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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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 1.8-3.17 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 $\boldsymbol{t}$, the expected value of Y_t at the $\boldsymbol{\tau}$-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 $j=1,...,t-1$ 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.

$$SGP_i = (\max\{\tau_i, \hat{Q}_\tau(Y|X=x_i) < y_i\} + \min(\{\tau_i, \hat{Q}_\tau(Y|X=x_i) > y_i\}) * \frac{100}{2} \quad (2)$$

Where x_i is the student *i's* vector of prior test scores.

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. 2018) 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.

$$Y_{it} = \beta_0 + \beta_1 y_{i(t-1)} + \beta_2 y_{i(t-2)} + \varepsilon_{it} \quad (5)$$

where Y_{it} 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 $\varepsilon_{it}$is a residual error.

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

$$\hat{\varepsilon}_{it} = y_{it} - \hat{y}_{it} \quad (6)$$

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

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

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

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 2017-18.

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

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

For each simulated y_{its}, 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		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		ELA, Math, Science	Overall Composite
8	ELA, Math, Social Studies		ELA, Math Social Studies	Overall Composite
11	Social Studies	ELA, Math	ELA, Math, 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 2018 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 2018	**1 Year 2019**	**2 Year 2020**	**3 Year 2021**	**4 Year 2022**
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 2017	**Current Year 2018**	**Current +1 Year 2019**	**Current +2 Year 2020**	**Current +3 Year 2021**
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 2018	Prior Year 1	Prior Year 2
M-STEP ELA & Math	4	M-STEP 3rd grade Spring 2017	
	5	M-STEP 4th grade Spring 2017	M-STEP 3rd grade Spring 2016
	6	M-STEP 5th grade Spring 2017	M-STEP 4th grade Spring 2016
	7	M-STEP 6th grade Spring 2017	M-STEP 5th grade Spring 2016
	8	M-STEP 7th grade Spring 2017	M-STEP 6th grade Spring 2016
SAT	11	M-STEP 8th grade Spring 2015	MEAP 7th grade Fall 2013
M-STEP Social Studies	8	M-STEP 5th grade Spring 2015	
	11	M-STEP 8th grade Spring 2015	MEAP 6th grade Fall 2012
MI-Access ELA & Math	4	MI-Access 3rd grade Spring 2017	
	5	MI-Access 4th grade Spring 2017	MI-Access 3rd grade Spring 2016
	6	MI-Access 5th grade Spring 2017	MI-Access 4th grade Spring 2016
	7	MI-Access 6th grade Spring 2017	MI-Access 5th grade Spring 2016
	8	MI-Access 7th grade Spring 2017	MI-Access 6th grade Spring 2016
	11	MI-Access 8th grade Spring 2015	MI-Access 7th grade Fall 2013
MI-Access Science	7	MI-Access 4th grade Spring 2015	
MI-Access Social Studies	8	MI-Access 5th grade Spring 2015	
	11	MI-Access 8th grade Spring 2015	
WIDA	1	WIDA Kindergarten Spring 2017	
	2	WIDA 1st grade Spring 2017	WIDA Kindergarten Spring 2016
	3	WIDA 2nd grade Spring 2017	WIDA 1st grade Spring 2016
	4	WIDA 3rd grade Spring 2017	WIDA 2nd grade Spring 2016
	5	WIDA 4th grade Spring 2017	WIDA 3rd grade Spring 2016
	6	WIDA 5th grade Spring 2017	WIDA 4th grade Spring 2016
	7	WIDA 6th grade Spring 2017	WIDA 5th grade Spring 2016
	8	WIDA 7th grade Spring 2017	WIDA 6th grade Spring 2016
	9	WIDA 8th grade Spring 2017	WIDA 7th grade Spring 2016
	10	WIDA 9th grade Spring 2017	WIDA 8th grade Spring 2016
	11	WIDA 10th grade Spring 2017	WIDA 9th grade Spring 2016
	12	WIDA 11th grade Spring 2017	WIDA 10th grade Spring 2016

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 2016, followed by Grade 5 M-STEP ELA in Spring 2018). 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	100,439	50
		5	104,348	50
		6	103,728	50
		7	103,092	50
		8	105,948	50
	Mathematics	4	100,786	50
		5	104,583	50
		6	104,088	50
		7	103,204	50
		8	105,981	50
	Social Studies	8	100,105	49
		11	93,541	50
SAT	English Language Arts	11	93,963	50
	Mathematics	11	93,984	49

Testing Program	Content Area	Grade	N	Median
WIDA	WIDA	1	8,264	50
		2	9,109	51
		3	9,142	51
		4	8,906	51
		5	6,681	51
		6	5,969	51
		7	5,600	52
		8	5,517	51
		9	5,346	51
		10	4,970	51
		11	3,667	50
		12	2,717	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	959	50
		5	1,174	51
		6	1,237	51
		7	1,285	50
		8	1,302	50
		11	933	51
	Mathematics	4	1,013	50
		5	1,257	51
		6	1,337	51
		7	1,418	51.5
		8	1,425	50
		11	1,042	51
	Science	7	901	50
	Social Studies	8	960	50
		11	959	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	959	50
		5	1,174	51
		6	1,237	51
		7	1,285	50
		8	1,302	50
		11	933	51
	Mathematics	4	1,013	50
		5	1,257	51
		6	1,337	51
		7	1,418	51.5
		8	1,425	50
		11	1,042	51
	Science	7	901	50
	Social Studies	8	960	50
		11	1,026	50
SGP	English Language Arts	4	100,439	50
		5	104,348	50
		6	103,728	50
		7	103,092	50
		8	105,948	50
		11	93,963	50
	Mathematics	4	100,786	50
		5	104,583	50
		6	104,088	50
		7	103,204	50
		8	105,981	50
		11	93,984	49
	Social Studies	8	100,105	49
		11	93,541	50

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

Content Area	Grade	N	Median
English Language Arts	4	101,398	50
	5	105,522	50
	6	104,965	50
	7	104,377	50
	8	107,250	50
	11	94,896	50
Mathematics	4	101,799	50
	5	105,840	50
	6	105,425	50
	7	104,622	50
	8	107,406	50
	11	95,026	49
Science	11	901	50
Social Studies	8	101,065	50
	11	94,567	50

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

Grade	N	Median
1	8,264	50
2	9,109	51
3	9,142	51
4	212,103	50
5	218,043	50
6	216,359	50
7	215,500	50
8	321,238	50
9	5,346	51
10	4,970	51
11	288,156	50
12	2,717	51

Goodness of Fit

To examine the fit of the growth models, the correlations between the outcome score (2018) 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 Social Studies it is 0.73. With the SAT correlations similar with a correlation of 0.78 for English Language Arts and 0.80 for Mathematics. WIDA correlations are fairly consistent but lower, ranging from 0.65 to 0.81. Finally, the correlations for MI-Access are consistent within content

area but lower ranging from 0.54 to 0.66 for English Language Arts, from 0.48 to 0.62 for Mathematics, 0.51 for Science and 0.42 to 0.51 for Social Studies.

