



# RESEARCH BRIEF

## Research Services

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### Exploring the 2018-2019 i-Ready Predictive Capability

Curriculum Associates' i-Ready is an adaptive diagnostic and individualized instructional tool that has been used in M-DCPS in the last few years. In addition, Curriculum Associates provides the District with results of their predictive model, which uses the students' outcomes on the Fall and Winter i-Ready diagnostic testing as well as the schoolwide percentages of students scoring proficient on the previous year's Florida Standards Assessments (FSA) in English Language Arts (ELA) and Mathematics to estimate the individual student probabilities scoring at every achievement level on the subsequent FSA ELA and Mathematics grades 3-8.

Predictive Capability of i-Ready was first examined in June 2019 and described in the corresponding Research Brief (<http://drs.dadeschools.net/ResearchBriefs/RB1608.pdf>). This Research Brief examines 2018-2019 i-Ready prediction data and their relationship with the 2018-2019 FSA outcomes in ELA and Mathematics.

To enable a comparison of the i-Ready predictive results with the 2019 FSA observed results, the following procedure was used. The 2018-2019 Winter i-Ready's reported probabilities of scoring in each of the achievement levels 3-5 on the 2019 FSA were added, and the results were converted into a dichotomous variable coded as 1 if the probability of scoring within achievement levels 3-5 was at least 0.5, and 0 otherwise. In addition, achievement level on the 2019 FSA was dichotomized and coded as 1 if a student scored within achievement levels 3-5, and 0 if the student scored within achievement levels 1-2.

The results of the comparison of the 2019 FSA ELA and the predicted Winter i-Ready results for Grade 3 students, as an example, are shown below.

2018-2019 Winter i-Ready	2019 FSA ELA		Total
	Levels 1-2	Levels 3-5	
Predicted to score in Levels 1-2	6211	1051	7262
Predicted to score in Levels 3-5	2077	10591	12668
Total	8288	11642	19930

It can be seen that of the 7262 Grade 3 students who were predicted to score within achievement levels 1-2 on the 2019 FSA ELA, 6211 in fact scored that way. The corresponding cell in the table above is generally referred to as containing the True Negative (TN) results. Similarly, of the 12668 students who were predicted to score within achievement levels 3-5, 10591 in fact scored that way. These are generally referred to as True Positive (TP) results.

One measure of predictive success is its *Accuracy*, defined as a percentage of correct predictions.

$$\text{For the table above, Accuracy} = \frac{\text{Correct Predictions}}{\text{Total}} = \frac{\text{TN} + \text{TP}}{\text{Total}} = \frac{6211 + 10591}{19930} = 84\%$$

Because predicted and actual achievement levels may agree by chance, the accuracy results are generally accompanied by a statistical measure of agreement that corrects for a chance agreement. One such popular measure is Cohen’s Kappa. It achieves a maximum value of 1 if the predicted and actual results are identical. Values of the Kappa in the 0.61 – 0.80 range are often interpreted as indicators of a substantial agreement, while the values in the 0.41 – 0.60 range as indicators of a moderate agreement.

Below are the results of an analysis of the capability of the Winter i-Ready diagnostic results to predict the 2019 FSA ELA and Mathematics results by grade level and subject area.

Grade	ELA		Mathematics	
	Accuracy	Kappa	Accuracy	Kappa
3	84%	0.67	83%	0.61
4	83%	0.64	85%	0.62
5	84%	0.66	84%	0.62
6	83%	0.66	85%	0.69
7	83%	0.66	82%	0.64
8	83%	0.66	78%	0.52
Total	84%	0.66	83%	0.64

The values of prediction accuracy and the Kappa coefficient reported in this table are very similar to those reported in June 2017.

It can be observed that the results displayed in the table above demonstrate a high accuracy of the Winter i-Ready results for predicting the 2019 FSA outcomes in both subjects and across all grade levels shown. In addition, they show a substantial degree of agreement (corrected for the chance agreement) between the predicted and actual outcomes in both subjects and across all grade levels, except for Grade 8 in mathematics. In that one case, the value of the Cohen’s Kappa falls within a moderate agreement range.

It should be noted that accurately predicting FSA achievement levels in grade 8 Mathematics is challenging because a considerable portion of the grade 8 students take Algebra 1 course and participate in the corresponding EOC assessment instead of the FSA Mathematics.

## Additional Measures of Predictive Success

Predictive abilities of various tests are often reported using several additional measures. In the remainder of this brief, some of these measures are defined and presented.

Looking back at the table on the first page, one can see that 1051 students in Grade 3 were predicted to score within achievement levels 1-2 but scored instead within achievement levels 3-5 on the 2019 FSA ELA. These cases are referred to as False Negatives (FN). Similarly, 2077 students were predicted to score within achievement levels 3-5, but instead scored within achievement levels 1-2. These are referred to as False Positives (FP).

These are four additional measures of a predictive success of a test:

- *Sensitivity* is the percentage equivalent of the following fraction  $\frac{TP}{TP+FN}$ . In our context it answers the following question: of all students who scored within achievement levels 3-5, what percent were predicted to score that way?
- *Specificity* =  $\frac{TN}{TN+FP}$  is the answer to the following question: of all students who scored within achievement levels 1-2, what percent were predicted to score that way?
- *Positive Predictive Value (PPV)* =  $\frac{TP}{TP+FP}$  answers the question: of all students who were predicted to score within achievement levels 3-5, what percent scored that way?
- *Negative Predictive Value (NPV)* =  $\frac{TN}{TN+FN}$  answers the question: of all students who were predicted to score within achievement levels 1-2, what percent scored that way?

The table below presents these additional indices.

	ELA				Mathematics			
Grade	Sensitivity	Specificity	PPV	NPV	Sensitivity	Specificity	PPV	NPV
3	91%	75%	84%	86%	93%	64%	84%	82%
4	88%	76%	86%	79%	95%	61%	85%	85%
5	91%	74%	83%	85%	94%	65%	83%	86%
6	88%	78%	83%	84%	92%	76%	83%	88%
7	89%	77%	82%	85%	91%	73%	77%	89%
8	90%	74%	83%	84%	72%	81%	65%	85%
Total	89%	75%	84%	84%	92%	70%	82%	86%

It should be noted that the values of the Sensitivity shown in the table above are somewhat higher than those found in 2017, especially in mathematics. On the other hand, the values of Specificity based on the 2019 data and exhibited in the table above are somewhat lower than the corresponding values found in 2017. That reflects an inverse relationship between Sensitivity and Specificity of any predictive measure.

## Summary

The results of the analyses presented above indicate that various indices of a test's predictive success are sufficiently high with a possible exception of the values of the Cohen's Kappa and the Positive Predictive Validity for Grade 8 students in mathematics. Therefore, the usage of the i-Ready diagnostic assessment as a predictive tool for the FSA outcomes in grades 3-8 is justified.