Predictability Study of ISIP Reading and Virginia Standards of Learning (SOL) for English Reading: 3rd – 5th Grade Students

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Abstract

This study provides evidence that Istation's Indicators of Progress (ISIP™) Reading cut scores can predict outcomes of the Virginia Standards of Learning (SOL) for English Reading tests. This study uses 3rd through 5th grade ISIP Overall Reading Ability scores and SOL English Reading scores. All data come from one county in the state of Virginia and were collected in the 2016–2017 school year. Simple linear regression analysis was applied. Predictability "bands" were further computed by using the confidence interval (CI) approach to identify the ISIP Reading cut scores that predict SOL English Reading performance levels pass/proficient and pass/advanced. Results of a simple linear regression show that the ISIP Reading measures are predictive of SOL English Reading tests. The ISIP Overall Reading Ability cut scores to predict SOL English Reading performance levels pass/proficient and pass/advanced are reported.

Introduction

Istation's Indicators of Progress, also known as ISIP, is a sophisticated Internet- and Web-delivered computer-adaptive testing (CAT) system that provides continuous progress-monitoring (CPM) assessments in the critical domains of reading in prekindergarten through 8th grade. It is built using two-parameter Item Response Theory and driven by a fully CAT algorithm. ISIP gathers and reports frequent information about student progress in the critical domains throughout and across academic years (Patarapichayatham, Fahle, & Roden, 2013).

The purpose of ISIP Reading is to measure reading ability and identify deficits in critical areas in order to provide continuous differentiated instruction. ISIP accomplishes this by delivering short tests, at least monthly, that target critical areas to inform instruction. It is realistic to administer ISIP assessments for an entire classroom, school, or district in a single day with adequate computer resources. Student results are immediately available online for teachers and administrators and illustrate each student's past and present performance and skill growth. Teachers are alerted when students are not making adequate progress so that the instructional program can be modified before a pattern of failure becomes established (Mathes, 2011). For full information about ISIP Early Reading (for prekindergarten through 3rd grade) and ISIP Advanced Reading (for 4th through 8th grade), see Mathes (2011) and Mathes, Torgesen, and Herron (2011).

The Standards of Learning (SOL) for Virginia Public Schools establish minimum expectations for what students should know and be able to do at the end of each grade or course in English, mathematics, science, history/social science, and other subjects. SOL tests in reading measure the success of students in meeting the Board of Education's expectations for learning and achievement. All items on SOL tests are reviewed by Virginia classroom teachers for

accuracy and fairness, and teachers also assist the state Board of Education in setting proficiency standards for the tests. (See http://www.doe.virginia.gov for full information.)

Student performance is graded on a scale of 0–600 with 400 representing the minimum level of acceptable proficiency and 500 representing advanced proficiency. On English Reading, the Board of Education has defined three levels of student achievement: basic (fail/basic and fail/below basic), proficient (pass/proficient), and advanced (pass/advanced) (http://www.doe.virginia.gov).

This study provides evidence that ISIP Overall Reading Ability scores can predict SOL English Reading performance levels pass/proficient and pass/advanced for 3rd through 5th grade students in the state of Virginia. In order to provide as much useful information as possible for teachers, parents, and administrators to prepare students for SOL English Reading tests, the scores to predict SOL English Reading and performance levels pass/proficient and pass/advanced are provided.

Methods

Measures

Results from ISIP Early Reading for 3rd grade, ISIP Advanced Reading for 4th and 5th grade, and SOL English Reading tests for 3rd through 5th grade come from the same set of students during the 2016–2017 school year. Each student had both SOL English Reading and ISIP Overall Reading Ability scores. The ISIP Overall Reading Ability scores are computed from four different sub-skills: reading comprehension, spelling, vocabulary, and connected text fluency. Table 2 shows the Pearson product-moment correlation coefficients between ISIP Overall Reading Ability and SOL English Reading scores by grade level.

The correlations between ISIP Reading and SOL English Reading scores were high, indicating a strong relationship between ISIP Reading assessments and SOL English Reading tests. The correlation coefficients for ISIP Overall Reading Ability scores and SOL English Reading scores were 0.72, 0.76, and 0.74 for grades 3 through 5, respectively.