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	100,439	0.82
		5	104,348	0.84
		6	103,728	0.83
		7	103,092	0.84
		8	105,947	0.84
	Mathematics	4	100,786	0.84
		5	104,583	0.86
		6	104,088	0.85
		7	103,204	0.87
		8	105,979	0.84
	Social Studies	8	100,105	0.73
		11	93,540	0.76
SAT	English Language Arts	11	93,962	0.78
	Mathematics	11	93,983	0.80
WIDA	WIDA	1	8,264	0.65
		2	9,109	0.76
		3	9,142	0.78
		4	8,906	0.77
		5	6,681	0.77
		6	5,969	0.74
		7	5,600	0.78
		8	5,517	0.81
		9	5,346	0.78
		10	4,970	0.80
		11	3,667	0.76
		12	2,717	0.68

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	959	0.59
		5	1,174	0.64
		6	1,237	0.60
		7	1,285	0.66
		8	1,302	0.60
		11	933	0.54
	Mathematics	4	1,013	0.54
		5	1,257	0.62
		6	1,337	0.53
		7	1,418	0.48
		8	1,425	0.58
		11	1,042	0.58
	Science	7	901	0.51
	Social Studies	8	960	0.42
		11	1,026	0.51

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.

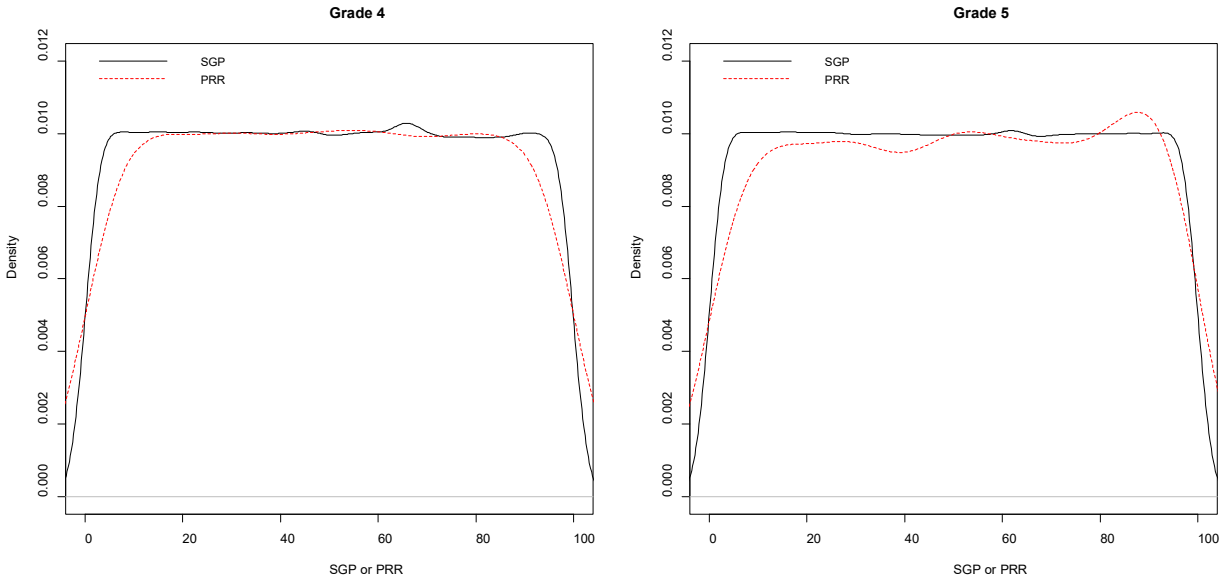


Figure 1. Distribution of SGP/PRR for Mathematics Grades, 4 and 5

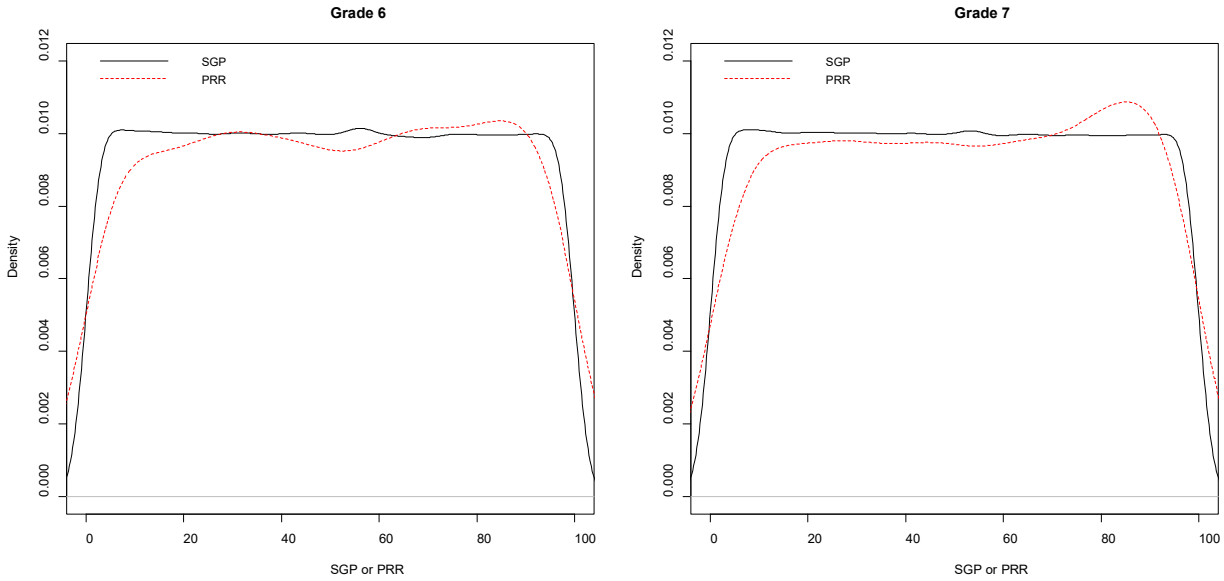


Figure 2. Distribution of SGP/PRR for Mathematics Grades, 6 and 7

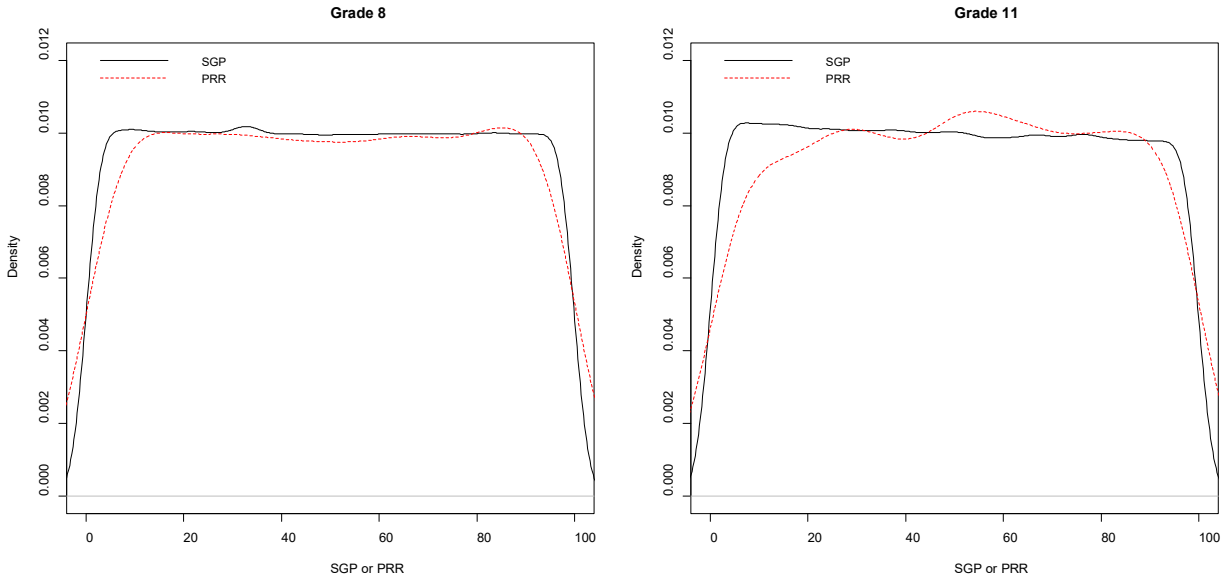


Figure 3. Distribution of SGP/PRR for Mathematics Grades, 8 and 11

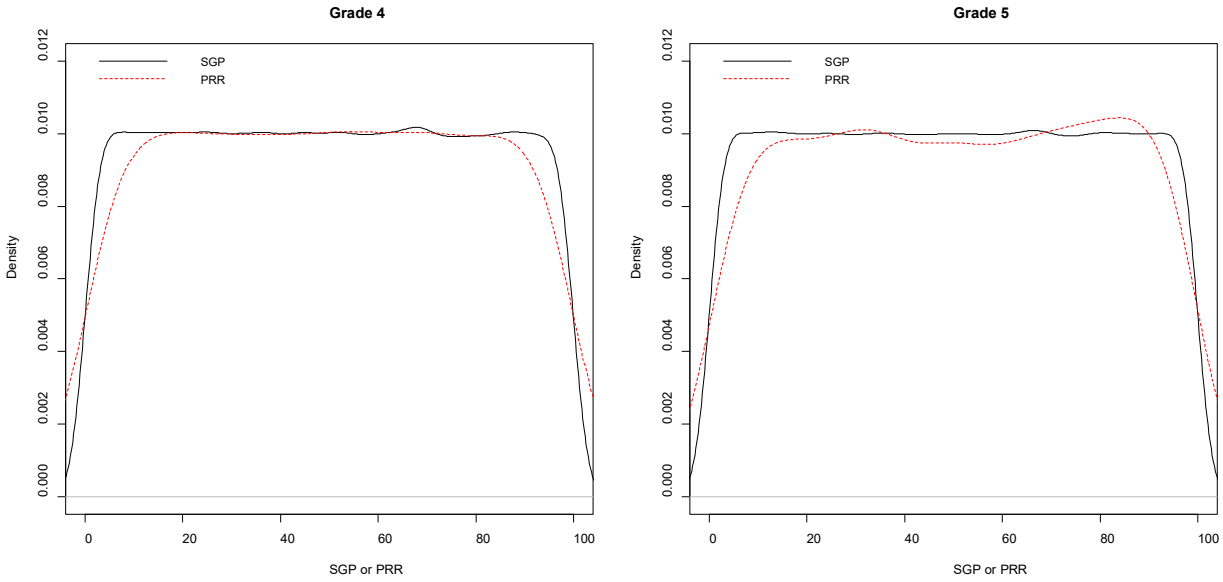


Figure 4. Distribution of SGP/PRR for English Language Arts Grades, 4 and 5

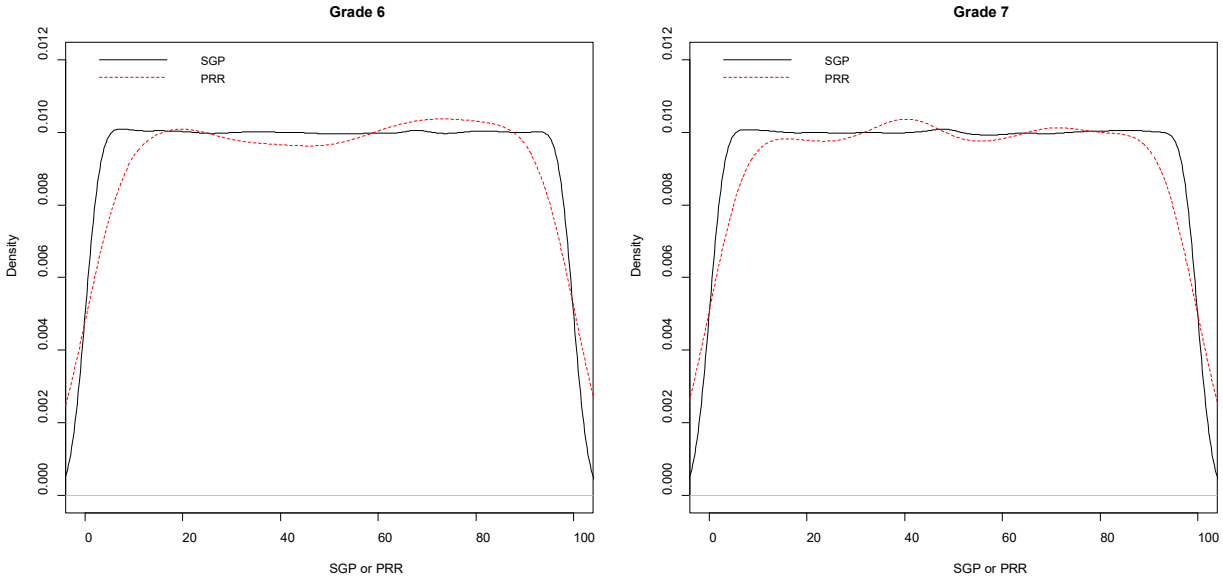


Figure 5. Distribution of SGP/PRR for English Language Arts Grades, 6 and 7

