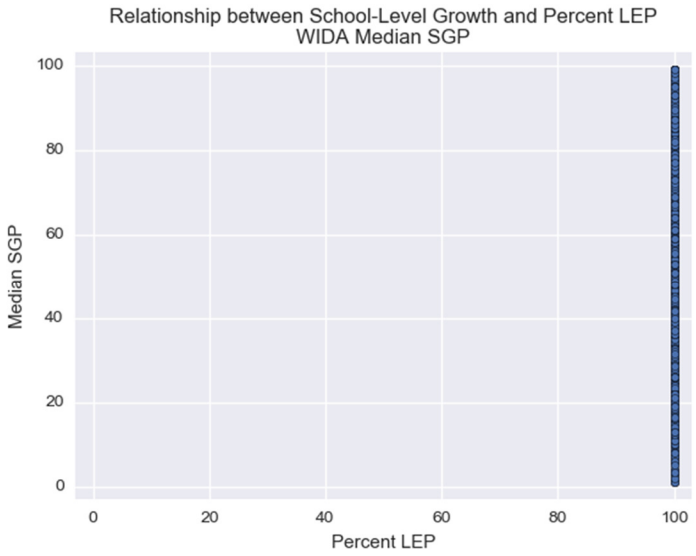
40
60
80
100


Relationship between School-Level Growth and Percent ED
WIDA Median SGP
Median SGP
Percent ED
0
20
40
60
80
100


Relationship between School-Level Growth and Percent LEP
WIDA Median SGP
Median SGP
Percent LEP
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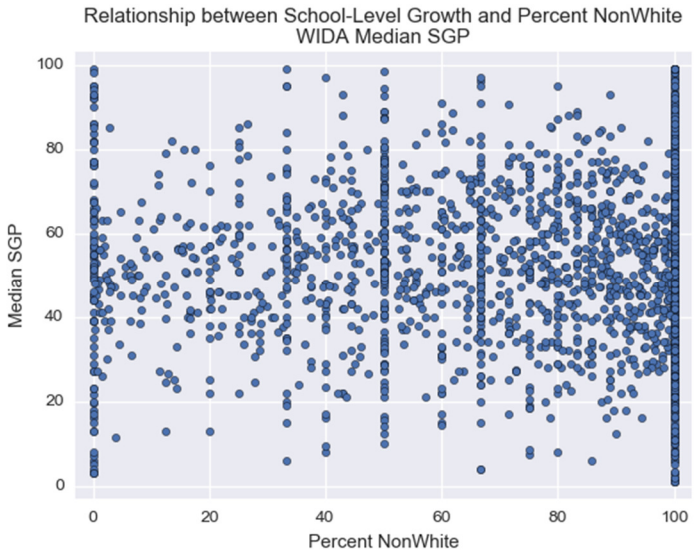
20
40
60
80
100


Relationship between School-Level Growth and Percent NonWhite
WIDA Median SGP
Median SGP
Percent NonWhite
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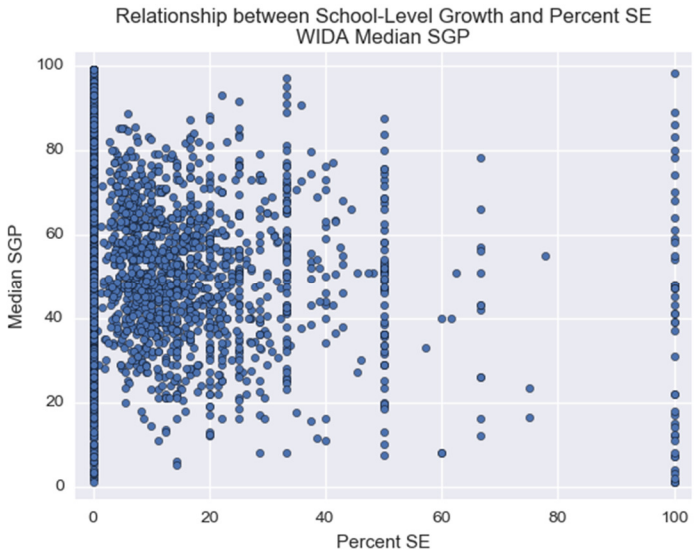
40
60
80
100


Relationship between School-Level Growth and Percent SE
WIDA Median SGP
Median SGP
Percent SE
0
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