Samples

The sample included 2,962 students from 3rd through 5th grade in the state of Virginia: 1,003 from 3rd grade; 1,043 from 4th grade; and 916 from 5th grade. Table 1 shows descriptive statistics of the samples. The means of ISIP Overall Reading Ability scores were 255.24; 1,983.01; and 2,074.70 for grades 3 through 5, respectively. The means of SOL English Reading scores were 421.28; 431.06; and 441.75 for grades 3 through 5, respectively.

Analysis

The simple linear regression analysis was applied for each grade's data by using SPSS software version 22. The ISIP Overall Reading Ability score was the predictor, and the SOL English Reading score was the outcome variable. I first ran the simple linear regression. The $\hat{y}$ for each grade's data was computed (see Part I result). Then the confidence interval (CI) was further computed.

Prediction bands commonly arise in regression analysis. The goal of a prediction band is to cover with a prescribed probability the values of one or more future observations for the same population from which a given data set was sampled. There are two types of prediction bands: confidence interval (CI) and prediction interval (PI). A CI is used in statistical analysis to represent the uncertainty in an estimate of a curve or function of the data. The 95 percent confidence intervals enclose the area that I can be 95 percent certain contains the true curve. If I have many data points, the confidence intervals will be near the line or curve, and most of the

data will lie outside the confidence intervals. The 95 percent prediction intervals enclose the area

that I expect to enclose 95 percent of future data points. They are wider than confidence bands,

and they are much wider with large data sets.

The confidence interval (CI) for the average expected value of *y* for a given x^* is as

follows:

$$E(y \mathrm{I} x^*) = \hat{y} \pm t^*_{n-2} \sqrt{\frac{1}{n} + \frac{(x^* - \overline{x})^2}{(n-1) s_x^2}}$$

where s_y is the standard deviation of the residuals, calculated as

$$s_y = \sqrt{\frac{\sum (y_i - \hat{y}_i)^2}{n-2}}.$$

The ISIP Reading scores around the SOL English Reading cut point for the lower bound

and the upper bound of the CI were then selected.

Results

Part I: Simple Linear Regression

Simple linear regression was applied for each grade's data. The results for each grade are

shown in Table 5 and reported as follows.

For 3rd grade, 52.1 percent of the variance in SOL English Reading scores can be

predicted from ISIP Overall Reading Ability. The equation for predicting SOL English Reading

scores is *SOL English Reading = 421.281 + 2.661 (ISIP) + e.* The intercept was 421.281. The

SOL English Reading score was 421.281 as ISIP was zero. The slope for ISIP was 2.661,

indicating that the SOL English Reading score was 423.942 as the ISIP Overall Reading Ability

score increased 1 unit.

For 4th grade, 57.3 percent of the variance in SOL English Reading scores can be

predicted from ISIP Overall Reading Ability. The equation for predicting SOL English Reading

scores is *SOL English Reading = 431.056 + 0.307 (ISIP) + e.* The intercept was 431.056. The SOL English Reading score was 431.056 as ISIP was zero. The slope for ISIP was 0.307, indicating that the SOL English Reading score was 431.363 as the ISIP Overall Reading Ability score increased 1 unit.

For 5th grade, 54.7 percent of the variance in SOL English Reading scores can be predicted from ISIP Overall Reading Ability. The equation for predicting SOL English Reading scores is *SOL English Reading = 441.748 + 0.284 (ISIP) + e.* The intercept was 441.748. The SOL English Reading score was 441.748 as ISIP was zero. The slope for ISIP was 0.284, indicating that the SOL English Reading score was 442.032 as the ISIP Overall Reading Ability score increased 1 unit.

Part II: Prediction Bands

The confidence interval (CI) was applied to obtain the prediction bands from simple linear regression results. The confidence level was set at 0.95, or 95 percent. Table 3 shows ISIP Reading prediction bands to predict SOL English Reading performance levels pass/proficient and pass/advanced for 3rd through 5th grades. Table 4 shows ISIP Reading cut scores to predict SOL English Reading performance levels proficient and advanced for 3rd through 5th grades. The results are reported as follows.