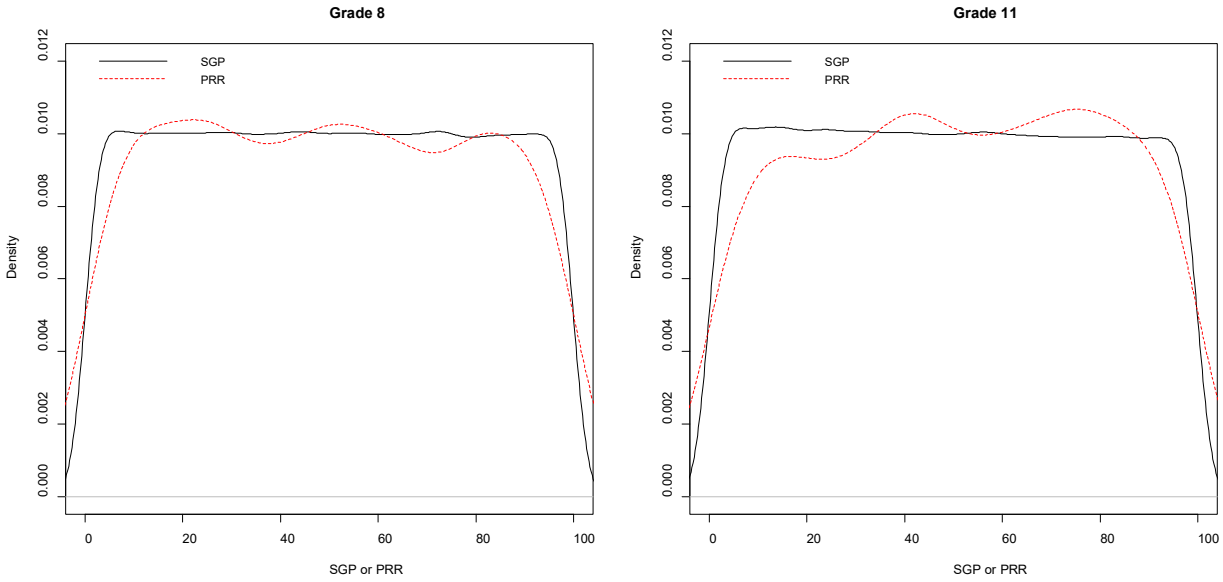


Figure 6. Distribution of SGP/PRR for English Language Arts Grades, 8 and 11

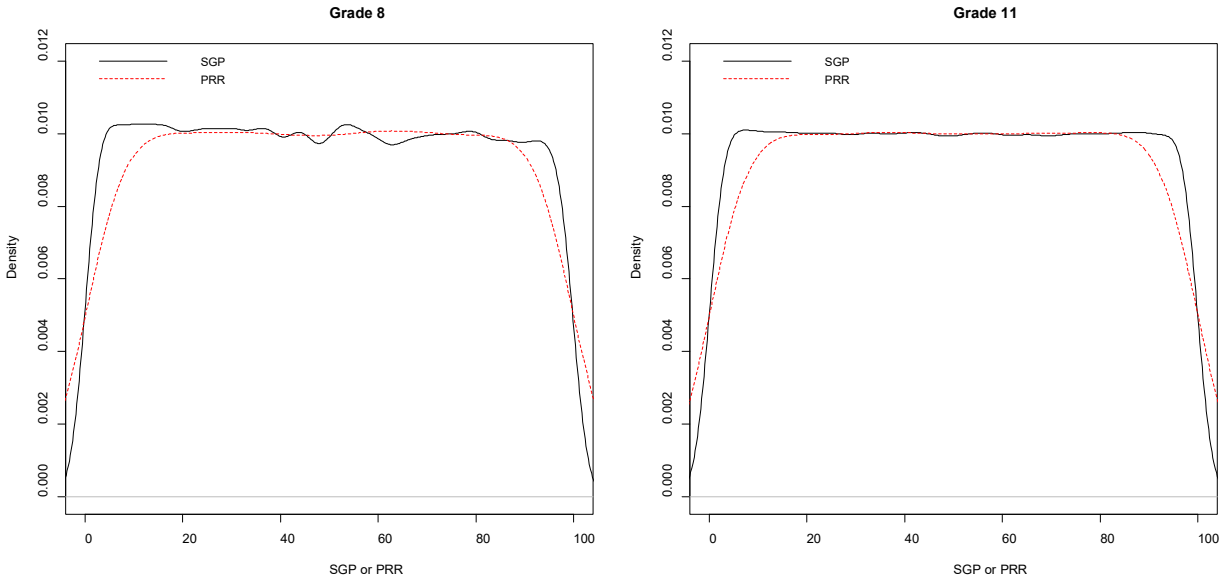


Figure 7. Distribution of SGP/PRR for Social Studies Grades, 8 and 11

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	-0.37	-0.20	0.10	-0.18
Mathematics	-0.39	-0.20	0.04	-0.22
Social Studies	-0.38	-0.21	-0.06	-0.23
WIDA	-0.43	-0.12		-0.18

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

Content Area	ED	SE	LEP	Non-White
English Language Arts	-0.28	-0.23	0.12	-0.05
Mathematics	-0.35	-0.24	0.05	-0.15
Social Studies	-0.35	-0.20	0.00	-0.15
WIDA	-0.34	-0.09		-0.27

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.

