Psychometric Analysis Report for the
Michigan English Language Arts (ELA), Mathematics, Science, and SAT
Student Growth Percentile and Adequate Growth Percentile Reporting
2018-2019

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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 1.9-3.13 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 t, the expected value of Y_t at the τ-th quantile, $Q_{Y_t}(\tau|Y_{t-1}, \ldots, Y_1)$ based on prior assessment scores $(Y_{t-1}, \ldots, Y_1)$, is then given by (Betebenner, 2011, p17)

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

Where $\phi_{ij}, i = 1, 2, 3$ and $j = 1, \ldots, t$-1 denote the B-spline basis functions for quantile τ. For instance, for $\tau = 0.5$, Q_{Y_t} returns the estimated median expectation of Y_t for any combination of $(Y_{t-1}, \ldots, Y_1)$. 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.

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

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. 2019) 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.

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

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 ε_{it} is a residual error.

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

$$\hat{\varepsilon}_{it} = y_{it} - \hat{y}_{it} \tag{6}$$

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).

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

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 2018-19.

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:

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

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 grade, assessment, and content area/domain combinations for which SGPs or PRRs were provided.

Table 1: Applicable assessments by grade

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

AGP Projections

For ELA and Math grades 4 through 7, AGP targets and/or lagged targets were computed for 1 to 3 years from 2019 or 7th grade, whichever comes first. For example, a grade 4 student had AGPs to grades 5, 6, and 7. While a grade 6 student had an AGP to 7th grade. Lagged AGP targets are calculated for Grades 4 through 7. Tables 2 and 3 show the grade progressions for AGP and AGP lagged targets respectively.

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

Grade	1 Year 2020	2 Year 2021	3 Year 2022
4	5th grade	6th grade	7th grade
5	6th grade	7th grade	
6	7th grade		

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

	Projected AGP Lagged Target Year			
Grade 2018	Current Year 2019	Current +1 Year 2020	Current +2 Year 2021	Current +3 Year 2022
3	4th grade	5th grade	6th grade	7th grade
4	5th grade	6th grade	7th grade	
5	6th grade	7th grade		
6	7th 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)

Inclusion and Exclusion Rules

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 2019	Prior Year 1	Prior Year 2
M-STEP ELA & Math	4	M-STEP 3rd grade Spring 2018	
	5	M-STEP 4th grade Spring 2018	M-STEP 3rd grade Spring 2017
	6	M-STEP 5th grade Spring 2018	M-STEP 4th grade Spring 2017
	7	M-STEP 6th grade Spring 2018	M-STEP 5th grade Spring 2017
PSAT 8	8	M-STEP 7th grade Spring 2018	M-STEP 6th grade Spring 2017
SAT	11	M-STEP 8th grade Spring 2016	M-STEP 7th grade Spring 2015
M-STEP Social Studies	8	M-STEP 6th grade Spring 2016	
	11	M-STEP 8th grade Spring 2016	M-STEP 6th grade Spring 2014
MI-Access ELA & Math	4	MI-Access 3rd grade Spring 2018	
	5	MI-Access 4th grade Spring 2018	MI-Access 3rd grade Spring 2017
	6	MI-Access 5th grade Spring 2018	MI-Access 4th grade Spring 2017
	7	MI-Access 6th grade Spring 2018	MI-Access 5th grade Spring 2017
	8	MI-Access 7th grade Spring 2018	MI-Access 6th grade Spring 2017
	11	MI-Access 8th grade Spring 2016	MI-Access 7th grade Spring 2015
MI-Access Science	7	MI-Access 4th grade Spring 2016	
	11	MI-Access 7th grade Spring 2015	MI-Access 5th grade Fall 2012
MI-Access Social Studies	8	MI-Access 5th grade Spring 2016	
	11	MI-Access 8th grade Spring 2016	
WIDA	1	WIDA Kindergarten Spring 2018	
	2	WIDA 1st grade Spring 2018	WIDA Kindergarten Spring 2017
	3	WIDA 2nd grade Spring 2018	WIDA 1st grade Spring 2017
	4	WIDA 3rd grade Spring 2018	WIDA 2nd grade Spring 2017
	5	WIDA 4th grade Spring 2018	WIDA 3rd grade Spring 2017
	6	WIDA 5th grade Spring 2018	WIDA 4th grade Spring 2017
	7	WIDA 6th grade Spring 2018	WIDA 5th grade Spring 2017
	8	WIDA 7th grade Spring 2018	WIDA 6th grade Spring 2017
	9	WIDA 8th grade Spring 2018	WIDA 7th grade Spring 2017
	10	WIDA 9th grade Spring 2018	WIDA 8th grade Spring 2017
	11	WIDA 10th grade Spring 2018	WIDA 9th grade Spring 2017
	12	WIDA 11th grade Spring 2018	WIDA 10th grade Spring 2017

Minimum Number of Students

A minimum of 5,000 students were required for the SGP M-STEP & SAT run.

A minimum of 1,000 students was preferred for the MI-Access FI PRR run.

A minimum of 2,000 students were required for the SGP WIDA Access for ELLs 2.0 run.

Repeat Test Takers

Students who repeated the grade immediately before the posttest were not 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 was not included in the analysis and does not receive an SGP.

Skipped Grades

Students who skipped the grade immediately prior to the posttest were not 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 2017, followed by Grade 5 M-STEP ELA in Spring 2019). Students with a gap were not 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 were 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	98,372	50
		5	101,393	50
		6	104,787	50
		7	98,372	50
	Mathematics	4	98,609	50
		5	101,570	50
		6	104,942	50
		7	104,751	50
	Social Studies	8	98,160	49
		11	91,542	50
PSAT	English Language Arts	8	103,386	50
	Mathematics	8	103,488	50
SAT	English Language Arts	11	91,751	50
	Mathematics	11	91,829	50
WIDA	WIDA	1	7,639	50
		2	8,829	50
		3	8,877	50
		4	8,326	51
		5	7,173	51
		6	5,884	51
		7	5,978	51
		8	5,627	50
		9	5,351	51
		10	4,924	50
		11	4,287	50
		12	3,300	50

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	835	50
		5	929	51
		6	1,095	51
		7	1,108	51
		8	1,129	51
		11	872	50
	Mathematics	4	872	50
		5	1,010	51
		6	1,195	51
		7	1,238	50
		8	1,250	50
		11	953	51
	Science	7	854	50
		11	889	49
	Social Studies	8	956	50
		11	954	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	835	50
		5	929	51
		6	1,095	51
		7	1,108	51
		8	1,129	51
		11	872	50
	Mathematics	4	872	50
		5	1,010	51
		6	1,195	51
		7	1,238	50
		8	1,250	50
		11	953	51
	Science	7	854	50
		11	889	49
	Social Studies	8	956	50
		11	954	50
SGP	English Language Arts	4	98,372	50
		5	101,393	50
		6	104,787	50
		7	104,635	50
		8	103,386	50
		11	91,751	50
	Mathematics	4	98,609	50
		5	101,570	50
		6	104,942	50
		7	104,751	50
		8	103,488	50
		11	91,829	50
	Social Studies	8	98,160	49
		11	91,542	50

