Aligning Aimsweb+ Results to TNReady in Grades 3 Through 6

Technical Report

Clint Sattler
Supervisor of Research and Evaluation
Knox County Schools
Department of Research, Evaluation, and Assessment

January 2022

Overview

The Knox County Schools (KCS) uses multiple assessments to guide decision-making within the district. Two commonly used assessment suites are Pearson's Aimsweb+ skills-based screeners and the state end-of-year assessment (TNReady). Although these assessments measure student ability in different domains, the results show some level of correlation.

The Tennessee state legislature mandated that students in grades 3 through 7 who did not "pass" the TNReady assessment (by scoring in the on-track or mastered categories) be invited to a learning camp during the summer of 2021. TNReady data from the 2020-2021 school year (SY2021) would not be available before the commencement of the summer learning camp, so district leadership decided to use Aimsweb+ data to identify students who were less likely to pass the state test. Students who scored below the 40th percentile in any of three Aimsweb+ assessments during the winter benchmarking period were invited to summer learning camps. The 40th percentile threshold was chosen based on alignment with older skills-based screeners. The KCS department of Research, Evaluation, and Assessment (REA) could not determine appropriate thresholds from the Aimsweb+ assessment because TNReady and Aimsweb+ had not yet been administered to the same students in the same academic year. The REA department has created this report using data generated from the 2020-2021 school year (SY2021) to determine which Aimsweb+ percentile ranks corresponded to "passing" the state test (scoring in the "On Track" or "Mastered", or OTM, categories).

Methodology

REA used SY2021 Aimsweb+ benchmark data from three skills-based assessments in this analysis. The three assessments are Oral Reading Fluency (ORF), Reading Comprehension (RC), and a composite math measure (MATHB). District leadership selected these assessments to identify which students would participate in legislatively mandated learning camps during the summer of 2021.

REA used unique student identifiers to connect national percentile ranks from the SY2021 Aimsweb+ fall, winter, and spring benchmark periods with SY2021 TNReady performance levels ("Below", "Approaching", "On Track", "Mastered"). REA linked ORF and RC national percentiles to TNReady English/Language Arts performance levels. REA linked MATHB national percentiles to TNReady math performance levels.

REA used the R package cutpointr to identify the optimal Aimsweb+ percentile to classify "On Track" or "Mastered" students. The program selects an Aimsweb+ percentile, predicts that every student at or above that percentile would be OTM on the TNReady, and compares the predicted performance to the actual performance on the state test. The program iterates through all Aimsweb+ percentiles (from 1 to 99) and calculates true positive rates (TPRs) and true negative rates (TNRs) at each percentile.

$$TPR = \frac{Number\ of\ Cases\ Predicted\ to\ be\ OTM\ that\ were\ OTM}{Total\ Number\ of\ Cases\ that\ were\ OTM}$$

$$TNR = \frac{Number\ of\ Cases\ Predicted\ to\ Not\ be\ OTM\ that\ were\ Not\ OTM}{Total\ Number\ of\ Cases\ that\ were\ Not\ OTM}$$

The program identifies the Aimsweb+ percentile that maximizes the sum of sensitivity (TPR) and specificity (TNR). Cutpointr generates a receiver operator curve (ROC) for each data set, with the point on the curve corresponding to the maximum sum of TPR and TNR denoted with a black dot. The accuracy of the classification is calculated as follows:

$$Accuracy = \frac{\#\ of\ Cases\ Classified\ Correctly}{Total\ Number\ of\ Cases}$$

REA completed all calculations using R version 4.1.0 running on RStudio version 1.4.1106. Version 1.1.1 of cutpointr was used in this analysis.

Results

The results for ORF are contained in Table 1. The ORF assessment is not universally administered in grades 6 and 7.