SOL English Reading Performance Level: Proficient (Pass/Proficient)

For 3rd grade, the prediction band ranges from 246 to 248. The ISIP Overall Reading Ability score at 248 is the cut score. It is 95 percent certain that a group of students who have an ISIP Overall Reading Ability score of 248 will score higher than the SOL English Reading performance level *Proficient* cut score 400. In other words, 3rd grade students who score 248 or

higher on ISIP Overall Reading Ability will almost certainly achieve SOL English Reading performance level *Proficient*.

For 4th grade, the prediction band ranges from 1,865 to 1,897. The ISIP Overall Reading Ability score at 1,897 is the cut score. It is 95 percent certain that a group of students who have an ISIP Overall Reading Ability score of 1,897 will score higher than the SOL English Reading performance level *Proficient* cut score 400. In other words, 4th grade students who score 1,897 or higher on ISIP Overall Reading Ability will almost certainly achieve SOL English Reading performance level *Proficient*.

For 5th grade, the prediction band ranges from 1,907 to 1,947. The ISIP Overall Reading Ability score at 1,947 is the cut score. It is 95 percent certain that a group of students who have an ISIP Overall Reading Ability score of 1,947 will score higher than the SOL English Reading performance level *Proficient* cut score 400. In other words, 5th grade students who score 1,947 or higher on ISIP Overall Reading Ability will almost certainly achieve SOL English Reading performance level *Proficient*.

SOL English Reading Performance Level: Advanced (Pass/Advanced)

For 3rd grade, the prediction band ranges from 284 to 287. The ISIP Overall Reading Ability score at 287 is the cut score. It is 95 percent certain that a group of students who have an ISIP Overall Reading Ability score of 287 will score higher than the SOL English Reading performance level *Advanced* cut score 500. In other words, 3rd grade students who score 287 or higher on ISIP Overall Reading Ability will almost certainly achieve SOL English Reading performance level *Advanced*.

For 4th grade, the prediction band ranges from 2,186 to 2,232. The ISIP Overall Reading Ability score at 2,232 is the cut score. It is 95 percent certain that a group of students who have

an ISIP Overall Reading Ability score of 2,232 will score higher than the SOL English Reading performance level *Advanced* cut score 500. In other words, 4th grade students who score 2,232 or higher on ISIP Overall Reading Ability will almost certainly achieve SOL English Reading performance level *Advanced*.

For 5th grade, the prediction band ranges from 2,258 to 2,305. The ISIP Overall Reading Ability score at 2,305 is the cut score. It is 95 percent certain that a group of students who have an ISIP Overall Reading Ability score of 2,305 will score higher than the SOL English Reading performance level *Advanced* cut score 500. In other words, 5th grade students who score 2,305 or higher on ISIP Overall Reading Ability will almost certainly achieve SOL English Reading performance level *Advanced*.

Conclusions

Overall, I conclude that ISIP Reading test scores are predictive of SOL English Reading test scores for 3rd through 5th grade data. ISIP Reading curriculum and ISIP Reading measures can definitely help prepare students for the SOL English Reading tests. If a student does very well on ISIP measures, it is likely that he or she will do very well on SOL English Reading tests. The ISIP cut scores to predict SOL English Reading tests are useful for school administrators, superintendents, teachers, and parents to predict students' performance on SOL English Reading tests. Also, teachers can use ISIP cut scores to encourage students to improve their reading ability in order to meet SOL English Reading performance standards. Teachers and parents can compare a student's ISIP Overall Reading Ability score directly with the ISIP cut score in this study.

To benefit from these results, teachers would ideally begin tracking their students' scores from the beginning of the school year. By comparing a student's ISIP Reading score with the

ISIP cut score, teachers can immediately see how much a student must improve his or her

English reading ability in order to meet the ISIP cut score, which means a likely chance of

passing the SOL English Reading test.

