

PARCC Predictability Study – 3rd Grade

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June 2020



**Center for Research and
Reform in Education**

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EXECUTIVE SUMMARY: PARCC Predictability Study – 3rd grade

In April 2019, the Center for Research and Reform in Education (CRRE) at Johns Hopkins University contracted with Istation to conduct a mixed-methods evaluation study of the implementation and impacts on student achievement of Istation's ISIP Early Reading (ISIP ER) assessment in Carlsbad Municipal School District (CMSD). The present report examines findings from multinomial logistic regression analyses of the association between ISIP ER scores and PARCC ELA achievement levels. Previous reports examined findings from a teacher survey and case study visits to seven CMSD schools, as well as relationships between ISIP ER scores and PARCC ELA scores. This report serves as a supplement to the Phase 2 quantitative report.

This report was designed to address the following research question:

To what degree are ISIP ER scores associated with PARCC proficiency levels?

Correlational and multinomial logistic regression analyses were used to examine the associations between fall 2018 and winter 2019 ISIP ER scores and spring 2019 PARCC ELA proficiency levels for grade 3 CMSD students in the 2018-19 school year. The important findings from these analyses include:

- Fall 2018 and winter 2019 ISIP ER scores were strongly associated with spring 2019 PARCC ELA scores, with observed correlations of $+0.71$, and $+0.74$, respectively.
- Students with ISIP ER scores in the 40th percentile or higher had at least a 50% probability of attaining at least level 3 (approached expectations) PARCC ELA proficiency.
- Students with ISIP ER scores in the 75th percentile or higher had at least a 50% probability of attaining at least level 4 (met expectations) PARCC ELA proficiency.

PARCC Predictability Study – 3rd Grade

In April 2019, the Center for Research and Reform in Education (CRRE) at Johns Hopkins University contracted with Istation to conduct a mixed-methods evaluation study of the implementation and impacts on student achievement of Istation's ISIP Early Reading (ISIP ER) assessment in Carlsbad Municipal School District (CMSD). The present report examines findings from multinomial logistic regression analyses of the association between ISIP ER scores and PARCC ELA achievement levels.

The ISIP ER assessment, developed by Dr. Joseph Torgeson, Dr. Patricia Mathes, and Dr. Jeannine Herron, is a validated computer-based adaptive testing system that provides benchmark and continuous progress monitoring of student performance. Key indicators include:

- Assessment in critical domains of reading in all tested grades
- Assessment of skills most predictive of future reading success
- Assessment of progress in each area relevant to a larger domain
- Provision of a comprehensive snapshot of reading ability

Testing occurs in a game-like and engaging environment. Scoring results are obtained and reported to teachers immediately after test completion. The assessments are nationally normed every three to five years. ISIP ER levels were originally reported on a three-tier normative grouping, based on scores associated with the 20th and 40th percentiles, similar to the Response to Intervention (RTI) model. During the 2018-19 school year, however, the reporting system was changed by Istation to a five-tier grouping model.

In SY 2016-17, CMSD adopted ISIP ER and ISIP Lectura Temprana assessments as part of the New Mexico PED assessment guidelines. In SY 2017-18, the district also implemented Istation's Reading and Spanish Curriculum across nine campuses. Implementation that year varied by campus, grade, and language. In the 2018-19 school year, CMSD returned to using Istation for assessment only. ISIP Early Reading is administered monthly to approximately 2,500 students across Grades K-3. ISIP Lectura Temprana is administered monthly to about 100 primarily Spanish-speaking students across Grades K-3. All students are also administered the Partnership for the Assessment of Readiness for College and Career (PARCC) assessment each year, beginning in grade 3. PARCC scores are standardized and range from 650-850. PARCC proficiency levels, ranging from 1 (did not meet expectations) to 5 (exceeded expectations) are also assigned on the basis of a student's scaled score.

The current study was designed to address the following research question:

To what degree are ISIP ER scores associated with PARCC ELA proficiency levels?