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

Content Area	Grade	N	Median
English Language Arts	4	99,207	50
	5	102,322	50
	6	105,882	50
	7	105,743	50
	8	104,515	50
	11	92,623	50
Mathematics	4	99,481	50
	5	102,580	50
	6	106,137	50
	7	105,989	50
	8	104,738	50
	11	92,782	50
Science	7	854	50
	11	889	49
Social Studies	8	99,116	49
	11	92,496	50

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

Grade	N	Median
1	7,639	50
2	8,829	50
3	8,877	50
4	207,014	50
5	212,075	50
6	217,903	50
7	218,564	50
8	313,996	50
9	5,351	51
10	4,924	50
11	283,077	50
12	3,300	50

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 are at or above 0.80, for Social Studies it is at or above 0.75. With the SAT correlations similar with a correlation of 0.81 for English Language Arts and Mathematics. WIDA correlations are fairly consistent but lower, ranging from 0.62 to 0.80. Finally, the correlations for MI-Access are

consistent within content area but lower ranging from 0.50 to 0.67 for English Language Arts, from 0.50 to 0.61 for Mathematics, 0.46 to 0.53 for Science and 0.46 to 0.53 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	98,372	0.82
		5	101,393	0.84
		6	104,787	0.84
		7	104,635	0.85
	Mathematics	4	98,609	0.85
		5	101,570	0.86
		6	104,942	0.86
		7	104,751	0.88
	Social Studies	8	98,160	0.75
		11	91,542	0.76
PSAT	English Language Arts	8	103,386	0.80
	Mathematics	8	103,488	0.84
SAT	English Language Arts	11	91,751	0.81
	Mathematics	11	91,829	0.81
WIDA	WIDA	1	7,639	0.62
		2	8,829	0.74
		3	8,877	0.78
		4	8,326	0.75
		5	7,173	0.76
		6	5,884	0.73
		7	5,978	0.78
		8	5,627	0.80
		9	5,351	0.75
		10	4,924	0.77
		11	4,287	0.75
		12	3,300	0.67

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	835	0.56
		5	929	0.62
		6	1,095	0.65
		7	1,108	0.67
		8	1,129	0.65
		11	872	0.56
	Mathematics	4	872	0.50
		5	1,010	0.61
		6	1,195	0.56
		7	1,238	0.58
		8	1,250	0.60
		11	953	0.55
	Science	7	854	0.46
		11	889	0.53
	Social Studies	8	956	0.46
		11	954	0.53