Even though this study suggests that teachers use ISIP Overall Reading Ability cut scores

to prepare students for SOL English Reading tests, it must be understood that complete certainty

of passing SOL English Reading test cannot be guaranteed. There are many other factors that

may affect students' SOL English Reading scores besides their English reading ability.

Figures 1, 2, and 3 show that ISIP Reading cut scores and SOL English Reading

performance levels for grades 3 to 5 create four meaningful quadrants. Quadrant I represents

students who have met the ISIP Reading cut score and passed the SOL English Reading test. A

majority of students are in this quadrant, indicating that ISIP Reading tests are predictive of SOL

English Reading tests. Quadrant II represents students who have not met the ISIP Reading cut

score but passed the SOL English Reading test. Only a few students are in quadrant II,

confirming that ISIP Reading tests are highly correlated with SOL English Reading tests.

Quadrant III represents students who have not met the ISIP Reading cut score and did not

pass the SOL English Reading test. A significant number of students fall in quadrant III, showing

that if students do not do well on ISIP Reading tests, it may be almost impossible for them to

pass SOL English Reading tests. Again, this finding also confirms a relationship between ISIP

Reading tests and SOL English Reading tests. Quadrant IV represents students who have met the

ISIP Reading cut score but did not pass SOL English Reading test. A few students fall in this

quadrant, unfortunately. It is possible that if a student has an ailment (i.e., sickness or stress)

before or during the SOL English Reading test, he or she may or may not pass, despite having

previously met the ISIP Reading cut score.

References

Mathes, P. (2011). Technical manual: Istation's Indicators of Progress, Advanced Reading:
Computer Adaptive Testing System for Continuous Progress Monitoring of Reading
Growth for Students Grade 4 through Grade 8.

Mathes, P., Torgesen, J., & Herron, J. (2011). Technical manual: Istation's Indicators of
Progress, Early Reading: Computer Adaptive Testing System for Continuous Progress
Monitoring of Reading Growth for Students Pre-K to Grade 3.

Patarapichayatham, C., Fahle, W., & Roden, T. R. (2013). ISIP Reading versus STAAR
Reading: The Predictability Study. Dallas, TX: Istation.

Virginia Department of Education. *Virginia Department of Education Home Page | CDE*,
www.cde.virginia.gov.

Table 1

Descriptive Statistics of Samples

Grade	n	ISIP		SOL	
		Mean	SD	Mean	SD
3	1,003	255.24	20.10	421.28	74.06
4	1,043	1,983.01	178.51	431.06	72.37
5	916	2,074.70	179.29	441.75	68.98

Table 2

Pearson Product-Moment Correlation Coefficients between ISIP Overall Reading Ability Scores and SOL Scores

Grade	Correlation coefficients
3	0.72
4	0.76
5	0.74

Table 3

ISIP Reading Prediction Bands to Predict SOL Performance Levels

Grade	Pass/Proficient	Pass/Advanced
3	246–248	284–287
4	1,865–1,897	2,186–2,232
5	1,907–1,947	2,258–2,305

Table 4

ISIP Reading Cut Scores to Predict SOL Performance Levels

Grade	Pass/Proficient	Pass/Advanced
3	248	287
4	1,897	2,232
5	1,947	2,305

Table 5

Simple Linear Regression Analysis for 3rd Grade

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
						Change Statistics			
1	.722[a]	.521	.521	51.273	.521	1089.687	1	1001	.000

a. Predictors: (Constant), ISIP

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2864708.091	1	2864708.091	1089.687	.000[b]
	Residual	2631556.410	1001	2628.927		
	Total	5496264.500	1002			

a. Dependent Variable: SOL

b. Predictors: (Constant), ISIP

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	421.281	1.619		260.216	.000
	ISIP	2.661	.081	.722	33.010	.000

a. Dependent Variable: SOL

Table 5 (Continued)

Simple Linear Regression Analysis for 4th Grade

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.757[a]	.573	.573	47.307	.573	1397.356	1	1041	.000

a. Predictors: (Constant), ISIP

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3127154.804	1	3127154.804	1397.356	.000[b]
	Residual	2329661.971	1041	2237.908		
	Total	5456816.775	1042			

a. Dependent Variable: SOL
b. Predictors: (Constant), ISIP

Coefficients[a]