Method

Research Design

This series of analyses analyzed retrospective ELA state data from the 2018-19 school year in Carlsbad Municipal School District. Specifically, ELA scores from the PARCC and the Istation Indicators of Progress Early Reading (ISIP ER) assessments were examined in this study. Correlational analyses were conducted that examined the interrelationships between ISIP ER scores and PARCC ELA test scores and proficiency levels. ISIP and PARCC scores were examined for students in grade 3 only in the 2018-19 school year, as this was the only grade of students who had both ISIP ER and PARCC scores for that year.

Participants

Carlsbad Municipal School District (CMSD) is a small to medium-sized district of approximately 7,300 students in southeastern New Mexico. The majority of its students (57%) are Hispanic/Latino and most of the remainder (39%) are White. Approximately 60% of the students qualify for free or reduced-price lunch (FRL), 8% are EL, and 16.7% are SPED.

Student demographics for participants in these analyses are displayed in Table 1. Other Race is defined as ethnicities other than Hispanic/Latino and White, which are the two dominant ethnicities in CMSD. Characteristics of the analytic sample were generally similar to overall district-wide characteristics. There was a slightly larger proportion of Hispanic/Latino students in the sample, while proportions of economically disadvantaged and special education students were slightly smaller in the analytic sample than in the district overall.

Table 1
Student characteristics for analytic sample

Grade 3	Treatment
% Hispanic	59.77
% White	35.93
% Other Race	3.32
% Female	48.44
% Economically disadvantaged	53.32
% Students with Disabilities/SPED	11.72
% ELs	11.13
N	512

Measures

Data sources for the current study include student ISIP scores and PARCC ELA achievement data. Specifically, scores from the 2018-19 school year for 3rd grade students were analyzed to examine the probability of students reaching different levels of PARCC achievement, on the basis of fall 2018 and winter 2019 ISIP ER scores.

ISIP ER Scores. Overall and sub-domain ISIP data were obtained for students in grade 3 in the 2018-19 school year who also had non-missing PARCC ELA scores in this same school year. Sub-domains included Alphabetic Decoding, Comprehension, Letter Knowledge, Listening Comprehension, Phonemic Awareness, Spelling, and Vocabulary. We focused on the Comprehension, Spelling, and Vocabulary sub-domains, as these are the ISIP ER subtests offered in 3rd grade. For the purposes of these analyses, fall and winter ISIP ER scores were constructed from monthly ISIP ER scores. The September ISIP score was used as the fall score; if this was missing, then the first non-missing score October, August, and November was used as the fall ISIP ER score. Similarly, the January ISIP score was used as the winter score; if this was missing, then the first non-missing score from February or December was used as the winter ISIP ER score.

ISIP ER scores are nationally normed across grades, meaning that scores across grade levels can be interpreted as indicating the same ability level (Mathes, Torgesen, & Herron, 2016). For example, a Grade 3 student scoring at 220 and a grade 4 student scoring at 220 would be indicative of two performances at the same ability level. In the current grade 3 sample, overall ISIP ER scores range from 185-295.

Student achievement. Student achievement data were the standardized ELA exams administered to all district students (PARCC). ELA PARCC scores and proficiency levels from spring 2019 were used as the main outcome variables in these analyses. We specifically examined overall ELA PARCC proficiency level, which ranges from one to five. Table 2 shows the score ranges associated with each proficiency level.

Table 2
ELA PARCC proficiency levels and score ranges, grade 3

Level	Score Range
1 (Did not meet expectations)	650-699
2 (Partially met expectations)	700-724
3 (Approached expectations)	725-749
4 (Met expectations)	750-809
5 (Exceeded Expectations)	810-850

Analytical Approach

Multinomial logistic regression was used to examine the associations between fall and winter ISIP ER scores and spring 2019 ELA PARCC proficiency levels. Students who had ISIP ER scores between the 1st and 99th percentiles, as well as non-missing spring 2019 PARCC ELA scores, were included in the analyses. As with previous analyses, we also included demographic variables into these analyses, allowing us to control for potential confounding variables and get a more accurate picture of the association between ISIP ER scores and PARCC ELA proficiency levels. The use of multinomial logistic regression allowed for the estimation of the probabilities that students attain a certain level of PARCC proficiency or higher, given their ISIP ER score. For example, estimated probabilities for level 3 proficiency attainment would represent the probability that a student with a given score would attain a proficiency level of 3 or higher. Thus, predicted probabilities for higher proficiency levels will become lower, given the same ISIP ER score. Descriptive analyses and correlations were computed using STATA, and multinomial logistic regression analyses were performed using the “nnet” package in R.