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 in the 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.
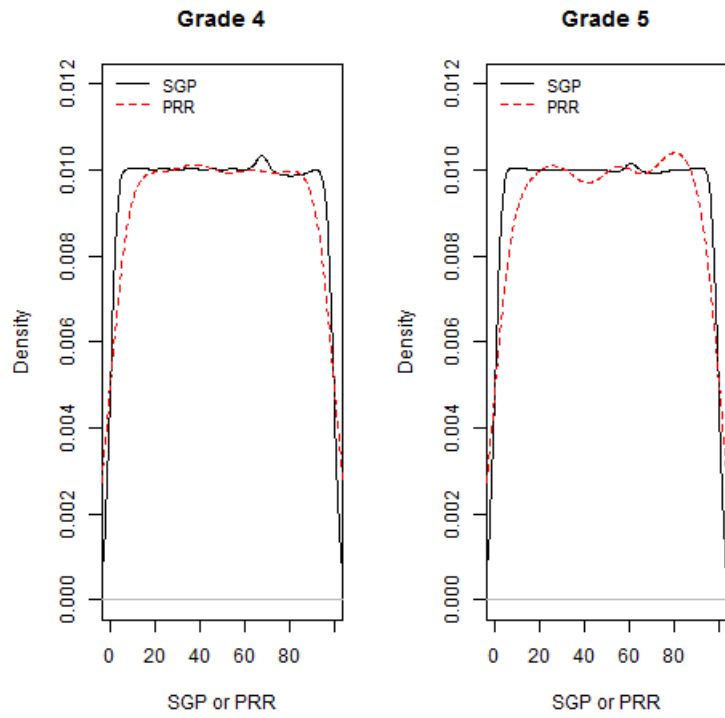
Figure 1. Distribution of SGP/PRR for Mathematics Grades, 4 and 5
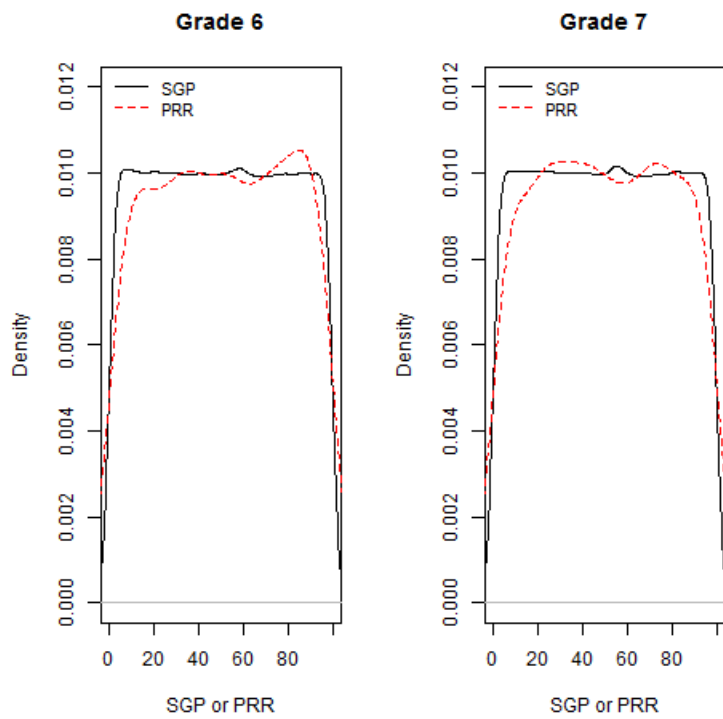
Figure 2. Distribution of SGP/PRR for Mathematics Grades, 6 and 7
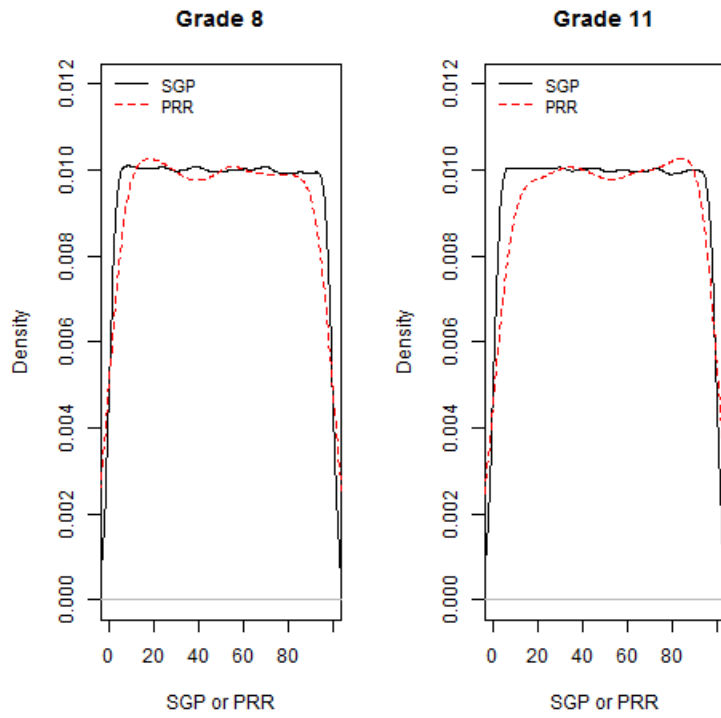
Figure 3. Distribution of SGP/PRR for Mathematics Grades, 8 and 11
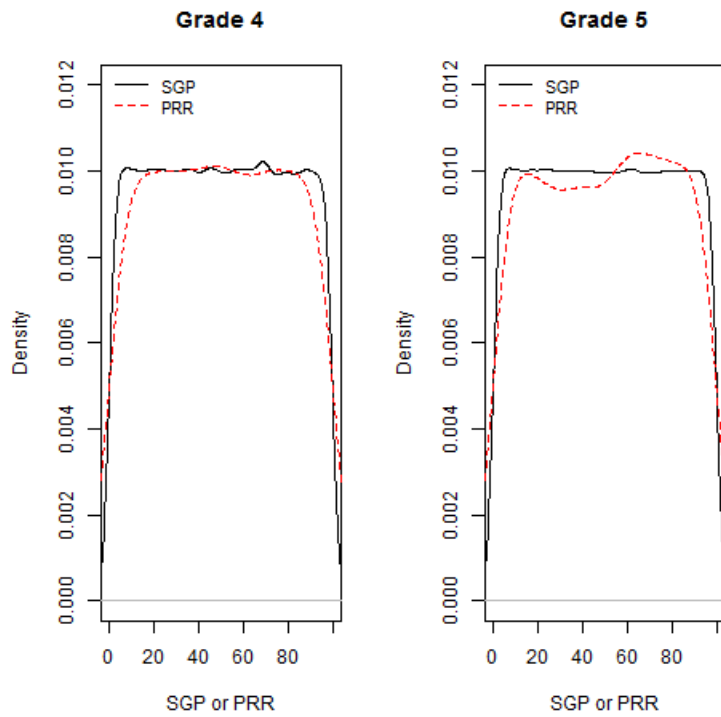
Figure 4. Distribution of SGP/PRR for English Language Arts Grades, 4 and 5
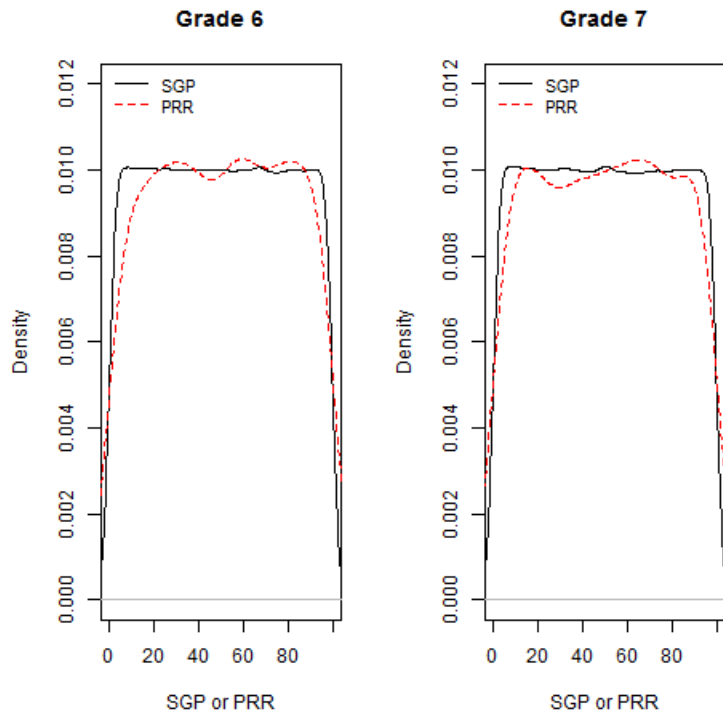
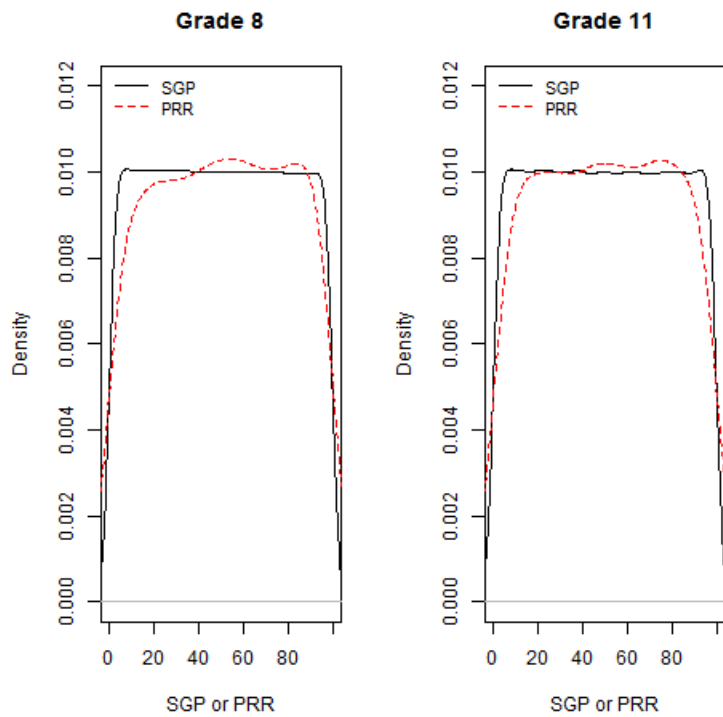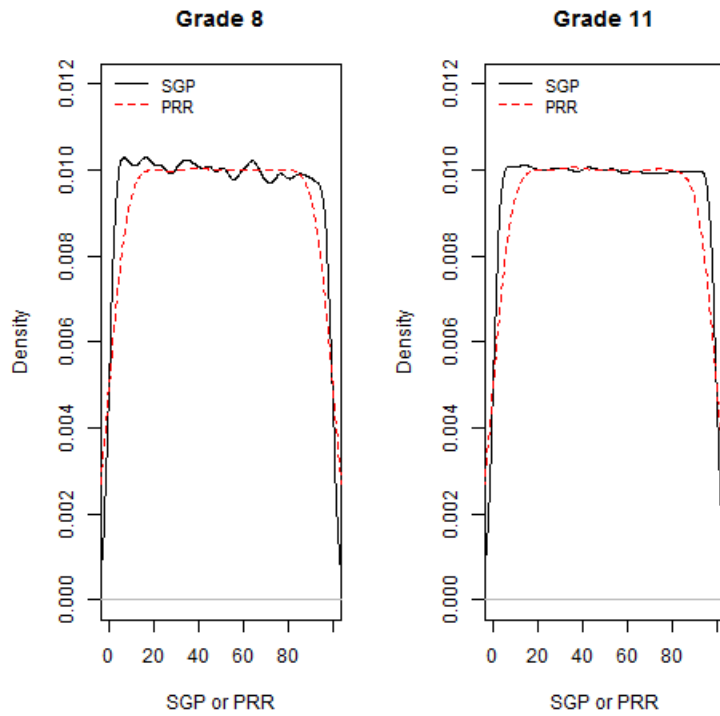Figure 5. Distribution of SGP/PRR for English Language Arts Grades, 6 and 7