Model		Unstandardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	431.056	1.465		294.276	.000
	ISIP	.307	.008	.757	37.381	.000

a. Dependent Variable: SOL

Table 5 (Continued)

Simple Linear Regression Analysis for 5th Grade

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	F Change	df1	df2	Sig. F Change
1	.739 a	.547	.546	46.458	.547	1102.857	1	914	.000

a. Predictors: (Constant), ISIP

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2380386.917	1	2380386.917	1102.857	.000[b]
	Residual	1972760.833	914	2158.382		
	Total	4353147.750	915			

a. Dependent Variable: SOL
b. Predictors: (Constant), ISIP

Coefficients[a]

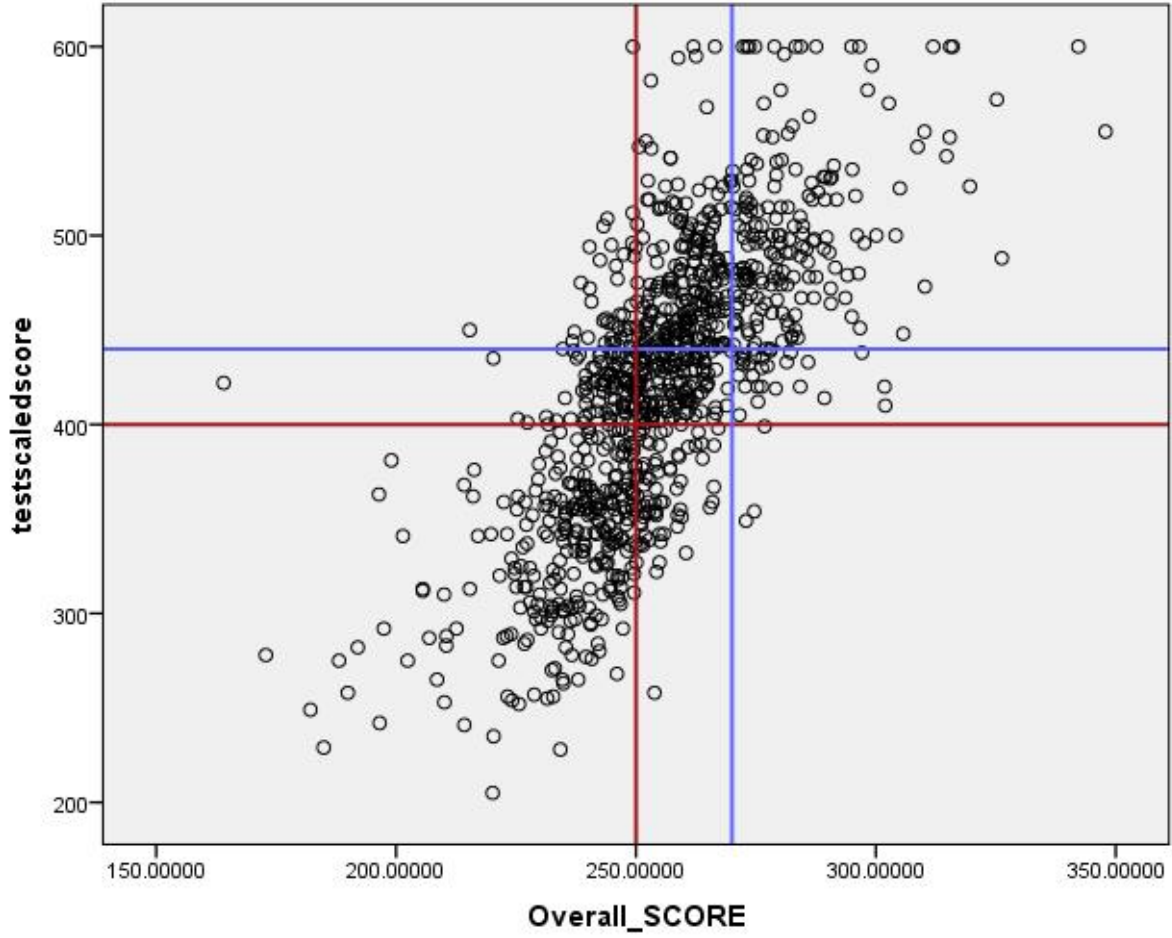| Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	441.748	1.535		287.779	.000
	ISIP	.284	.009	.739	33.209	.000