Results

Descriptive statistics

We first provide descriptive statistics regarding the ISIP ER and PARCC ELA assessments. Table 3 shows the average ISIP ER and PARCC ELA scores for the analytic sample, along with the breakdown of students by proficiency level for each assessment. One important finding from descriptive analyses is that only 7 out of 512 students achieved at a PARCC Level of 5 (Exceeded Expectations). Given this very low number (only 1%), the multinomial logistic regressions that we discuss later, in all likelihood, would underestimate the probabilities of students attaining Level 5 achievement on the PARCC. Distributions of students across the other achievement levels appeared to be reasonable for both assessments, although there were similar numbers of PARCC level 1 and level 2 students, which is also a bit unusual, relative to expected normal curve properties of these scores.

Table 3
ISIP and PARCC score frequencies and percentages, Grade 3 (n = 512)

ISIP Mean	Istation Tier				
	1	2	3	4	5
243.02	53 (10.35%)	110 (21.84%)	124 (24.22%)	100 (19.53%)	125 (24.41%)
PARCC Mean	PARCC Level				
	1	2	3	4	5
733.30	102 (19.92%)	101 (19.73%)	129 (25.20%)	173 (33.79%)	7 (1.37%)

Relationships between Fall ISIP ER scores and PARCC achievement levels

In this section, we examine the results of multinomial logistic regression analyses of the predictive utility of ISIP ER scores on PARCC achievement levels. In these analyses, we used ISIP ER scores from fall 2018 and PARCC ELA achievement levels from the spring of 2019. We only examined grade 3 students from the 2018-19 school year because this was the only grade having both sets of scores.

The Pearson product-moment correlation between fall 2018 ISIP ER scores and spring 2019 PARCC ELA scores was +.71. A correlation of this magnitude indicates that ISIP ER scores have high levels of predictive validity in relation to PARCC ELA scores. In other words, students with higher scores on the ISIP ER assessment also tended to have higher scores on the PARCC ELA assessment.

Projected proficiency of Levels 2 and 3 or higher. We now examine the results of multinomial logistic regression analysis concerning the predictive utility of ISIP ER scores on PARCC ELA proficiency levels. We chose to display probabilities for every 5th percentile of ISIP scores in this particular sample, as well as the 99th percentile score. There are five PARCC proficiency levels, but we are focusing on the probabilities of attaining proficiency levels 2-5 in these analyses. Note that level 1 attainment is guaranteed as a minimum and that, in these analyses, level 5 was combined with level 4 for the reasons described above (i.e., low frequency). It also is important to consider that these probabilities of attaining a given level are actually the sum of the probabilities of achieving at that level or a higher level. Thus, the probability of attaining level 4 is $p(\text{level 4}) + p(\text{level 5})$, and the probability of attaining level 3 is $p(\text{level 3}) + p(\text{level 4}) + p(\text{level 5})$, and so on for lower levels. Table 4 shows the predicted probabilities of PARCC proficiency levels 2 (Partially Met Expectations) and 3 (Approached Expectations) for various ISIP ER scores. We also included probability bands of low, medium, or high, for each estimate. The utility of these probability bands will be discussed below.