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. [1]

Content Area	ED	SE	EL	Non-White
English Language Arts	-0.39	-0.17	0.04	-0.24
Mathematics	-0.38	-0.16	0.04	-0.23
Science				
Social Studies	-0.41	-0.16	-0.08	-0.25
WIDA	-0.38	-0.02		-0.19

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

Content Area	ED	SE	EL	Non-White
English Language Arts	-0.38	-0.27	0.01	-0.17
Mathematics	-0.37	-0.18	0.01	-0.19
Science	-0.16		-0.57	0.33
Social Studies	-0.37	-0.21	-0.01	-0.19
WIDA	-0.35	-0.02		-0.11

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.
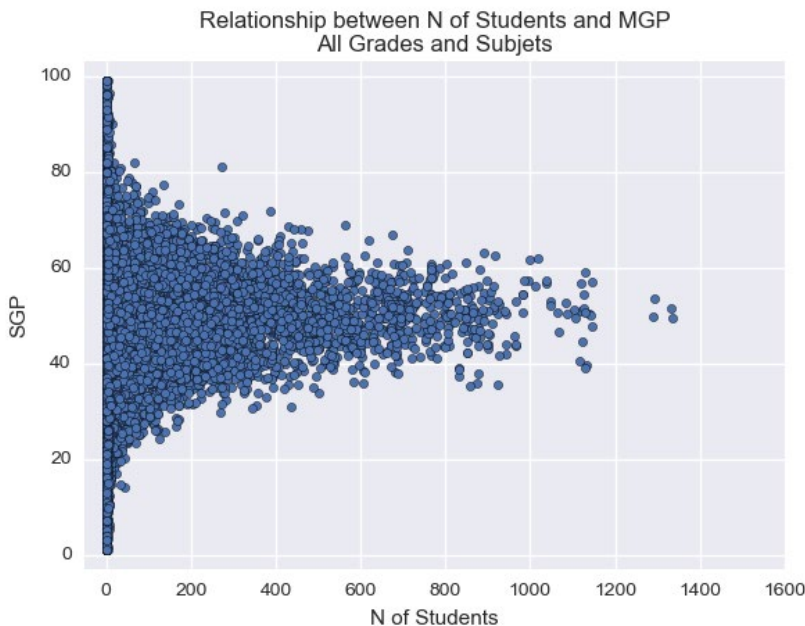
Figure 8. Number of Students versus Median SGP

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[1] Since Science was administered only for MI-Access, there were no schools with more than 20 students

AGP Outcomes

In 2019, AGPs and target AGPs were computed for M-STEP ELA and Mathematics, grades 4 through 7. 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 2019 performance level, grade, and years projected. Tables 14 and 15 do this by showing the percentage of students, by grade, who have a 2019 SGP greater than their 2019 lagged AGP, broken down by proficiency level, grade, and years projected. For example, in Grade 4 ELA, 65% 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 2019 SGP exceeds their lagged by performance level and years projected for M-STEP ELA.

Grade	Years Projected	Not Proficient		Partially Proficient		Proficient		Advanced	
		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	32,318	0%	20,517	16%	21,422	86%	24,115	100%
	2	32,318	0%	20,517	27%	21,422	69%	24,115	97%
	3	32,318	2%	20,517	34%	21,422	65%	24,115	94%
	4	32,318	2%	20,517	34%	21,422	65%	24,115	94%
5	1	32,245	0%	21,957	9%	29,093	81%	18,098	100%
	2	32,245	1%	21,957	23%	29,093	72%	18,098	99%
	3	32,245	1%	21,957	23%	29,093	72%	18,098	99%
	4	32,245	1%	21,957	23%	29,093	72%	18,098	99%
6	1	32,706	0%	27,984	11%	29,782	86%	14,315	100%
	2	32,706	0%	27,984	11%	29,782	86%	14,315	100%
	3	32,706	0%	27,984	11%	29,782	86%	14,315	100%
	4	32,706	0%	27,984	11%	29,782	86%	14,315	100%
7	1	30,397	0%	28,970	0%	32,009	95%	13,259	100%
	2	30,397	0%	28,970	0%	32,009	95%	13,259	100%
	3	30,397	0%	28,970	0%	32,009	95%	13,259	100%
	4	30,397	0%	28,970	0%	32,009	95%	13,259	100%

Table 15: Percentage of students whose 2019 SGP exceeds their lagged by performance level and years projected for M-STEP Math.