Table 1: ORF Thresholds

Metric	Grade	Fall	Winter	Spring	All Periods
threshold	3	36	41	40	41
	4	41	37	44	44
	5	42	35	38	41
	Grades 3-5	41	41	40	41
n	3	4090	4162	4239	12491
	4	3876	3926	3981	11783
	5	3866	3880	4011	11757
	Grades 3-5	11832	11968	12231	36031
Accuracy	3	75.70%	76.90%	76.70%	77.00%
	4	76.00%	73.20%	75.30%	75.40%
	5	74.30%	72.10%	73.60%	74.10%
	Grades 3-5	75.60%	74.90%	75.00%	75.30%
sensitivity	3	84.70%	78.80%	83.80%	80.00%
	4	76.90%	84.10%	79.00%	76.80%
	5	81.50%	86.90%	85.70%	82.00%
	Grades 3-5	79.70%	79.80%	83.50%	80.30%
specificity	3	70.70%	75.80%	72.80%	75.30%
	4	75.40%	66.60%	73.10%	74.50%
	5	70.50%	64.30%	67.30%	69.90%
	Grades 3-5	73.30%	72.20%	70.30%	72.50%

The ROC for grades 3 through 5 ORF (all benchmark periods) is contained in Figure 1. The point on the ROC corresponding to the 41st percentile is shown as a black point on the ROC. REA recommends using the 41st percentile threshold for all grade levels and all benchmark periods. The 41st percentile provides a reasonable level of accuracy for a single threshold value across all grade levels.
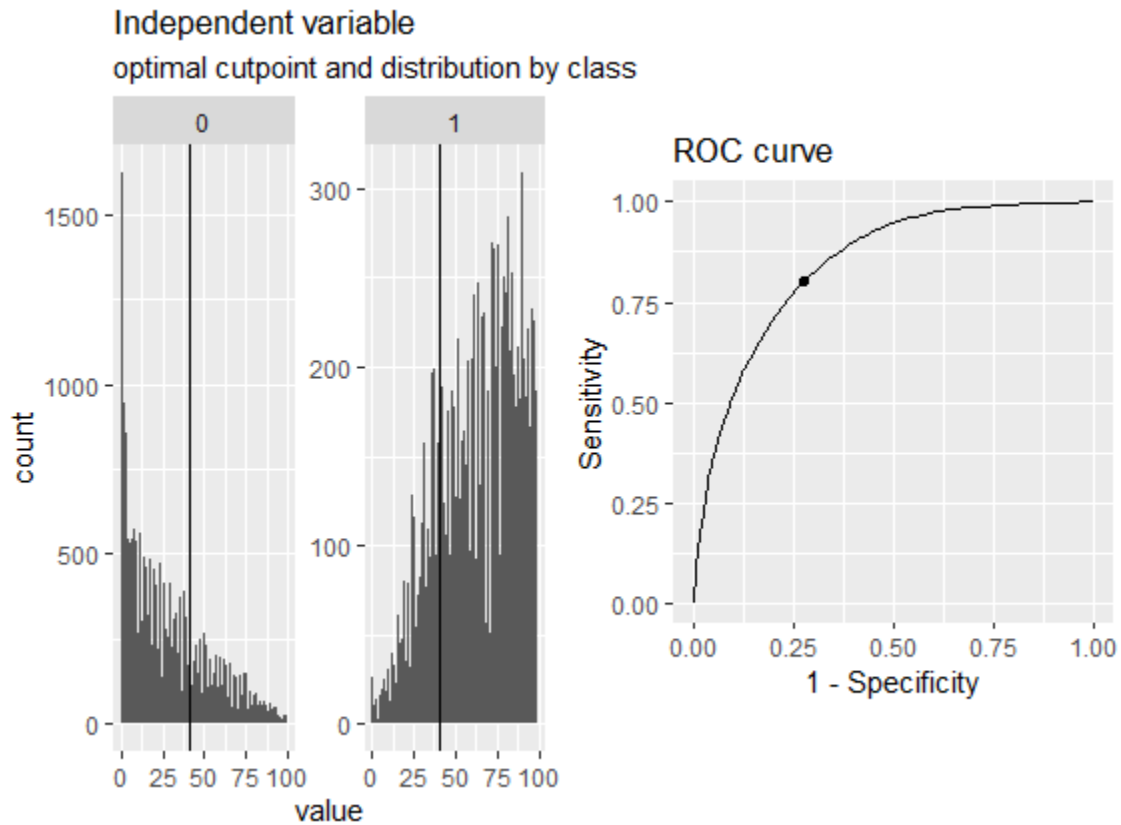