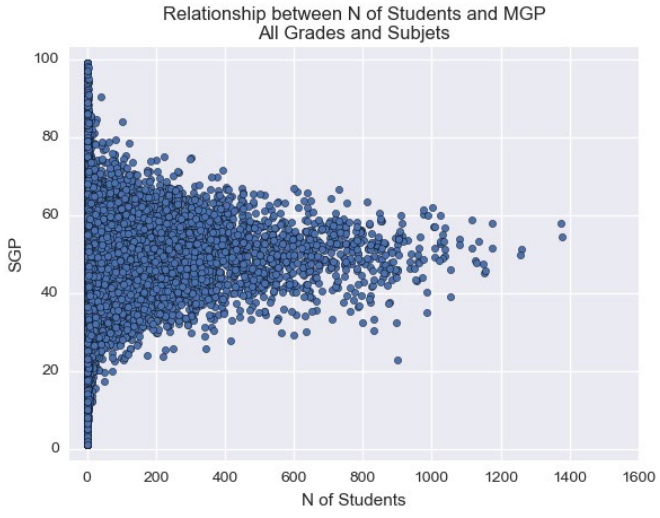


Figure 8. Number of Students versus SGP

AGP Outcomes

In 2018, 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 2018 performance level, grade, and years projected. Tables 14 and 15 do this by showing the percentage of students, by grade, who have a 2018 SGP greater than their 2018 lagged AGP, broken down by proficiency level, grade, and years projected. For example, in Grade 4 ELA, 62% 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 2018 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	% 2018 SGP Exceeds Lagged AGP	N Total	% 2018 SGP Exceeds Lagged AGP	N Total	% 2018 SGP Exceeds Lagged AGP	N Total	% 2018 SGP Exceeds Lagged AGP
4	1	33,350	0%	21,282	17%	21,880	87%	23,927	100%
	2	33,350	0%	21,282	23%	21,880	65%	23,927	97%
	3	33,350	2%	21,282	30%	21,880	62%	23,927	94%
	4	33,350	4%	21,282	33%	21,880	59%	23,927	90%
5	1	32,832	0%	22,341	4%	30,314	76%	18,861	100%
	2	32,832	0%	22,341	18%	30,314	69%	18,861	98%
	3	32,832	2%	22,341	25%	30,314	64%	18,861	95%
	4	32,832	2%	22,341	25%	30,314	64%	18,861	95%
6	1	31,766	0%	28,509	11%	29,568	88%	13,885	100%
	2	31,766	0%	28,509	22%	29,568	75%	13,885	100%
	3	31,766	0%	28,509	22%	29,568	75%	13,885	100%
	4								
7	1	29,367	0%	28,366	8%	31,995	85%	13,364	100%
	2	29,367	0%	28,366	8%	31,995	85%	13,364	100%
	3								
	4								
8	1	30,927	0%	29,029	0%	33,376	96%	12,616	100%
	2								
	3								
	4								

Table 15: Percentage of students whose 2018 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	% 2018 SGP Exceeds Lagged AGP	N Total	% 2018 SGP Exceeds Lagged AGP	N Total	% 2018 SGP Exceeds Lagged AGP	N Total	% 2018 SGP Exceeds Lagged AGP
4	1	24,351	0%	33,674	2%	26,124	72%	16,637	100%
	2	24,351	0%	33,674	10%	26,124	66%	16,637	99%
	3	24,351	0%	33,674	18%	26,124	65%	16,637	98%
	4	24,351	1%	33,674	22%	26,124	60%	16,637	94%
5	1	38,194	0%	29,996	8%	18,818	80%	17,575	100%
	2	38,194	0%	29,996	22%	18,818	74%	17,575	99%
	3	38,194	2%	29,996	28%	18,818	64%	17,575	95%
	4	38,194	2%	29,996	28%	18,818	64%	17,575	95%
6	1	35,224	0%	32,486	11%	19,558	88%	16,820	100%
	2	35,224	0%	32,486	22%	19,558	71%	16,820	97%
	3	35,224	0%	32,486	22%	19,558	71%	16,820	97%
	4	35,224	0%	32,486	11%	19,558	88%	16,820	100%
7	1	36,724	0%	29,080	10%	20,304	74%	17,096	100%
	2	36,724	0%	29,080	10%	20,304	74%	17,096	100%
	3								
	4								
8	1	41,907	0%	27,855	1%	17,000	92%	19,219	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.

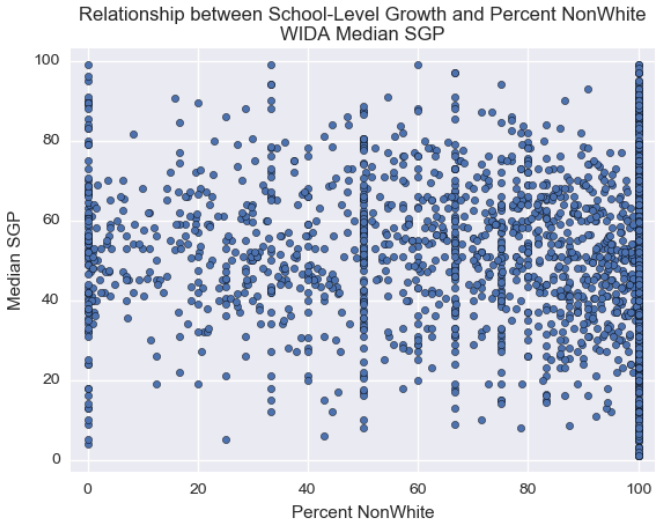
Betebenner, D. W., VanIwaarden, A., Domingue, B., and Shang, Y. (2016). SGP: An R Package for the Calculation and Visualization of Student Growth Percentiles & Percentile Growth Trajectories. R package version 1.5-0.0. https://cran.r-project.org/web/packages/SGP/