Grade	Years Projected	Not Proficient		Partially Proficient		Proficient		Advanced	
		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	23,787	0%	33,164	3%	25,149	72%	16,509	100%
	2	23,787	0%	33,164	12%	25,149	67%	16,509	99%
	3	23,787	0%	33,164	19%	25,149	65%	16,509	97%
	4	23,787	0%	33,164	19%	25,149	65%	16,509	97%
5	1	36,530	0%	29,314	11%	18,440	82%	17,286	100%
	2	36,530	0%	29,314	24%	18,440	75%	17,286	99%
	3	36,530	0%	29,314	24%	18,440	75%	17,286	99%
	4	36,530	0%	29,314	24%	18,440	75%	17,286	99%
6	1	35,401	0%	32,306	10%	20,080	86%	17,155	100%
	2	35,401	0%	32,306	10%	20,080	86%	17,155	100%
	3	35,401	0%	32,306	10%	20,080	86%	17,155	100%
	4	35,401	0%	32,306	10%	20,080	86%	17,155	100%
7	1	36,943	0%	29,872	1%	20,471	94%	17,465	100%
	2	36,943	0%	29,872	1%	20,471	94%	17,465	100%
	3	36,943	0%	29,872	1%	20,471	94%	17,465	100%
	4	36,943	0%	29,872	1%	20,471	94%	17,465	100%

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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