Figure 1: ORF ROC

The results for RC are contained in Table 2. Grade 7 is only universally tested during the spring benchmark period.

Table 2: RC Thresholds

Metric	Grade	Fall	Winter	Spring	All Periods
threshold	6	79	73	64	71
	7	73	62	70	64
	Grades 6-7	72	66	64	70
n	6	3704	3798	3731	11233
	7	1008	1301	3442	5751
	Grades 6-7	4712	5099	7137	11674
Accuracy	6	77.9%	79.8%	80.3%	78.9%
	7	83.0%	80.6%	81.5%	80.3%
	Grades 6-7	77.0%	78.9%	79.9%	80.0%
sensitivity	6	78.7%	82.1%	82.3%	80.7%
	7	85.3%	89.7%	81.3%	86.6%
	Grades 6-7	85.2%	86.7%	84.6%	80.8%
specificity	6	77.6%	78.7%	79.3%	78.0%
	7	82.6%	78.0%	81.6%	77.7%
	Grades 6-7	73.7%	75.7%	77.5%	79.6%

The ROC for grade 6 RC (all benchmark periods) is contained in Figure 2. The point on the ROC corresponding to the 71st percentile is shown as a black point on the ROC. REA recommends using the 71st percentile threshold for grade 6 at the winter benchmark to determine summer learning eligibility. The 71st percentile provides a reasonable level of accuracy for a single threshold value for grade 6 during the winter benchmark. REA decided to discard thresholds impacted by Grade 7 data since invitations will be made before spring benchmarks. Participation is low among grade 7 students, suggesting that Aimsweb+ data is ill-suited to be used as eligibility criteria for summer learning camps.
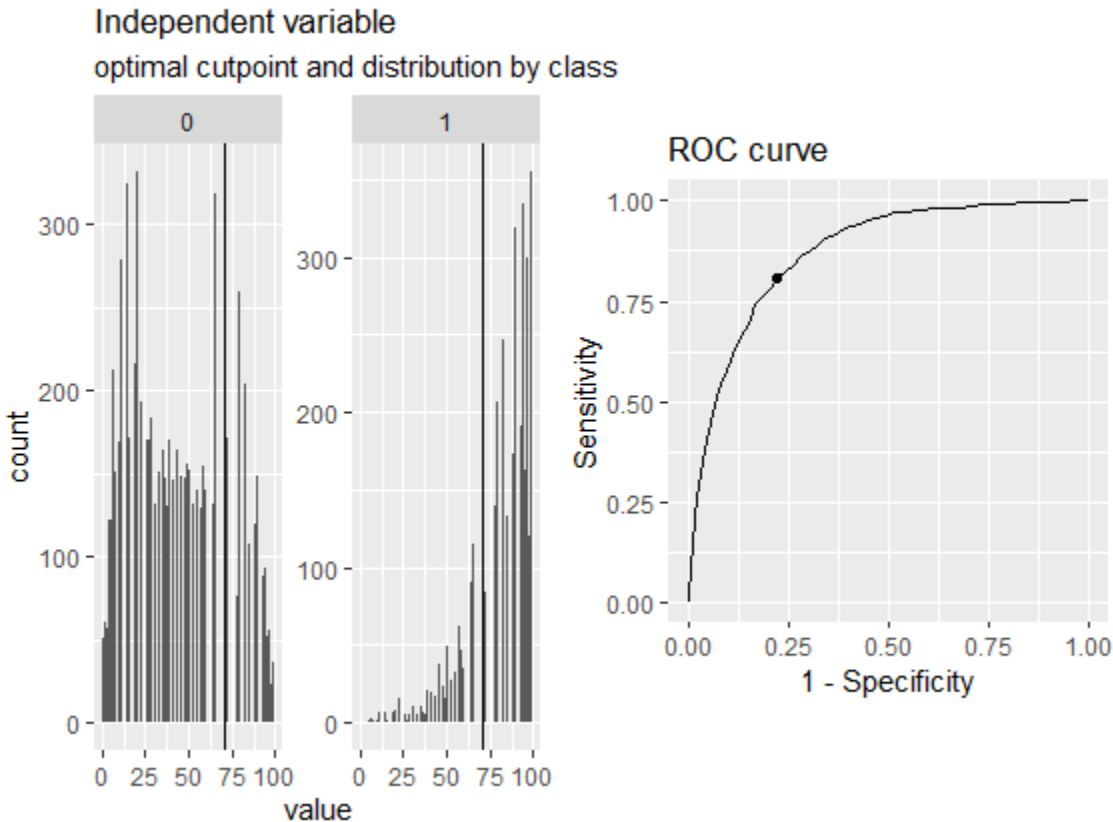