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 NonWhite
WIDA Median SGP
Median SGP
Percent NonWhite
0
20
40
60
80
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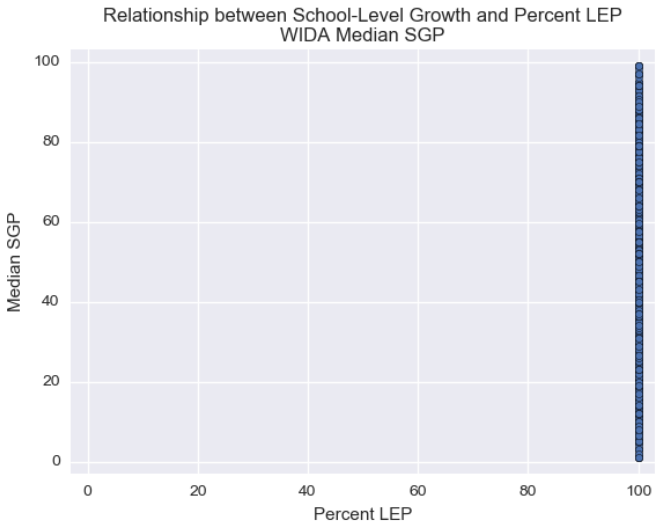
Relationship between School-Level Growth and Percent LEP
WIDA Median SGP
Median SGP
Percent LEP
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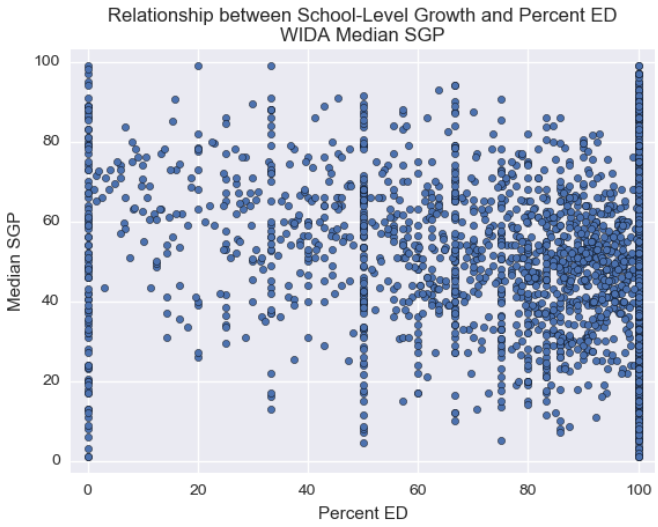
Relationship between School-Level Growth and Percent ED
WIDA Median SGP
Median SGP
Percent ED
0
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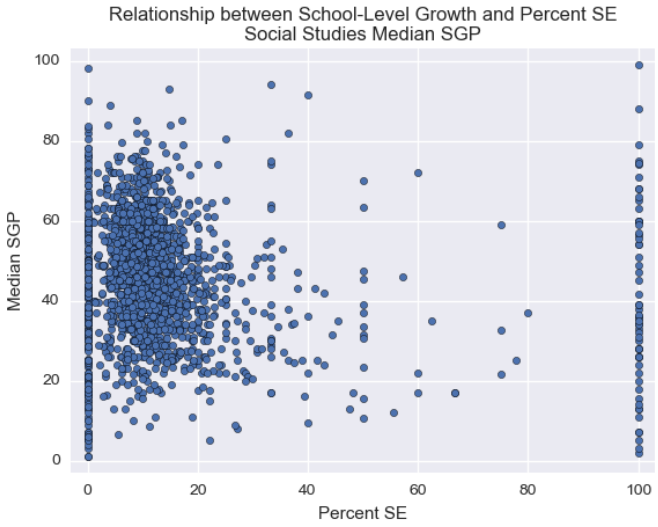
Relationship between School-Level Growth and Percent SE
Social Studies Median SGP
Median SGP
Percent SE
0
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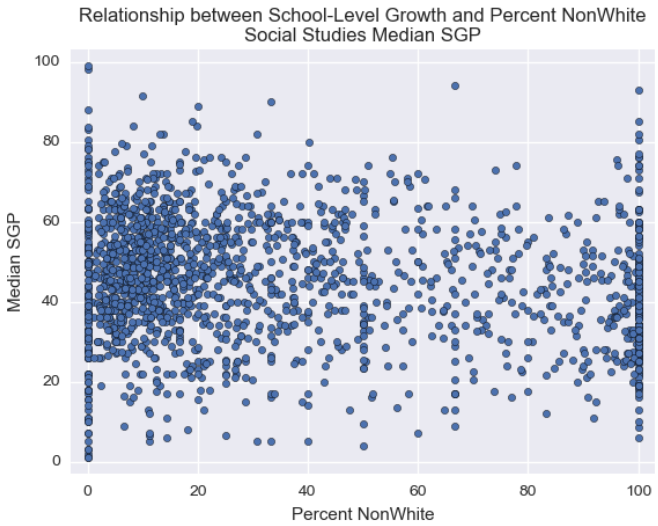
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Social Studies Median SGP
Median SGP
Percent NonWhite
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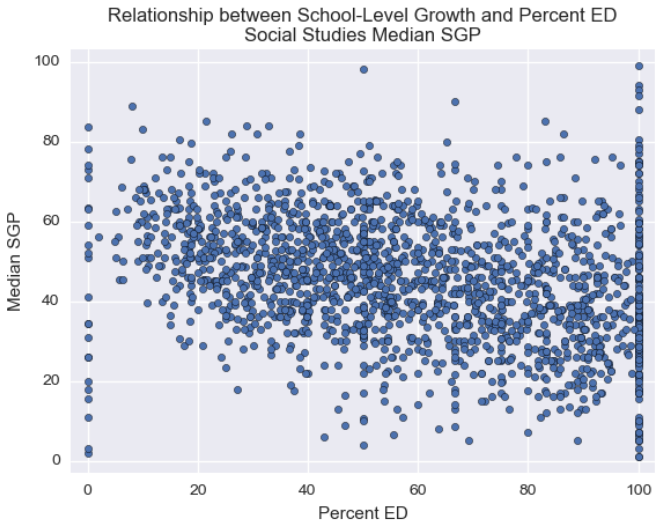
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Social Studies Median SGP