English Language Arts
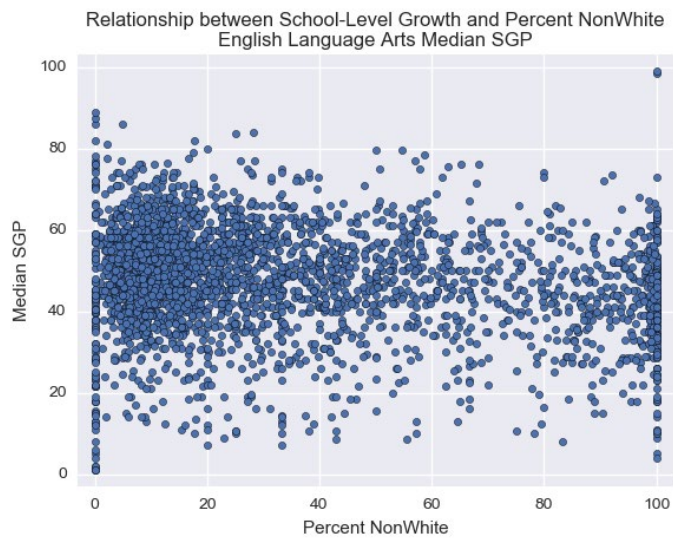
Figure A.1. Median School SGP versus Percentage of Non-White Students for English Language Arts
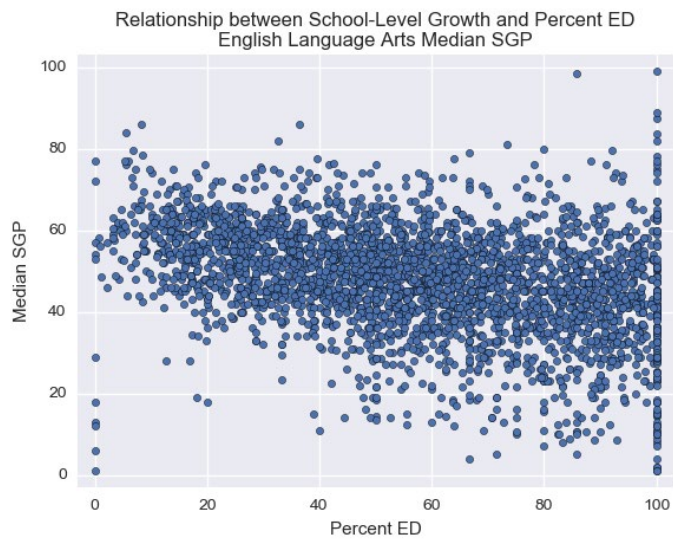
Figure A.2. Median School SGP versus Percentage of Economically Disadvantaged Students for English Language Arts
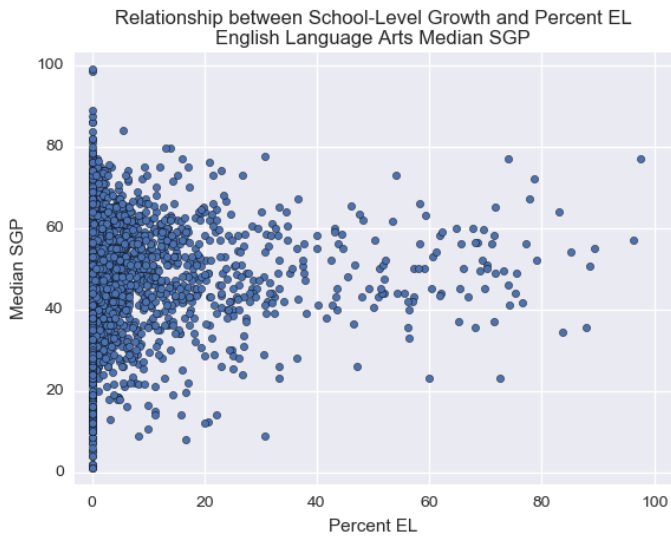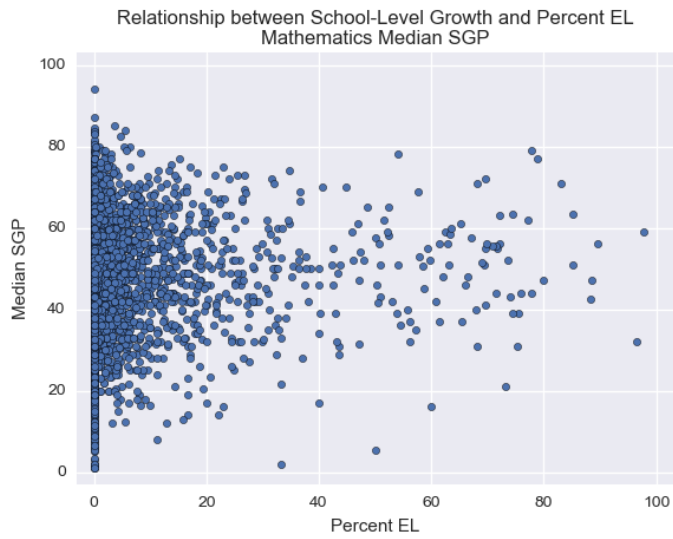
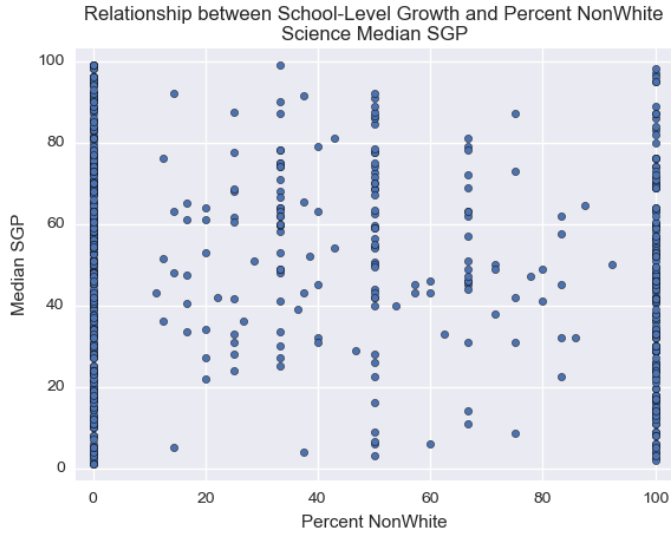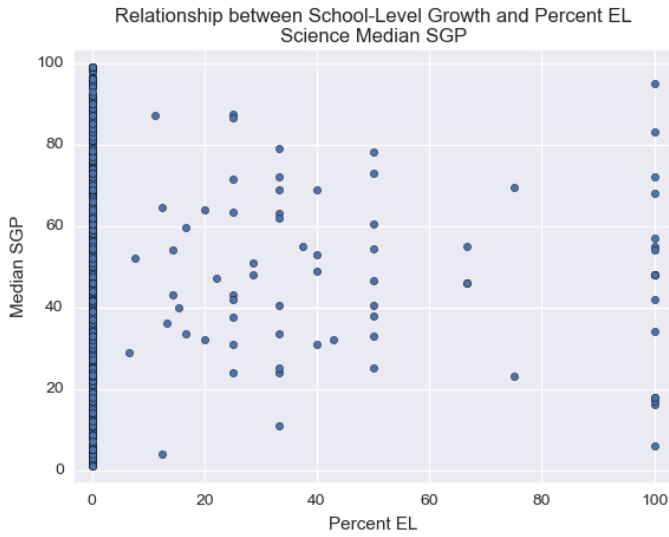Figure A.3. Median School SGP versus Percentage of English Learner (EL) Students for English Language Arts
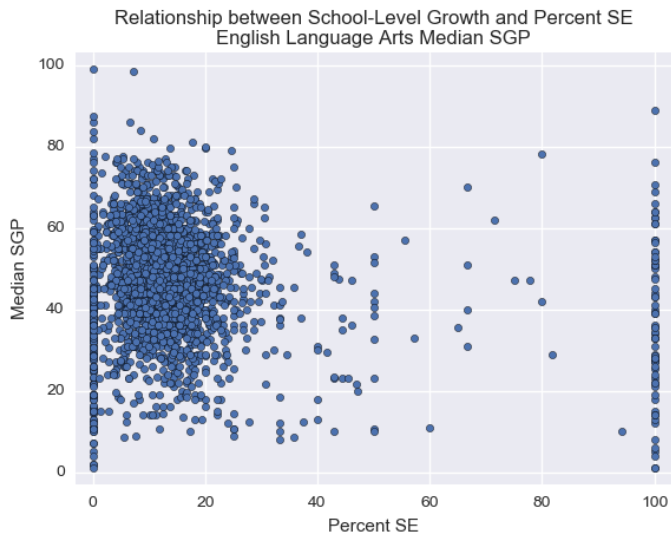
Figure A.4. Median School SGP versus Percentage of Special Education Students for English Language Arts
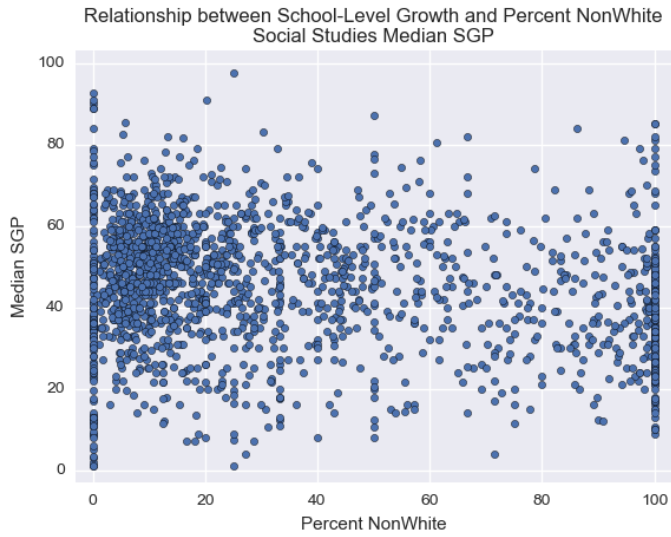
Mathematics
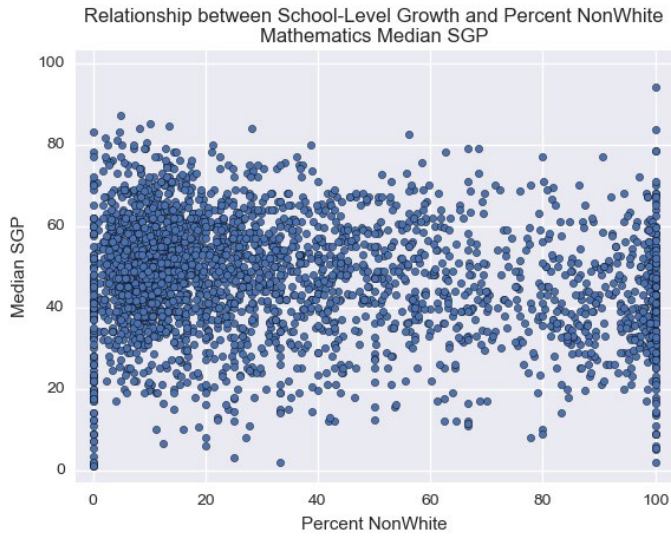
Figure A.5. Median School SGP versus Percentage of Non-White Students for Mathematics
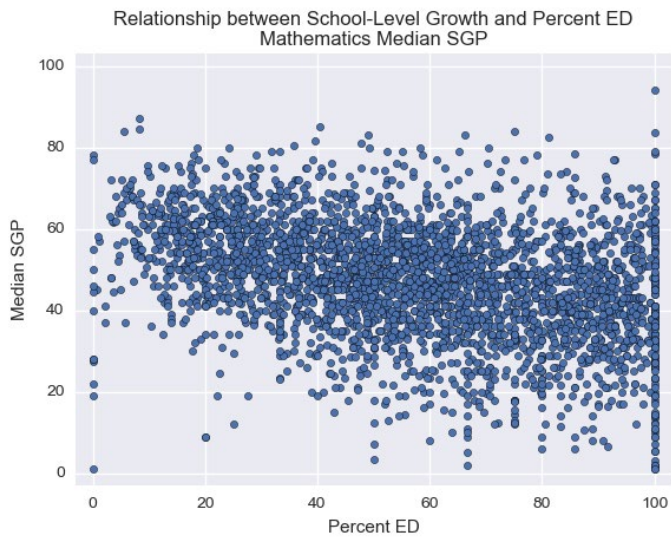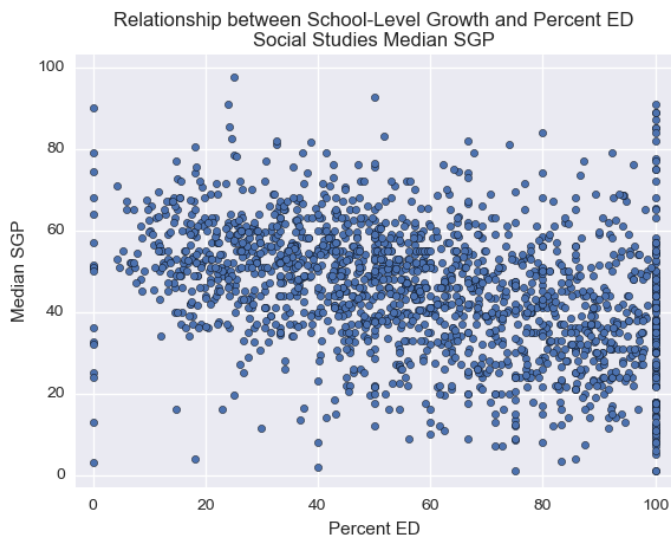