Figure 2: RC ROC

The results for MATHB are contained in Table 3. Grade 7 is only universally tested during the spring benchmark period.

Table 3: MATHB Threshold

Metric	Grade	Fall	Winter	Spring	All Periods
threshold	3	54	58	68	56
	4	60	58	64	63
	5	65	70	79	74
	6	70	65	71	70
	7	61	73	80	77
	Grades 3-5	56	64	69	65
	Grades 6-7	68	68	74	70
	Grades 3-7	61	64	71	65
n	3	3853	4100	4177	12130
	4	3694	3885	3967	11546
	5	3593	3912	3998	11503
	6	3695	3794	3662	11151
	7	1075	1284	3490	5849
	Grades 3-5	11140	11897	12142	35179
	Grades 6-7	4770	5078	7152	17000
	Grades 3-7	15910	16975	19294	52179
Accuracy	3	79.4%	82.2%	87.1%	81.7%
	4	82.1%	83.5%	87.1%	84.4%
	5	83.9%	85.8%	88.0%	85.8%
	6	82.2%	85.0%	86.9%	85.0%
	7	83.6%	87.3%	88.1%	88.2%
	Grades 3-5	80.8%	84.0%	86.4%	84.0%
	Grades 6-7	82.1%	85.8%	86.8%	84.8%
	Grades 3-7	81.0%	84.0%	86.4%	83.5%
sensitivity	3	84.9%	88.6%	85.0%	88.0%
	4	82.0%	88.6%	90.8%	84.4%
	5	82.4%	87.1%	88.3%	83.6%
	6	84.5%	86.9%	90.9%	86.3%
	7	92.4%	90.1%	92.8%	89.7%
	Grades 3-5	85.5%	86.3%	88.6%	84.5%
	Grades 6-7	87.0%	85.1%	91.0%	88.8%
	Grades 3-7	83.3%	87.1%	89.2%	86.7%
specificity	3	76.7%	78.9%	88.2%	78.6%
	4	82.0%	80.3%	84.7%	84.4%
	5	84.9%	84.9%	87.8%	87.2%
	6	81.2%	84.1%	85.1%	84.4%
	7	81.7%	86.5%	85.9%	87.6%
	Grades 3-5	78.0%	82.6%	85.2%	83.6%
	Grades 6-7	80.2%	86.1%	84.8%	83.1%
	Grades 3-7	79.8%	82.4%	84.9%	81.8%