Table 4

Predictability table for Levels 2 and 3 PARCC ELA proficiency, Fall 2018 ISIP Scores

ISIP Score	Percentile Rank	Probability	Partially Met Expectations	Probability	Approached Expectations
214	5	.228	Low	.055	Low
224	10	.463	Medium	.178	Low
228	15	.578	Medium	.264	Low
231	20	.665	Medium	.342	Medium
233	25	.719	High	.398	Medium
234	30	.745	High	.427	Medium
235	35	.769	High	.456	Medium
237	40	.814	High	.515	Medium
239	45	.853	High	.573	Medium
242	50	.900	High	.655	Medium
243	55	.913	High	.680	High
245	60	.935	High	.728	High
247	65	.952	High	.770	High
250	70	.970	High	.825	High
253	75	.982	High	.869	High
257	80	.991	High	.914	High
262	85	.997	High	.950	High
266	90	.998	High	.969	High
275	95	1.000	High	.990	High
292	99	1.000	High	.999	High

The results shown in Table 4 tell how likely a student is to attain “partially met expectations” or “approached expectations” proficiency levels or higher on the Spring 2019 PARCC ELA assessment, based on fall 2018 ISIP ER score. For example, a student with a score of 231 (20th percentile score) has a 66.5% percent chance of attaining PARCC level 2 (partially met expectations) or higher. Similarly, this score would indicate a 34.2% chance of attaining PARCC level 3 (approached expectations) or higher. In terms of important cutpoints, such as scores where students reach a probability of 50% or higher of attaining a proficiency level, students with a fall 2018 ISIP ER score of 228 had a 57.8% chance of attaining PARCC level 2 proficiency or higher, while students with a fall 2018 ISIP ER score of 237 had a 51.5% chance of attaining PARCC level 3 proficiency or higher

Projected proficiency of Level 4 or higher. Table 5 shows the same estimates for ELA PARCC proficiency levels 4 and 5. Accordingly, we only display the probabilities of achieving at least at level 4.

Table 5

Predictability table for Level 4 PARCC ELA proficiency, Fall 2018 ISIP Scores

ISIP Score	Percentile Rank	Probability	Met or Exceeded Expectations
214	5	.006	Low
224	10	.035	Low
228	15	.064	Low
231	20	.096	Low
233	25	.124	Low
234	30	.139	Low
235	35	.155	Low
237	40	.192	Low
239	45	.232	Low
242	50	.298	Low
243	55	.321	Low
245	60	.369	Medium
247	65	.417	Medium
250	70	.489	Medium
253	75	.558	Medium
257	80	.643	Medium
262	85	.733	High
266	90	.793	High
275	95	.888	High
292	99	.973	High

Using the logic described for Table 4, the probability shown in a given row is the probability that a student with the corresponding ISIP ER score would attain PARCC ELA proficiency of level 4 or higher. For example, a student with a score of 245 would have a 36.9% chance of attaining a proficiency of level of 4 or higher on the PARCC ELA assessment. A score of 253 is associated with a 55.8% chance of attaining PARCC ELA proficiency of level 4 or higher.

Probability bands. In supplementary analyses, we used cutpoint probabilities of .33 and .67 to create probability bands of “low”, “medium”, and “high” for all ISIP ER scores considered in the above analyses. Specifically, probabilities of less than .33 were considered “low”, probabilities between .33 and .67 were considered “medium”, and probabilities greater than .67 were considered “high”. This allows for efficient and easily digestible summarization of the probabilities obtained in the previous analyses. For example, regarding level 2 performance, students with ISIP scores of 224 or less would have a low probability of attaining at least level 2 PARCC performance, students with scores between 224 and 233 would have a medium probability of attaining level 2 performance, and students with scores or 233 or greater would have a high probability. In turn, students with ISIP ER scores of 228 or less would have a low probability of

attaining at least level 3 PARCC proficiency, while students with ISIP ER scores between 228 and 243 would have a medium probability, and students with scores of 243 or greater would have a high probability. Similarly, for level 4 PARCC achievement, students with ISIP ER scores of 243 or less would have a low probability of attaining at least level 4 proficiency, while students with scores between 243 and 262 would have a medium probability, and students with scores of 262 or larger would have a high probability.