Figure A.6. Median School SGP versus Percentage of Economically Disadvantaged for Mathematics

Figure A.7. Median School SGP versus Percentage of English Learner (EL) Students for Mathematics
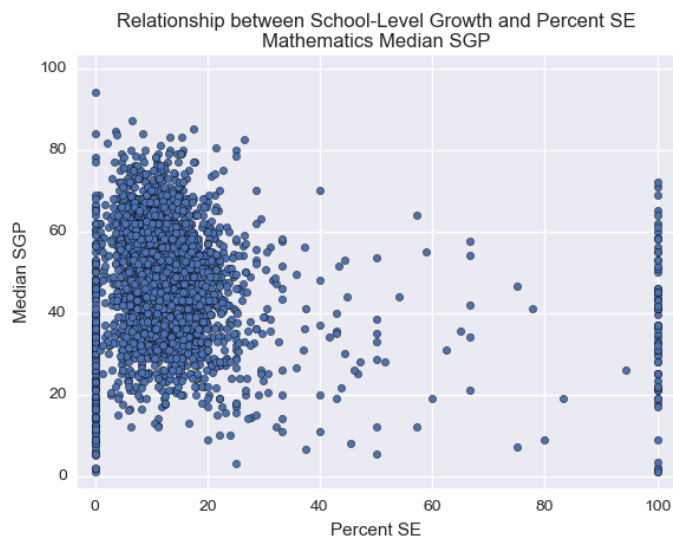
Figure A.8. Median School SGP versus Percentage of Special Education Students for Mathematics

Science

Figure A.9. Median School SGP versus Percentage of Non-White Students for Science[2]
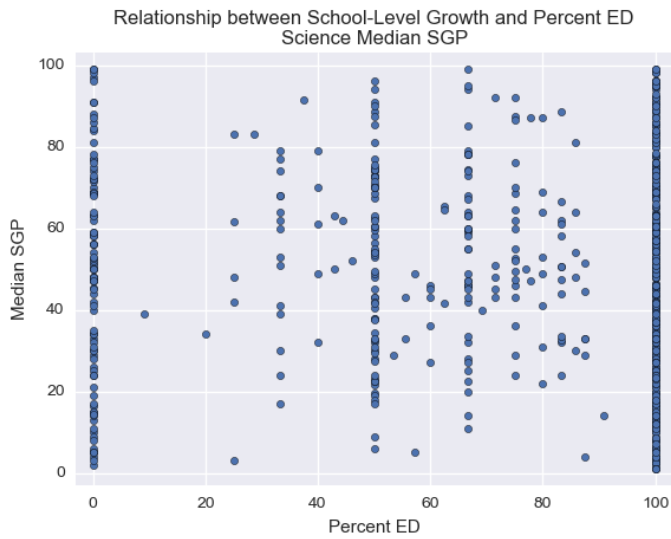
Figure A.10. Median School SGP versus Percentage of Economically Disadvantaged Students for Science[2]

[2] Note that MI-Access is the only science assessment addressed in this report.

Figure A.11. Median School SGP versus Percentage of English Learner (EL) Students for Science[3]
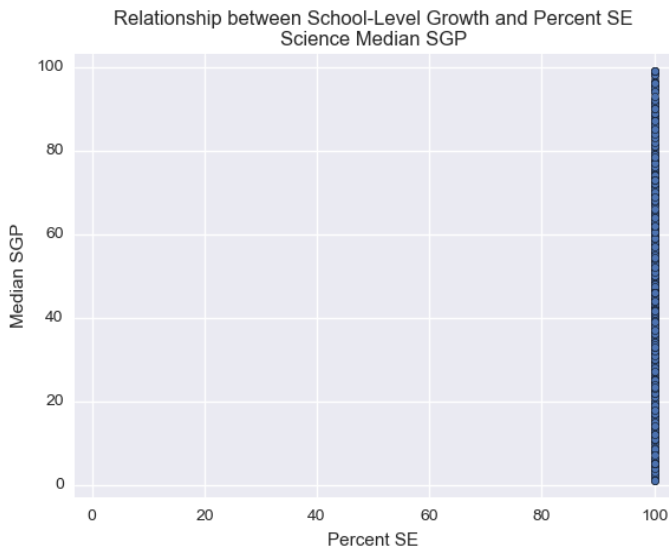
Figure A.12. Median School SGP versus Percentage of Special Education Students for Science[3]

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[3] Note that MI-Access is the only science assessment addressed in this report.

Social Studies

Figure A.13. Median School SGP versus Percentage of Non-White Students for Social Studies

Figure A.14. Median School SGP versus Percentage of Economically Disadvantaged Students for Social Studies
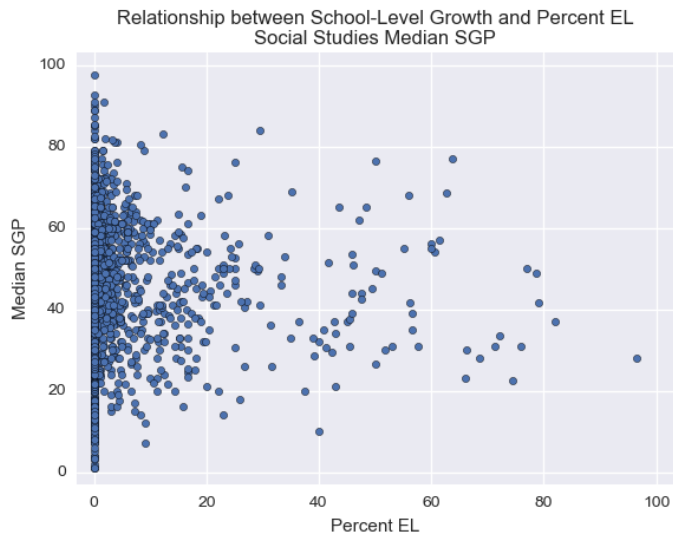
Figure A.15. Median School SGP versus Percentage of English Learner (EL) Students for Social Studies
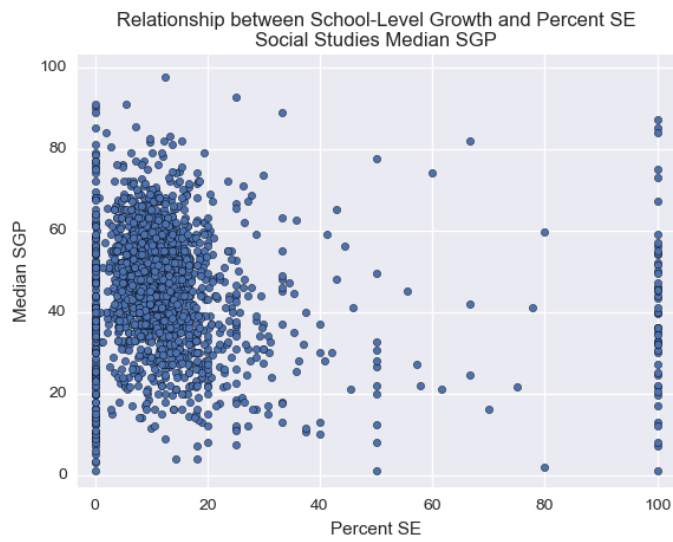