Median SGP
Percent ED
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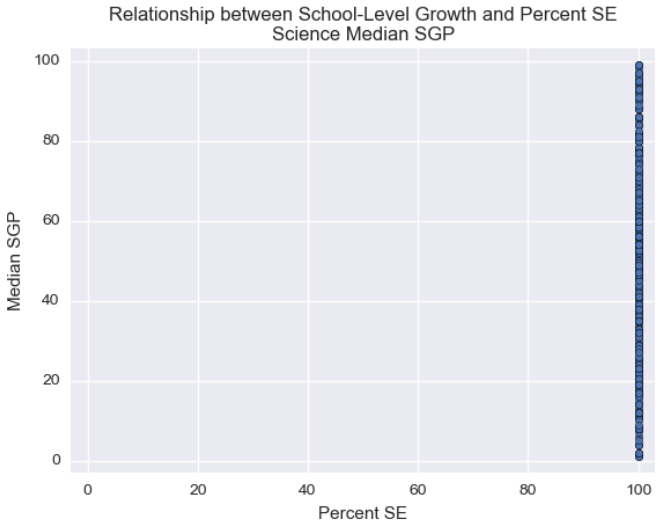
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Science Median SGP
Median SGP
Percent SE
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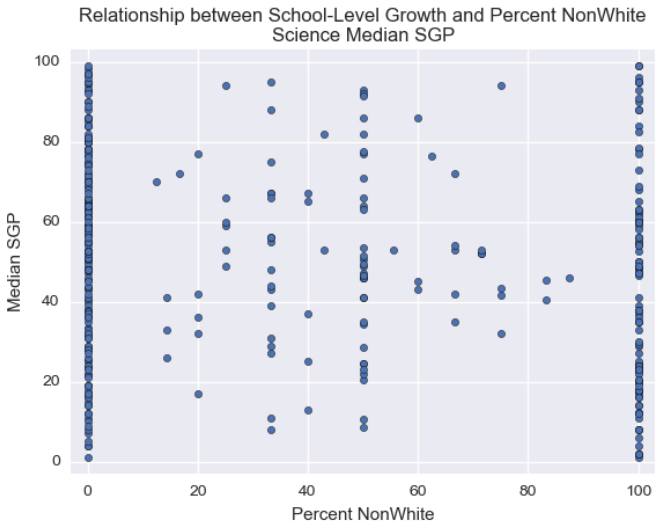
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Science Median SGP
Median SGP
Percent NonWhite
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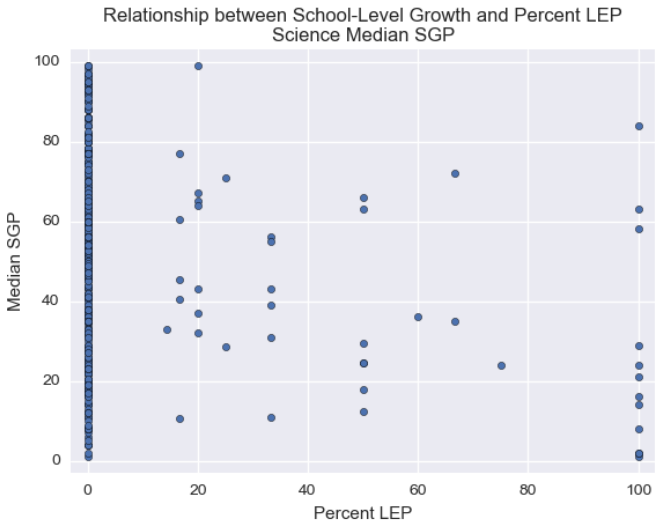
Relationship between School-Level Growth and Percent LEP
Science Median SGP
Median SGP
Percent LEP
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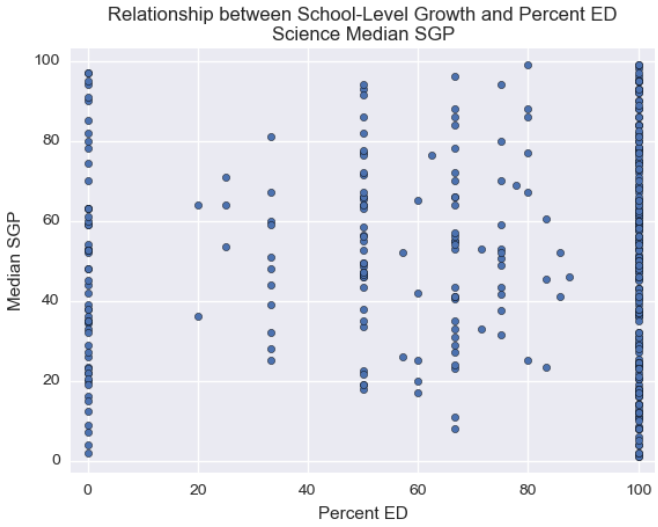
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Science Median SGP
Median SGP
Percent ED
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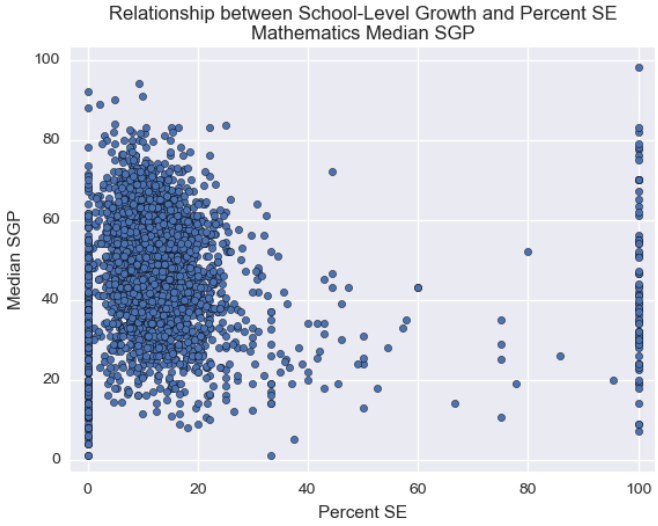
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Median SGP
Percent SE
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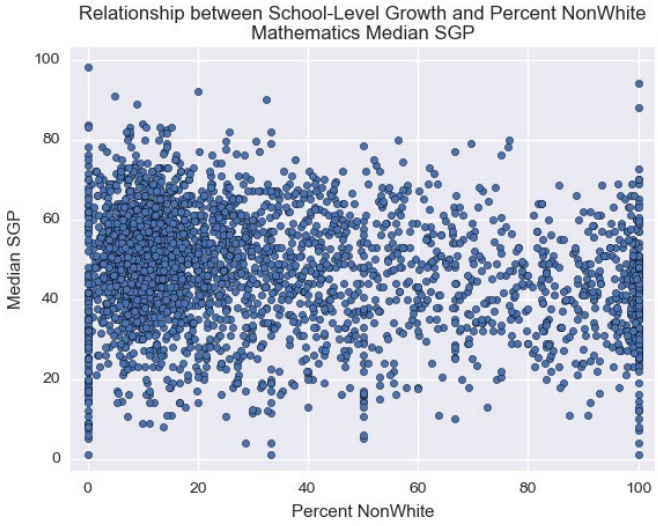