a. Dependent Variable: SOL

Figure 1. 3rd grade ISIP Reading cut scores and SOL performance levels

    Pass/Proficient = red

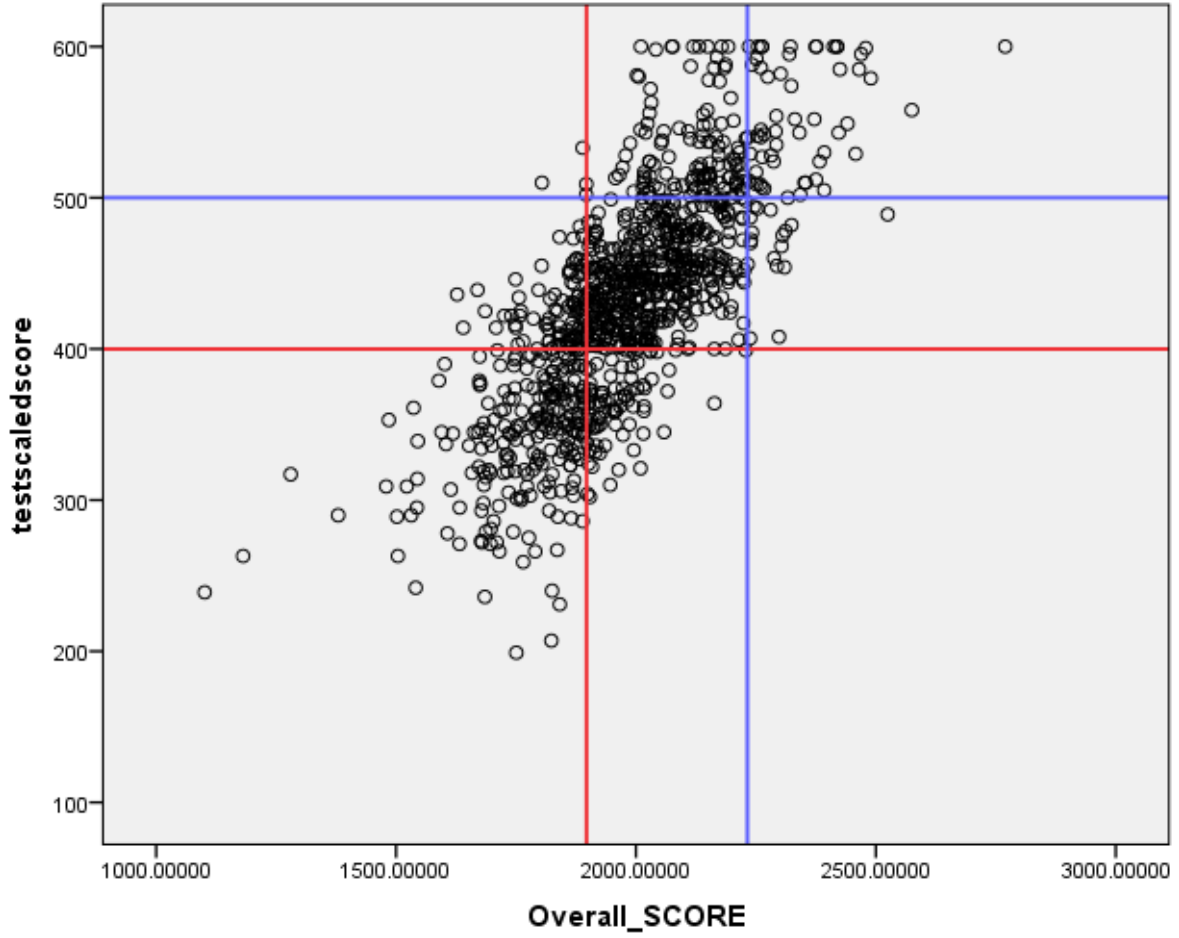   Pass/Advanced = blue

Figure 2. 4th grade ISIP Reading cut scores and SOL performance levels