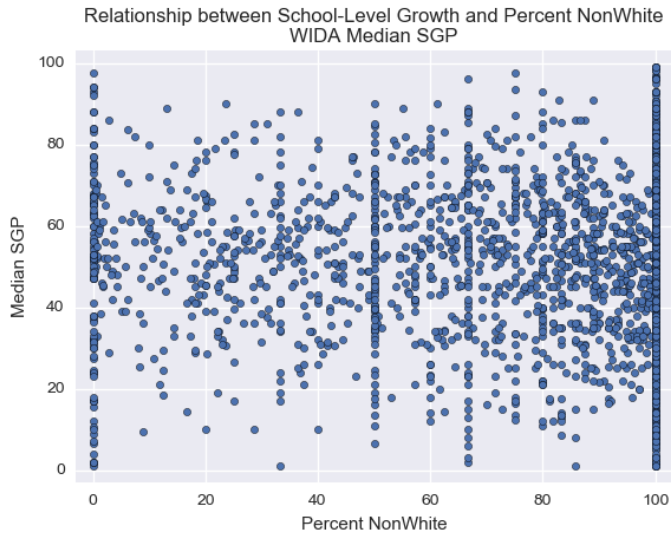Figure A.16. Median School SGP versus Percentage of Special Education Students for Social Studies

WIDA

Figure A.17. Median School SGP versus Percentage of Non-White Students for WIDA[4]
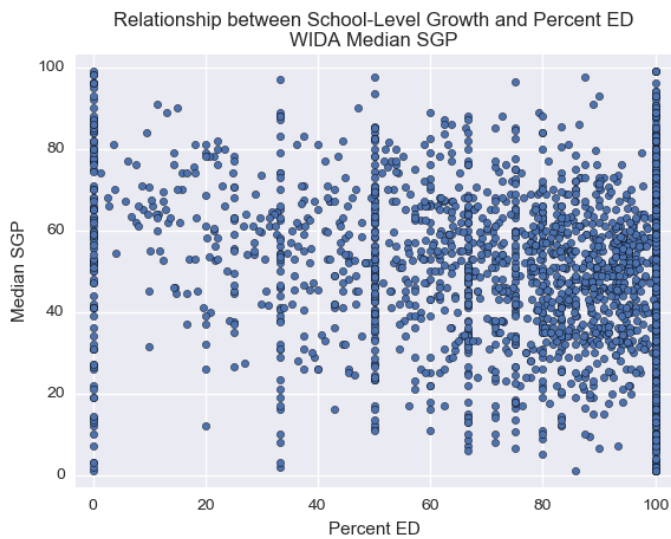

Figure A.18. Median School SGP versus Percentage of Economically Disadvantaged Students for WIDA[4]

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[4] Note that the WIDA assessment is administered to only English Learner (EL) students
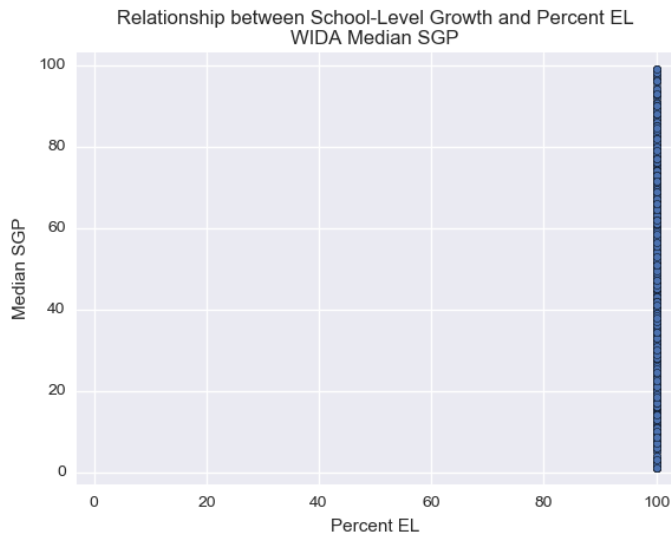
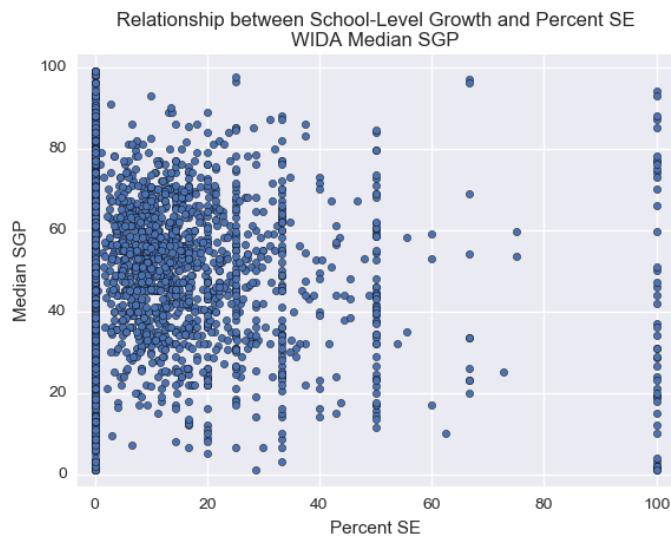Figure A.19. Median School SGP versus Percentage of English Learner (EL) Students for WIDA[5]

Figure A.20 Median School SGP versus Percentage of Special Education Students for WIDA[5]

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[5] Note that the WIDA assessment is administered to only English Learner (EL) students