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Median SGP
Percent NonWhite
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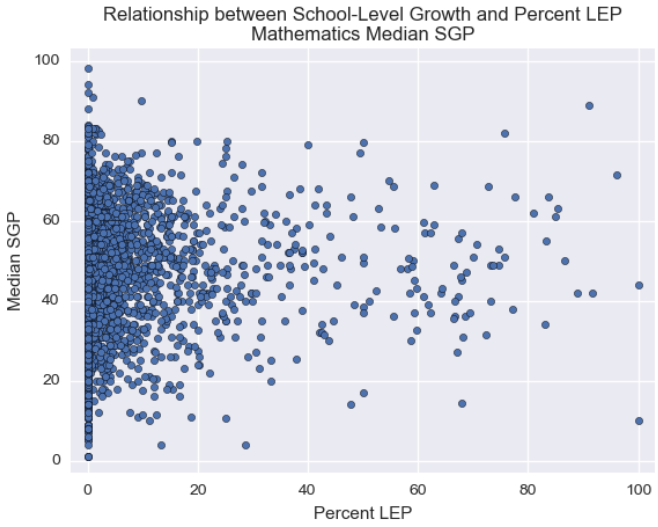
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Median SGP
Percent LEP
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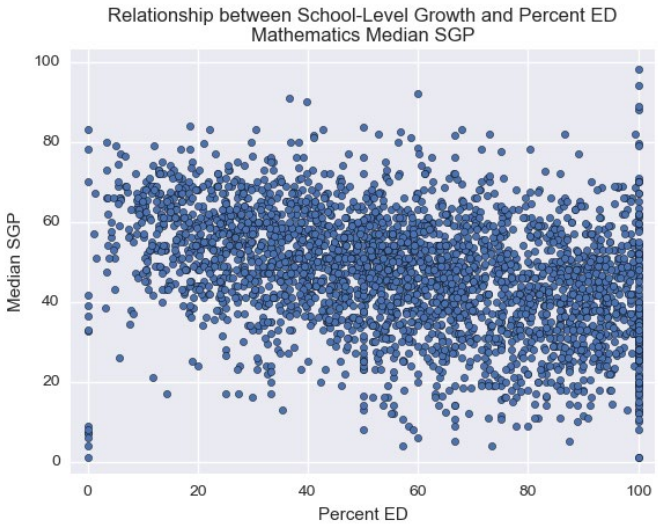
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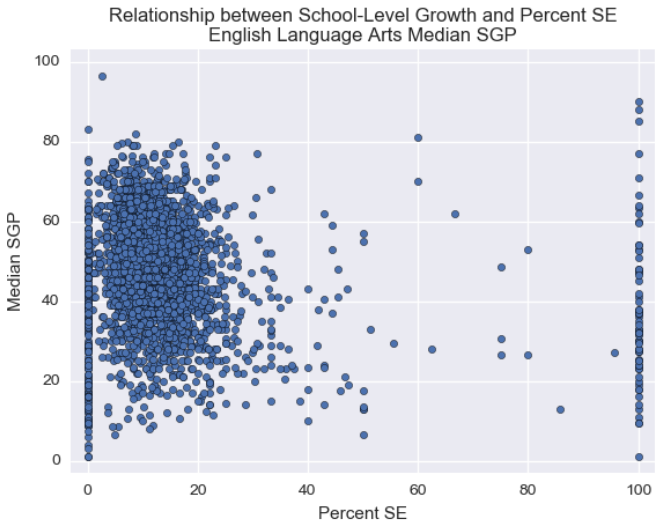
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Percent SE
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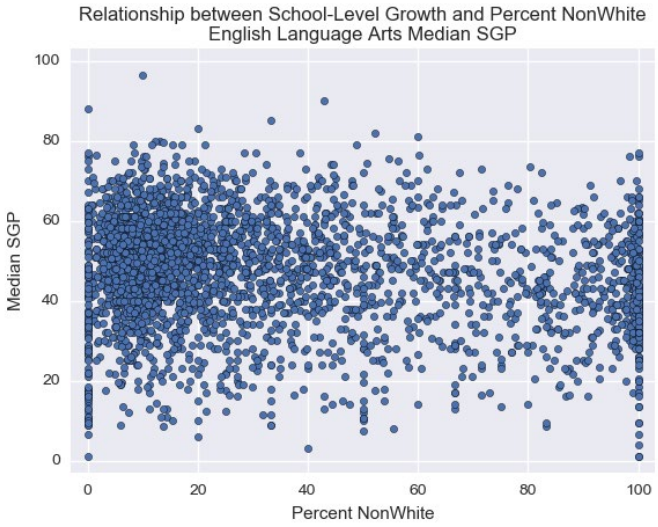
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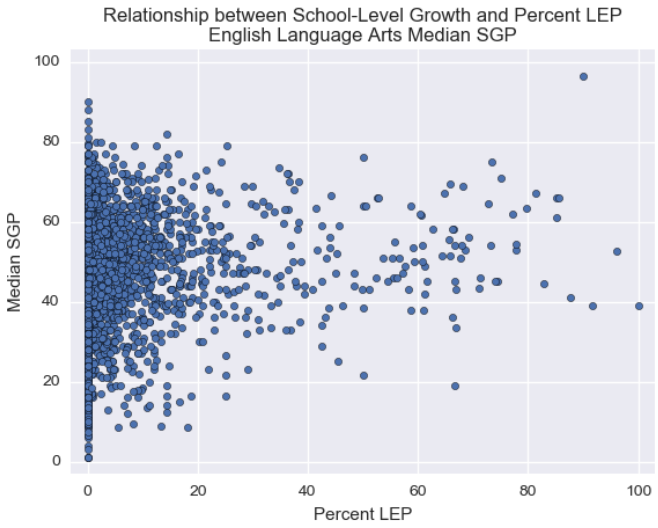
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Percent LEP
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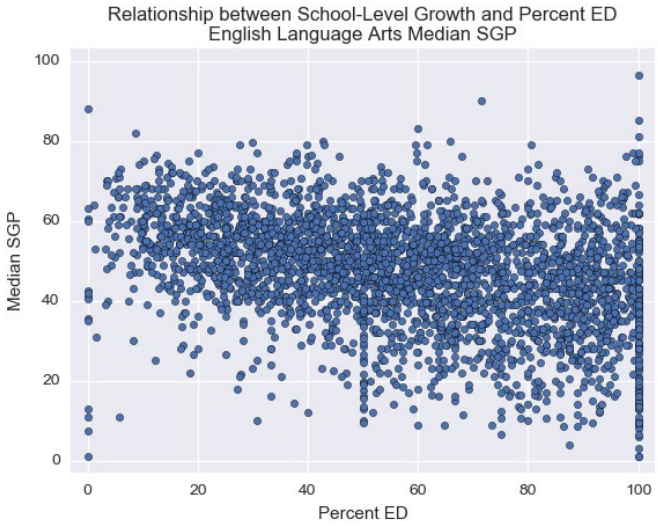
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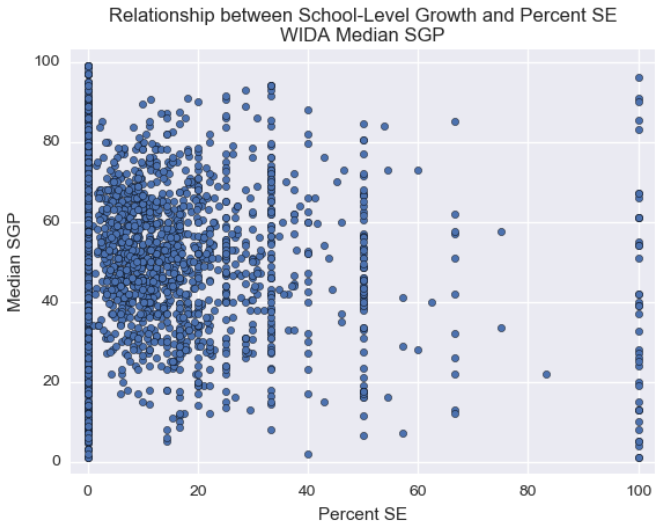
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Median SGP
Percent SE
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