        Pass/Proficient = red

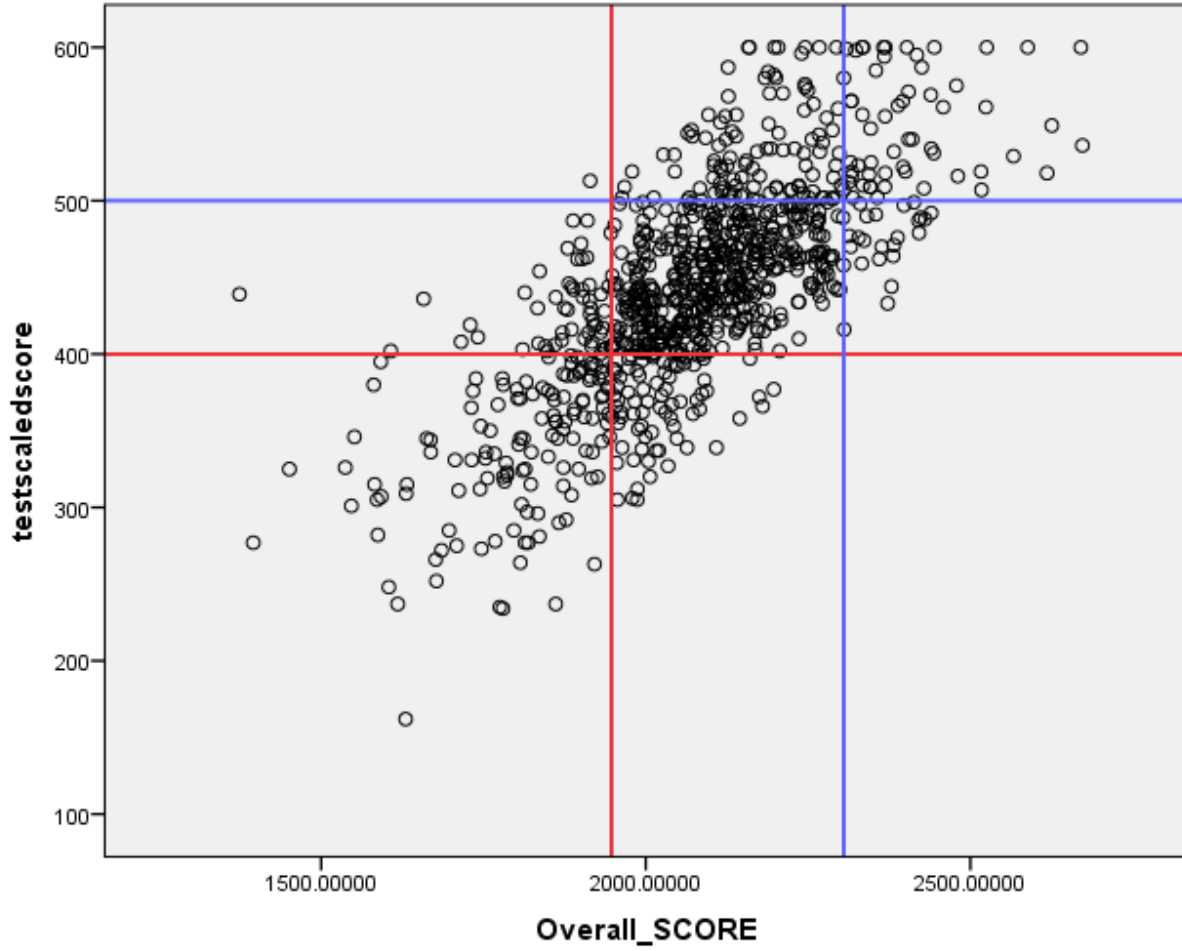   Pass/Advanced = blue

Figure 3. 5th grade ISIP Reading cut scores and SOL performance levels

        Pass/Proficient = red

        Pass/Advanced = blue