Relationships between Winter ISIP ER scores and PARCC achievement levels

In this section, we examine the results of another set of multinomial logistic regression analyses examining the predictive utility of ISIP ER scores on PARCC achievement levels. In these analyses, we used winter 2019 ISIP scores to predict PARCC ELA achievement levels in the spring of 2019. As with the previous analysis, we only examined grade 3 students from the 2018-19 school year because this was the only grade having both sets of scores.

The Pearson product-moment correlation between winter 2019 ISIP ER scores and spring 2019 PARCC ELA scores was $+.74$. This correlation provides additional evidence that ISIP ER scores have high levels of predictive validity in relation to PARCC ELA scores.

Projected proficiency of Levels 2 and 3 or higher. We now examine the results of multinomial logistic regression analysis concerning the predictive utility of winter ISIP ER scores on PARCC ELA proficiency levels. We displayed the same tables for these analyses as we did with the fall ISIP ER score analyses. Probability bands are also included in the following tables, and will be discussed below.

Table 6

Predictability table for Levels 2 and 3 PARCC ELA proficiency, Winter 2019 ISIP Scores

ISIP Score	Percentile Rank	Probability	Partially Met Expectations	Probability	Approached Expectations
214	5	.216	Low	.050	Low
228	10	.464	Medium	.179	Low
232	15	.553	Medium	.244	Low
236	20	.643	Medium	.323	Low
238	25	.687	High	.367	Medium
240	30	.729	High	.412	Medium
242	35	.768	High	.460	Medium
244	40	.804	High	.508	Medium
248	45	.866	High	.603	Medium
250	50	.892	High	.648	Medium
252	55	.913	High	.691	High
254	60	.931	High	.731	High
256	65	.946	High	.768	High
259	70	.964	High	.817	High
262	75	.976	High	.858	High
266	80	.987	High	.902	High
270	85	.993	High	.933	High
276	90	.997	High	.964	High
285	95	.999	High	.987	High
304	99	1.000	High	.999	High

The results shown in Table 6 tell how likely a student is to attain “partially met expectations” or “approached expectations” proficiency levels or higher on the Spring 2019 PARCC ELA assessment, based on winter 2019 ISIP ER score. In terms of important cutpoints, such as scores where students reach a probability of 50% or higher of attaining a proficiency level, students with a fall 2018 ISIP ER score of 232 had a 55.3% chance of attaining PARCC level 2 proficiency or higher, while students with a fall 2018 ISIP ER score of 244 had a 50.8% chance of attaining PARCC level 3 proficiency or higher

Projected proficiency of Level 4 or higher. Table 7 shows the same estimates for ELA PARCC proficiency levels 4 and 5. Accordingly, we only display the probabilities of achieving at least at level 4.

Table 7

Predictability table for Level 4 PARCC ELA proficiency, Winter 2019 ISIP Scores

ISIP Score	Percentile Rank	Probability	Met or Exceeded Expectations
214	5	.003	Low
228	10	.027	Low
232	15	.047	Low
236	20	.077	Low
238	25	.097	Low
240	30	.120	Low
242	35	.147	Low
244	40	.178	Low
248	45	.250	Low
250	50	.291	Low
252	55	.334	Medium
254	60	.378	Medium
256	65	.424	Medium
259	70	.492	Medium
262	75	.558	Medium
266	80	.640	Medium
270	85	.713	High
276	90	.801	High
285	95	.891	High
304	99	.974	High

In this table, the probability shown in a given row is the probability that a student with the corresponding winter 2019 ISIP ER score would attain PARCC ELA proficiency of level 4 or higher. For example, a student with a score of 244 would have a 17.8% chance of attaining a proficiency of level of 4 or higher on the PARCC ELA assessment. A score of 262 is associated with a 55.8% chance of attaining PARCC ELA proficiency of level 4 or higher.