The ROC for grades 3 through 7 MATHB (winter benchmark) is contained in Figure 3. The point on the ROC corresponding to the 64th percentile is shown as a black point on the ROC. REA recommends using the 64th percentile threshold for grades 3 through 7 at the winter benchmark to determine summer learning eligibility. The 64th percentile provides a reasonable level of accuracy for a single threshold value for grades 3 through 7 during the winter benchmark.
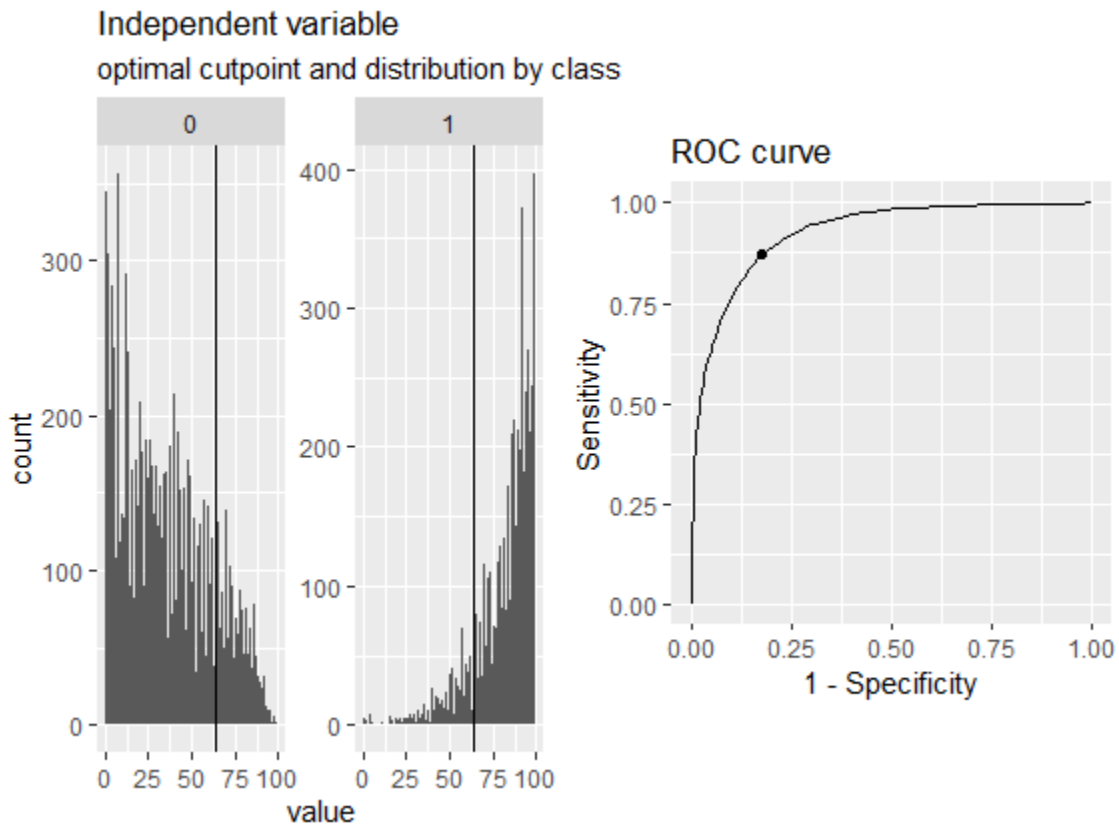

Figure 3: MATHB ROC

Conclusions & Considerations

REA recommends using the following Aimsweb+ thresholds to identify summer learning camp invitees:

- ORF (Grades 3 through 5): 41st national percentile
- RC (Grade 6): 71st national percentile
- MATHB (Grade 3 through 6): 64th national percentile

The district should invite students performing below these thresholds on the winter benchmarks to participate in summer learning camps. REA recommends that KCS continue the practice of using alternative data to invite students in grade 7 since winter benchmark data is scarce among this grade level.

REA can define new thresholds if participants can be identified after the spring benchmark.