Probability bands. The same cutpoints for “low”, “medium”, and “high” probabilities were used in these analyses. For example, regarding level 2 performance, students with ISIP scores of 214 or less would have a low probability of attaining at least level 2 PARCC performance, students with scores between 214 and 236 would have a medium probability of attaining level 2 performance, and students with scores or 236 or greater would have a high probability. In turn, students with ISIP ER scores of 236 or less would have a low probability of attaining at least level 3 PARCC proficiency, while students with ISIP ER scores between 236 and 250 would have a medium probability, and students with scores of 250 or greater would have a high probability. Similarly, for level 4 PARCC achievement, students with ISIP ER scores of 250 or less would have a low probability of attaining at least level 4 proficiency, while students with

scores between 250 and 266 would have a medium probability, and students with scores of 266 or larger would have a high probability.

Discussion

In this study, we performed a set of multinomial logistic regression analyses to estimate the probability of students attaining different levels of PARCC ELA proficiency, based on ISIP ER scores. Specifically, we used fall 2018 and winter 2019 ISIP ER scores to predict proficiency levels on the spring 2019 PARCC ELA assessment. In previous analyses, we found that the observed correlation between fall 2018 ISIP ER scores and spring 2019 PARCC ELA scores, was $+0.71$, and the observed correlation between winter 2019 ISIP ER scores and spring 2019 PARCC ELA scores was $+0.74$, indicating strong, statistically significant positive associations between ISIP ER and PARCC ELA scores. The present analyses allowed us to move a step further and make predictions about student proficiency attainment on the basis of ISIP ER scores.

Among the most important findings here, we found that students with ISIP ER scores between the 70th and 75th percentile will have a probability of about 50% of attaining PARCC ELA proficiency of level 4 (meets expectation) or greater. By comparison, students with ISIP ER scores between the 35th and 40th percentiles have a probability of around 50% of attaining PARCC ELA proficiency of level 3 (approached expectations).

In addition, we classified different ranges of scores as having a low, medium, or high probability of being associated with a given PARCC ELA proficiency level. Low probability was defined as a less than 33% chance of attaining a proficiency level, medium probability was defined as between 33% and 67%, and high probability was defined as greater than 67%. In terms of attaining level 4 (meets expectations) PARCC ELA proficiency, students with 55th percentile or lower ISIP ER scores had a low probability of attainment, students with 60th-80th percentile ISIP ER scores had a medium probability of attainment, and students with 85th percentile or higher ISIP ER scores had a high probability of attainment. In terms of attaining level 3 (approached expectations) PARCC ELA proficiency, students with lower than 20th percentile ISIP ER scores had a low probability of attainment, students with 20th-50th percentile ISIP ER scores had a medium probability of attainment, and students with greater than 50th percentile ISIP ER scores had a high probability of attainment. These patterns of associations were consistent across both fall 2018 and winter 2019 ISIP ER scores.

The results of these analyses may provide useful achievement benchmarks for students, teachers, and administrators. Knowledge of students' fall ISIP ER scores, along with the predicted probabilities of standardized test proficiency, can be used to help teachers set achievement goals through Istation instruction throughout the year.

Limitations

The present analyses were restricted to ISIP ER and PARCC ELA proficiency levels for third grade students in one school district. Thus, generalization to other school districts and of the relationship between ISIP ER scores to other standardized ELA assessments cannot be assumed. In addition, these analyses were only correlational in nature, so causal inferences cannot be made regarding ISIP ER scores and PARCC proficiency levels.

Conclusions

The main findings from this study are as follows:

- Fall 2018 and winter 2019 ISIP ER scores were strongly associated with spring 2019 PARCC ELA scores, with observed correlations of $+.71$ and $+.74$, respectively.
- Students with ISIP ER scores in the 40th percentile or higher had at least a 50% probability of attaining at least level 3 (approached expectations) PARCC ELA proficiency.
- Students with ISIP ER scores in the 75th percentile or higher had at least a 50% probability of attaining at least level 4 (met expectations) PARCC ELA proficiency.

References

Mathes, P., Torgesen, J., & Herron, J. (2016). Istation's Indicators of Progress (ISIP) Early Reading Technical Report: Computer Adaptive Testing System for Continuous Progress Monitoring of Reading Growth for Students Pre-K through Grade 3.